

The female of the cricket (*Ecanthus fasciatus*), called in Maryland "gabberer" or "chatterer," doubtless from the song of the male, introduces its eggs into the stalks of the plants, and sometimes proves very detrimental to them through its stings, as do a certain number of other insects that we shall pass by without mention.

Tobacco in a dry state has also very numerous enemies among insects; for example, the Cigarette beetle, the *Lasioderma serricone*, Fab. (Fig. 5, Nos. 1 to 4), which is often seen making its exit from cigars and cigarettes through small round holes. It is a singular thing that certain smokers prefer cigars thus damaged to others, not only on account of their cheapness, but also because of their peculiar taste. The *Dermestes vulpinus* has been known to give rise to a litigation between France and the United States on account of its having developed en masse in a cargo en route. Certain caterpillars that have lived upon the leaves of tobacco in a growing state continue to eat them after they have been cured.

In stores and manufactories, the use of hydrocyanic acid and of sulphide of carbon suffices to destroy these ravagers; but it must not be forgotten that the vapors of sulphide of carbon form detonating mixtures with the air in a closed space.—For the above particulars and the illustrations, we are indebted to *La Nature*.

RECENT IMPROVEMENTS IN RICE CULTURE.

By Dr. EUGENE MURRAY-AARON.

IN 1898 the United States used 190,285,315 pounds of imported rice, and produced a crop of 116,401,760 pounds. Of barley, maize, oats, rye, and wheat, we produced at the same time, in addition to the domestic consumption, an export quantity of 24,205,469,356 pounds. In the case of rice, we produce less than half the amount we consume; of all the others an enormous surplus for export. This is due to the fact that rice, in addition to its subtropical character, is a crop growing chiefly on wet lands, where it has hitherto been impossible to use harvesting machinery. It must, therefore, be cut with a sickle, and American hand labor has been thrown into competition with the cheap labor of the tropics, a competition that has not proved profitable to the American.

In 1884, enterprising settlers in Louisiana began the development of a new system of rice culture, by which, as now perfected, the dry prairie lands are flooded by a system of pumps, canals, and levees, and when the rice is about to mature the water is drained off, leaving the land dry enough for the use of reaping machines. Under this system the cost of harvesting, and, therefore, the total cost of production, has been greatly reduced and the industry has undergone a rapid development.

In September, 1898, Dr. S. A. Knapp, of Louisiana, was appointed by the Secretary of Agriculture as an agricultural explorer, with instructions to visit Japan, investigate the rice of that country, and purchase a stock suited to meet the requirements of the American problem. Dr. Knapp returned in the early spring of 1899 with ten tons of Kiushu rice which was distributed to experimenters in southwestern Louisiana and elsewhere. Dr. Knapp has just submitted a report to the department,* of which this article is an epitomization, the careful study of which must amply repay anyone specially interested in rice culture.

Where dense populations are dependent for food upon an annual crop, and considerable diminution in the supply would result in starvation for many, rice has been selected as the staple food wherever climate permits its cultivation. Under such conditions certainty of supply is of first importance. The estimated total population of the Chinese empire, of the British possessions in Asia, of Japan, and of other rice-eating countries is 826,000,000. It is estimated that rice constitutes fully half of the entire food supply of these nations.

There is an immense variety in cultivated rice; it differs in length of the season for the maturing, in character, yield, and quality. The divergence not only extends to size, shape and color, but to relative proportion of food constituents and the consequent flavor. South Carolina and Japan rices are rich in fats, and much esteemed above Patua, which is very poor in fats, as well-fattened beef is esteemed superior to the lean animals of the range. A botanical catalogue enumerates 161 varieties found in Ceylon alone, while in Japan, China, and India, where great care is taken in improvement by the selection of seed, probably 1,400 varieties exist.

Rice production in the United States is limited to the South Atlantic and Gulf States, where in some sections it is the principal cereal product. Recently Louisiana and Texas have increased their rice area so that they now furnish three-fourths of all the product of the country.

