immensity of the business (the estimated number of cows in the United States being 5,500,000) would warrant much more attention than it has received.

The subject may conveniently be arranged under two divisions, namely: 1st, methods of contamination; 2d, prevention of contamination.

1st. Methods of contamination can be subdivided into:

(a) Diseases affecting cow, her food and surroundings.

(b) Contamination while being milked and gotten ready for shipment at the dairy.

(c) While being transported and delivered to consumer.

(d) After milk is in consumer's possession.

2d. Prevention of contamination covers a wide field, and can only anywhere near approach perfection by constant, intelligent supervision from the pasture field, watering place, and food trough to its final delivery to the consumer, and after it is in the consumer's hands by general education of the masses in hygiene in general.

In order to more fully put before you the immensity of this traffic, I wish to quote some statistics showing amount of milk used in some of our large cities. It is said that 1,250,000 quarts are used in New York city daily. That would mean milk from about 155,000 cows, and that about 31,000 milkmen have been employed in milking these cows, that 62,000 hands have been used in the work, and that most of them are wet with milk and that a very small per cent have been washed before milking, a fact to which I am sorry to be obliged to call your attention.

In regard to diseases liable to affect the cow, of course tuberculosis holds first place, and in some localities seems to be present to an almost alarming extent.

H. E. Annett's experiments show tubercle bacilli were present in the milk used in the English cities in from 3 to 30 per cent of tests made (inoculation of animals was the test used), and in butter in from 10 to 47 per cent, but that they do not live in butter more than twelve days. Out of twenty-eight samples of oleomargarine they were present but once. This latter observation points to the fact that butter used in the manufacture of oleomargarine is usually more than twelve days old, and the moral would be "eat oleomargarine." It is a well-known fact that a cow can be affected with tuberculosis and yet give non-tubercular milk, in fact, is not liable to do so unless extensive general tuberculosis be present or else tuberculosis of teats, milk glands, or udder exists. It would seem the sensible thing to do, to examine milk and destroy the animal only when she gives milk containing tubercle bacilli, instead of the expensive, not to say questionable, proceeding of slaughtering them because they react to the tubercle serum.

Is there great liability to contract tuberculosis from the use of milk that occasionally contains tubercle bacilli? Or putting it more strongly, is tuberculosis disseminated in the human being by use of tuberculous cow's milk? This opens up a wide field, and no doubt opinions would be very different, yet by a little observation much can be learned.

Tuberculosis is hardly more prevalent or fatal in the United States and England than in Germany, while milk is used raw very largely in the two former, and is very generally sterilized by boiling in the latter country. Woodhead carefully examined 127 children that died of tuberculosis and found the mesenteric glands involved in 100 of them. Osler relates the instance of a milk dealer whose herd was giving tuberculous milk, and withdrew his milk from the market and fed it to a litter of pigs, which all became affected with intestinal tuberculosis. Is there any reason to believe that young children are less susceptible than young pigs? The answer would be modified by two propositions.

We have no direct evidence of such a result, and the bacillus found in cow's milk is not exactly the same as that found in human tuberculosis. Sparsely settled regions, regions of an elevation above 5,000 feet, are almost exempt from this disease. While they probably use as much milk as other people, no doubt immunity plays an important part here, but hardly to such an extent. The American Indian and negro races are especially prone to this disease, although they use a much smaller amount of milk than the white race. Primary intestinal tuberculosis is uncommon in the human being, which would not be the case if it was at all generally produced by milk consumption. Hydrochloric acid or gastric juice is very destructive to the bacillus, and probably under ordinary conditions few, if any, pass through the stomach alive, and provided some do they hardly would infect from the intestine if the mucous membrane were intact. We do not deny the possibility of infection, but the practical question is, how large a proportion of those using tuberculous milk become affected? This can only be answered, in the light of facts before us, by saying that there are not nearly as many as alarmists would have us believe. The writer's opinion, based upon years of observation is, that children who consume much milk during early life, say up to fifteen years of age, are better equipped physically, have less skin and digestive diseases, and really have a lower mortality from all causes, tuberculosis included, than those deprived of this useful food. Cattle are, of course, liable to acute diseases, but fortunately give but little milk during an attack, and the same may be said of most chronic diseases, tuberculosis being the main exception. The disease of milk glands known as garget is quite common, and the average farmer thinks such milk not sufficiently bad to warrant throwing it away, and into the can it goes. Once seeing a farmer emptying a few quarts of this kind into a can, I protested, telling him that it might easily cause some bottle-fed infant to become sick, or, still worse, some sick one to die. He said so small an amount in the whole mass would do no harm, besides he received such a pittance for his milk that he could not afford to throw it away.

New milk (that is the secretion of milk glands for first two or three days after dropping calf) is not generally considered fit for use, but quite generally goes in to enrich the mass sent to cities.