Rice is of such vigor that it could be grown on any arable land as far north as the Ohio River but for three reasons:

First.—The crop must be irrigated. The smaller tributaries of the rivers that drain the Mississippi Valley and the small creeks and streams emptying directly into the Gulf bring down very little water during the summer. The flood period is not coincident with the period during which the most water is required by the rice crop. In the absence of natural reservoirs throughout this region it would be necessary to raise the water by pumping, and it is an open question whether the water supply would be large enough for any extended area.

Second.—Rice, in its best development, also requires a moist climate. With irrigation alone rice would mature in the mountains of Tennessee, but it would not compare in quality or quantity with the crops of the coasts, and could not compete in the world's markets. As an example, in southwestern Louisiana the winds from the Gulf are laden with moisture, but the north winds are dry, and consequently the lands along the south side of a lake or large pond usually produce two barrels per acre more than the north side, although other conditions of soil and moisture may be equal.

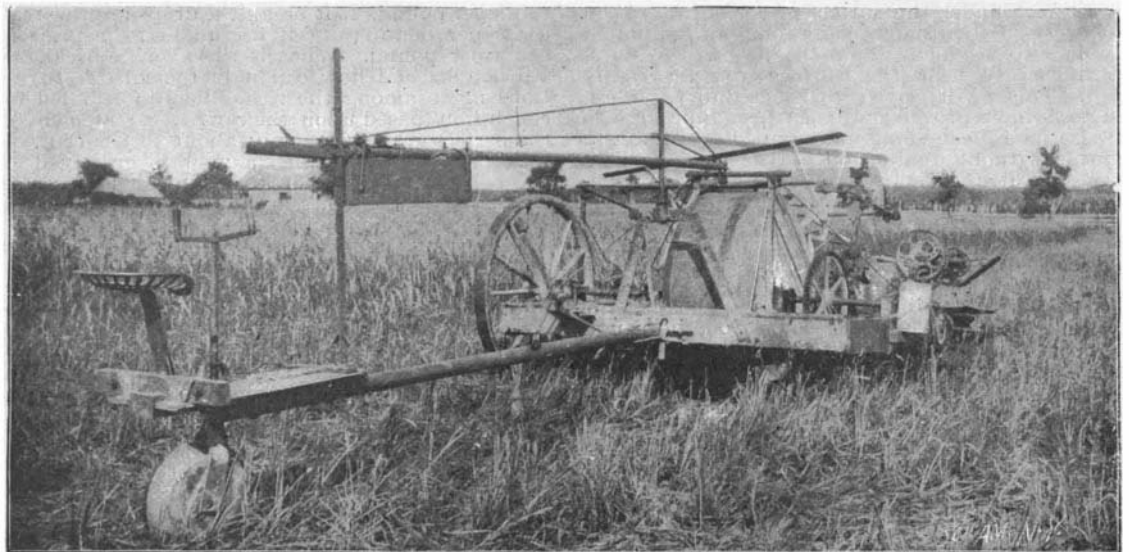
Third.—The best rice lands are underlaid by an impervious subsoil. Otherwise the land cannot be satis-

factorily drained in order to use improved harvesting machinery. The alluvial lands along the Mississippi Valley in Louisiana are not underlaid by hardpan, and cannot be drained sufficiently for heavy harvesters and teams of horses.

According to the best estimates, the suitable area which can be successfully irrigated by present methods, using the available surface, and artesian flows, does not exceed 3,000,000 acres. Much more could be brought into cultivation were it necessary, but the

greatly reducing the cost. The American employing higher priced labor than any other rice grower, will ultimately be able to market his crop at the least cost and the greatest profit. If, in addition, improvement can be secured in the rice itself, if varieties which yield from 80 to 90 per cent. of head rice in the finished product can be introduced, American rice growers will be able to command the highest prices in the markets of the world.

In 1884 and 1885 a few Northwestern farmers settled



A RICE CUTTING MACHINE.

cost would, perhaps, be prohibitive at present prices. The best results require rotation of crops; consequently only one-half of that amount, or 1,500,000 acres, would be in rice at any one time. At an average yield of 10 barrels (of 162 pounds) per acre, 1,500,000 acres of rice would produce nearly 2,500,000,000 pounds of cleaned rice; nearly six times the amount of our present consumption. The crop harvested in 1899 is said to be the largest which has ever been grown. It would appear that the demand for rice is increasing in the United States.

on the prairie along the coast from the parish of St. Mary in Louisiana to the Texas line, about 140 miles. Finding that rice, grown for many years by Oriental methods, was well suited to the conditions here, they commenced immediately to adapt the agricultural machinery to which they had been accustomed to the rice industry. The gang plow, disk harrow, drill, and broadcast seeder were readily adjusted, but the twine binder encountered a number of serious obstacles. However, by the close of 1886 the principal difficulties had been overcome. Wherever prairies were found suf-

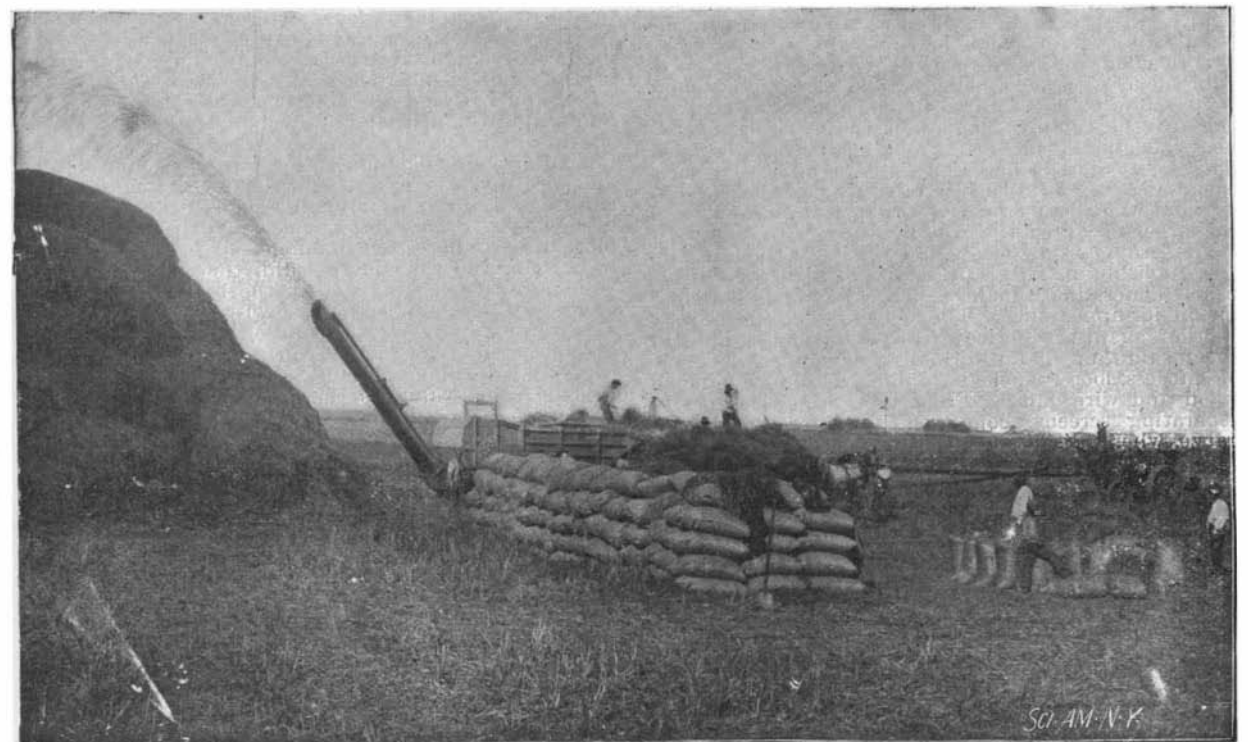


HARVESTING RICE ON A LOUISIANA PLANTATION.

The outlook for the industry is very promising. There has been recently quite an awakening among farmers to the importance of this industry, so that there have been large annual increases in the area planted. There is no satisfactory reason why we should not grow all of our own rice, nor why we should not become exporters.

The use of machinery in the rice fields, similar to that used in the great wheat fields of California and the Dakotas, is resulting in a revolution in cultivation

ficiently level, with an intersecting creek which could be used to flood them, they were surrounded by a small levee. The land was so level that fields of forty and eighty acres were common. Large crops were produced, the prairies were practically free from injurious grasses, and the creek or river water was soft and bore no damaging seeds to the fields. The rice fields were handled like the bonanza wheat farms of Dakota, and fortunes were made; the main object being apparently to plant a large acreage and secure a certain



CYCLONE THRASHER AT WORK ON RICE PLANTATION.

* The Present Status of Rice Culture in the United States. By S. A. Knapp. United States Department of Agriculture, Division of Botany, Bulletin No. 22. 56 pages, 3 plates. Washington, 1899.

yield, regardless of quality. Ultimate failure was certain, but it was hastened by drought. A succession of dry years followed. The creeks failed, and reservoirs were found to be expensive and unreliable.

To provide a reliable supply of water, plants for pumping were substituted for natural irrigation. Fortunately the water in the rivers is soft, abundant, and free from silt and damaging weed seeds. The elevation of the prairies above the streams varies from 6 to 38 feet, the larger portion being from 15 to 25 feet. Scarcely had canals been accepted as a success when it was announced that there were strata of gravel at 125 to 200 feet under the surface of the entire section in southwestern Louisiana containing an unlimited supply of water, which would, of its own pressure, come sufficiently near the surface to be readily pumped. This was received with incredulity, but repeated tests have proved it to be true. Pipes of 2 to 8-inch size have been sunk and pumped continuously for months without diminution of the supply. The water is soft, at a constant temperature near 70 degrees, and free from injurious seeds or minerals. A 6-inch tube has been put down to the full depth required, 200 feet, in fourteen hours. It has been found that a 2-inch pipe furnishes sufficient water for ten acres of rice, and a 6-inch pipe will flood eighty to ninety acres. Any number of wells may be made, and even if no more than 20 or 30 feet apart, one does not diminish the flow from the other.

Rice follows the law so well established for wheat and other cereals, that thorough cultivation both increases the quantity produced and improves the quality and flavor. Some have claimed that rice, being a water plant, does not follow this rule. This is an error. The rice of commerce is an improved variety, far superior to wild rice, and the improvement has come through better environment. We have not yet reached the limit of possible improvement in rice by any means.

When rice is ready for the harvest, cutting proceeds rapidly. The length of straw to be cut is a matter of option, but if cut in the stiff dough state of the kernel, sufficient straw must remain with the head to enable the grains to mature. On an average $2\frac{1}{2}$ feet of straw will be found practical. The smaller the bundle, the better for curing. While care should be exercised in all the various processes of rice production, it is most necessary in shocking, which is generally left to some boy who can do nothing else. Thirty per cent. of the crop may be lost by improper shocking. Slow curing in the shade produces that toughness of kernel necessary to withstand the milling processes. In the shock every head should be shaded and sheltered from storm as much as possible. The rice should be left in the shock till the straw is cured and the kernel hard.

With the large steam thrashers there is frequently considerable breakage and waste of grain. Great care must be exercised to avoid this and preserve every part which has been won from the soil with such labor. At the commencement of thrashing, examination should be made to see that there is no avoidable breakage of the grain. The primitive method of milling rice was to place a small quantity in a hollow stone or block of wood and pound it with a pestle. The bran and hulls were then removed by winnowing. Later, the receptacle for the rice was made out of a short section of a hollow log, using a heavy wooden pounder bound to a horizontal beam 6 to 8 feet long, resting on a fulcrum 4 to 5 feet from the pounder. This was raised by stepping on the short end of the beam, and by suddenly removing the weight the pounder dropped into the rice tub and delivered a blow. The end of the pounder was concave, with edges rounded. This simple machine and the fanning mill are in common use in Oriental countries to-day. Looking to the right or left, one sees a rice mill, consisting of a one-man power jumping on and off the beam of the pounder and one woman power at a crude fanning mill cleaning the grain.

The improved processes of milling rice are quite complicated. It is first screened to remove trash and foreign particles. The hulls, or chaff, are removed by rapidly revolving "milling stones" set about two-thirds of the length of a rice grain apart. The product goes over horizontal screens and blowers, which separate the light chaff and the whole and broken kernels. The grain is now of a mixed yellow and white color. To remove the outer skin, the grain is put in huge mortars holding from four to six bushels each and pounded with pestles weighing 350 to 400 pounds, which, strange to say, break very little grain. When sufficiently decorticated, the contents of the mortars, flour, fine chaff, and clean rice of a dull, creamy color, are removed to the screens, where the flour is sifted out; thence to the fan, where the fine chaff is blown out and mixed with the other flour. The rice flour, or more properly "rice meal," is very valuable as stock feed, being rich in carbohydrates as well as albuminoids. From the fine-chaff fan the rice goes to the cooling bins, rendered necessary by the heavy frictional process through which it has just passed. It remains here for eight or nine hours and then passes to the brush screens, whence the smallest rice and what little flour is left runs down one side and the larger rice down the other.

The grain is now clean and ready for the last process—polishing. This is necessary to give the rice its pearly luster, and it makes all the difference imaginable in its appearance. The polishing is effected by friction against the rice of pieces of moose hide or sheep skin tanned and worked to a wonderful degree of softness, loosely tacked around a double cylinder of wood and wire gauze. From these the rice goes to separating screens, composed of different sizes of gauze, where it is divided into its appropriate grades; it is then barreled and ready for market.

In mills more recently erected, the foregoing process has been modified by substituting the "huller" for the mortar and pounder. A short, cast iron, horizontal tube with interior ribs and a funnel at one end to admit the rice, has within a shaft with ribs, so adjusted that the revolution of the shaft creates the friction necessary to remove the cuticle. The rice passes out of the huller at the end opposite the funnel.

It is to be regretted that fashion has so much to do with rice. A high gloss is required, to obtain which the most nutritious portions are removed. The Oriental custom of removing the hulls and bran with a pounder and using the grain without polishing is

economical and furnishes a rice of much higher food value than the rice of commerce. In polishing, nearly all the fats are removed. In 100 pounds of rice polish there are 72 pounds of fats; in 100 pounds of polished rice there is only 0.38 pound of fat. Upon the theory that the flavor is in the fats, it is easy to understand the lack of it in commercial rice and why travelers universally speak of the excellent quality of the rice they eat in Oriental countries.

We are now prepared to understand the loss by breakage of the kernel in milling. If the grain remains whole and receives a high polish, it sells for 6 $\frac{1}{4}$ cents per pound. If it breaks, it drops in price to 2 or 3 cents per pound; and if it crumbles, the price is 1 $\frac{1}{2}$ cents per pound. What is the average breakage per 100 pounds and how can it be remedied? Investigations made among the rice millers in 1897 led to the conclusion (based upon their written statements) that the perfect grains were only about 40 per cent. of the total product. It is with a view to greatly decrease this heavy percentage of loss that the Department of Agriculture is now attempting to introduce the hard, firm rice from the island of Kiushu, Japan.

Dr. Knapp's report contains much interesting matter as to the details of improvements in rice culture, yet to be adopted, as well as a fund of information as to the history, the comparative costs, and other differences in the rice-cultivating countries. Among his table of relative costs, the following exhibits the invincible nature of mechanism, backed by human ingenuity, when finally brought into contact with crude and primitive methods:

NUMBER OF ACRES ONE MAN CAN FARM IN RICE, WITH WAGES, IN DIFFERENT COUNTRIES.

Countries.	Acres.	Farm wages in gold per year, with board.
Japan.....	$\frac{1}{2}$	\$10 to \$18
China.....	$\frac{1}{2}$ to $2\frac{1}{2}$	8 to 12
Philippines.....	$2\frac{1}{2}$	15 to 20
India.....	3	10 to 20
Siam.....	3	10 to 20
Egypt.....	4	15 to 30
Italy.....	5	40 to 60
Spain.....	5	40 to 60
United States:		
Carolinias.....	8	96 to 120
Mississippi delta.....	10	120 to 144
Southwestern Louisiana and Texas.....	80	180 to 216

In a word, the laborer of Japan, although averaging a wage of less than \$15 a year and his board, caring for but one-half acre of rice, produces that crop at a cost of \$25 to \$30 per acre, above his board; while the Texan laborer, paid fifteen times the wage, with his improved implements and methods, cares for eighty acres, at a cost of less than one-tenth that possible to the Oriental. And, as Dr. Knapp makes quite clear, this relative difference is destined to grow materially in our favor in the near future.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Skin Wool in Germany.—The German Credit Institute, of Saxony, has formed a joint stock company having for its object the production of skin wool, which has hitherto been produced almost exclusively in the south of France and Northern Italy, says Consul George Sawter, of Glauchau. Glovers' wool has been produced here only in limited quantities. The textile industries were compelled to cover their requirements in this line from abroad—i. e., from France and Italy.

This term does not refer to a new sort of wool, but applies to the raw products of animal wools hitherto known as "Raufwoolle" (scraped wool) or "Gerberwoolle" (glovers' wool). Under "wool" is collectively understood the hairy covering of the various breeds of sheep, from which such wool is shorn during life. But, as one can hardly shear them down to absolute nakedness, a certain amount of wool, or hair, is left as a covering after shearing. The product so obtained is known as "glovers' wool." Now, the wool of slaughtered animals is mostly of inferior quality, and, moreover, materially shorter than that obtained by shearing the living animals, for which reason the former is used for making up inferior textiles, such as low class flannels, etc. Skin wool is wool which is scraped off of the skins of dead sheep. The wool obtained in this manner is, as a rule, longer, stouter, more healthy and uniform than that obtained by shearing, because sheepskins are mostly obtained from animals slaughtered for food, which must necessarily be sound, large, and healthy, whereas shorn wool is obtained as well from sickly, decrepit animals—such as are found in every flock. Skin wool is, consequently, likely to be more uniform in respect to fineness of quality, because, in scraping the wool off the skin, the coarser portions which grow on certain parts of the body can be sorted more carefully than is the case with shorn fleece.

Skin wool and glovers' wool are thoroughly different in character. The latter is principally removed from the skin by chemical means, and, in consequence, has not the same value as the shorn wool for the wool industries, more especially where it is a question of producing sensitive colors. Skin wool, on the other hand, is obtained without using chemicals and is fully equal to shorn wool in respect to quality and, indeed, for certain purposes—i. e., as abb wool (warp)—it is often preferred to shorn wool, owing to its tenacity and length. It is hardly necessary to specially mention that where skin wool is desired, the main thing is to allow the fleece to have had a growth of from eight to twelve months. As to the process of producing such skin wool and its commercial value, nothing whatever has been made public up to this time.

A New Electrolytic Process of Manufacturing Chemicals.—For some months past, there has been an increasing activity in the chemical trade of this district—the largest and most important of its kind in Great Britain—and quite recently an added impetus has

been given by the establishment of works using a new electrolytic process, says Consul James Boyle, of Liverpool. Up to a few years ago, the chemical trade of this district was exceptionally prosperous; but now it has to meet German competition, and since the going into active operation of the present tariff, the exportations to the United States have tremendously decreased. During the fiscal year ended June 30, 1893, there were exported to the United States from this district alone chemicals to the value of \$9,507,269. During the fiscal year ended June 30, 1899, the value was only \$1,982,536. The trade appears to recognize that it can never recover the American market—at least not to the extent heretofore existing. The endeavor is to create new markets and to meet competition by more economical methods of manufacture.

There has just been started at Farnworth, near Liverpool, a new process of separating chlorine and sodium by the direct decomposition of salt by electrolysis, without the introduction of any other ingredient. It is called the Hargreaves-Bird process. The Liverpool Post gives the following explanation of the method:

"Salt is submitted to a suitable current of electricity, and both the substances are produced unmixed and pure. The salt used is in its cheapest form, being that of brine pumped up from its native bed, the salt of which—delivered into the actual apparatus of the factory—costs no more than about 3d. (6 cents) per ton, as against 7s. (\$1.70), the usual price for the rough salt used in the older alkali works. The apparatus, or cell, in which this is effected is a narrow tank, the walls of which are porous. Brine is pumped into it, and on the passage of electricity a solution of soda flows slowly down from the outside of these wet walls, yielding at once soda crystals; while the chlorine in like automatic manner passes away for the production of bleaching powder, chlorate of potash, or such other chlorine compounds as may be required. No raging furnace, no sulphur kilns, nor the noxious fumes rising from such are present. No waste materials are produced, unless as such be reckoned the ashes from under the steam boilers which produce the motive power for the generation of the electric current. Even the smoke from the boiler fires and the waste steam from the engine are used in carbonating and dissolving the soda thus formed. In the actual production scarcely any hand labor is required. All moves on in silent regularity, and it is only in the necessary handling and packing up of the materials produced that labor comes in.

"One distinction of the cell is the peculiar diaphragm used. It is a sheet of asbestos composition, non-porous in the ordinary sense of the term, but when forming the walls of the cell, the contents of which are electrically excited, it allows molecules of sodium hydroxide to pass, but very little sodium chloride."

It is claimed that the above process is much more economical and simple than the former, including the rival electrolytic methods. It is stated that one difference between the Hargreaves-Bird process and the Kastner-Keller process (which has been in use in this district for some time) is that mercury is used in the latter process, but not in the former. Large sums of money have been spent in experiments with different electrolytic methods with varying success, and it is too early yet to say whether the new process will meet expectations. Speaking generally, however, the chemical trade of this district is now in a flourishing condition, and orders during the last month have been exceptionally large—mostly, however, for home consumption. Still, trade is not as good as it was ten years ago. Since the great decrease in shipments to the United States, continental orders have largely increased, in spite of German competition. Most of the new orders have been from Germany, Russia and France. Present prospects are good.

The salt trade is naturally closely allied with the chemical trade. Strange to say, however, the salt trade has not followed the chemical trade in a resumption of comparative prosperity. For months past, attempts have been made to form a combination of all the salt companies of Great Britain, most of them being in this neighborhood, on the Cheshire side of the Mersey. The combination was effected recently at a meeting of the trade in Liverpool, and the announcement is officially made that there will be an advance in prices from the present date. It is not proposed to consolidate the many individual companies into one gigantic "trust," to be operated by one executive, with a "prolong" of the profits and losses; but the arrangement is to form an agreement to regulate and limit the output of each concern and to keep prices up to a certain point, each company, however, to retain its own separate organization, both as to management and profits and losses.

Export of Watches to Russia.—Vice-Consul-General Hanauer writes from Frankfort, November 18, 1899:

During late years, Warsaw has become the center of the watch trade in Russia. The dealings between foreign and Russian merchants are consummated there, these parties meeting once a year for the transaction of business in this line. At this time, the Russian buyers from Moscow, Tula, Saratow, and Siberia give orders for the next twelve months and settle for past purchases. This trade is quite important. A few Geneva watch-making firms sell over 1,000,000 rubles' worth here annually. Swiss watch manufacturers purpose now to establish an extensive depot of goods in their line at Warsaw, to increase the sales and monopolize the Russian watch market. They have applied to the Swiss consul in Warsaw to furnish them detailed information. Our export associations would do well to obtain similar data from our consuls.

Beet Harvest in Russia in 1899.—Consul-General Holloway, of St. Petersburg, on November 22, 1899, writes:

The department of unassessed taxes and government sale of liquors has compiled a preliminary statement concerning the outlook for the beet harvest and its quality in 1899, based on information furnished September 1-13, 1899, by the excise collectors, which places the harvest of beets in European Russia during the present year at 7,026,513 tons, against 6,182,394 tons in 1898. Of that amount, the southwestern region will furnish 3,918,173 tons; the central, 2,267,218 tons; and the Vistula region, 841,122 tons. An increase of 13.7 per cent. is expected. In the southwestern region,