Milk, sometimes even deadly in its virulence, is

many times the result of food taken. The most notable example of this is the disease known as "milk sickness," and associated with the disease in cattle known as "the trembles." It has been demonstrated experimentally that an ounce of butter or cheese or four ounces of the meat from these animals, either raw or boiled, given to a dog daily for six days, will produce death. Although the exact cause of the disease is not definitely known, it is generally admitted to be due to some plant consumed by the animal. I believe new countries and certain localities only suffer from this disease.

Digestive diseases are most common during periods of drouth, when cattle are obliged to eat weeds and plants which they avoid when grass is abundant. Marked examples of the influence food has on the quality of milk are those of the milk and butter being scented by the leeks eaten by the cows in certain localities in the Western States, and the unwholesomeness of milk given by cows in cities when fed on cabbage leaves and other garbage. These are so well known that I hesitate to mention them. Those fed on malt and refuse from breweries and distilleries come under the same heading. There should be care of the cows not only in regard to food and water, but also in relation to construction of stables, ventilation, light, bedding, condition especially of stable floor (the latter often are afloat on a reeking mass of filth in latter part of winter and spring months, and in such cases the cow is usually pretty well plastered). This is not overdrawn, but is supported by facts altogether too numerous. Can milk from cows in such surroundings be a good article?

Probably the most prolific source of contamination occurs while milking is being done. Who ever heard of a milkman washing his hands before milking? Most of them wait until they are actually doing the work, and then wash them in the milk. Many times I have seen four dimples in froth on milk in milk pails, two where the streams of milk penetrated, the other two, dark brown ones, where milk drips from hands. Many milkmen think they cannot milk without first wetting teats with milk and consequently persist in this filthy habit. Water is not usually handy to milkyards or stables, consequently udders and teats rarely get washed.

The cow is a restless brute, especially inclined to be uneasy while being milked, occasionally kicks and now and then plants a filthy foot in the milk pail. (Such milk is usually strained before going into the can.) Hair, insects, hay, straw, blood, pus, particles of earth and more or less cow manure constitute the most common foreign elements that get in at this time. It is estimated that New York city consumes thirty tons of cow manure a year in milk. It cannot be entirely prevented, but can be very much lessened, if only more care were taken and result of the evil more generally appreciated. Also, at this time milk often has been made deadly by contamination with disease germs. They get into the milk in a variety of ways: most common, perhaps, is that by washing utensils with infected water. Scarlet fever, diphtheria and typhoid are no doubt often produced by the use of milk so infected. Scarlatina is unknown in countries where cow's milk is not used for food, which many authorities think is due to this source of transmission being absent. A common source of trouble comes from improper cleansing of utensils at this time, minute particles adhering to cans, pails, etc., being a nidus for rapid bacterial development in fresh milk that is added. Milk may contain enough butter fat, solids, be strained, and yet be very bad from this cause alone. The various preservatives such as borax, salicylates, paraldehyde, etc., are all bad and should never be used, and at the best are only a "premium on shiftlessness." Their use cannot always be laid at the producer's door.

Methods of contamination while in the hands of the shipper and dealer are mainly from removal of covers from cans for various purposes, thereby allowing particles of dust and various other minute substances to gain entrance, and quite generally such substances favor bacterial development. To illustrate the care necessary, I once saw some trainmen unloading empty cans at a country road crossing. Beside the track was a ditch filled with stagnant water and mud, and they thought they were having lots of fun by slamming cans in this ditch to see how dirty they could make them. Such a can could again be made fit to put milk in after more work than the average producer would care to give. The rate of multiplication of bacteria under favorable circumstances is such that it would stagger the uninitiated. In very good milk as it comes from the udder, the number is usually from three to four thousand per cubic centimeter, while milk as delivered in the city usually contains from three to six millions per cubic centimeter. After the milk is in the hands of consumer, the methods of entrance of impurities are many; the most common are from unclean dishes, keeping in living rooms, exposure to disease germs and lack of proper facilities to keep correct temperature. Good work in the line of inspection is now being done by the Philadelphia Pediatric Society. A committee has been appointed consisting of a bacteriologist, a veterinarian and a physician. They are noting all the conditions under which milk is obtained. Any farmer or milk producer that allows a thorough inspection once a month is given a certificate if the milk comes up to the standard fixed by the society. This plan at least has the right method in vogue, and will accomplish much good if faithfully carried out.

I understand at the present time the milk inspectors of New York city are appointed under civil service rules, and only the ones passing best examinations are chosen. Since this rule has been in force the relation of the producers and inspectors has been cordial, for the former are sure of fair treatment. Many of our smaller cities are making more or less abortive attempts at milk inspection, principally relying on penalties enforced on the producers when milk does not contain enough solids and butter fat, nothing whatever being done to keep out impurities.

2d. Methods of prevention of contamination that might and should be faithfully and earnestly carried out are many. Hygienic laws that are useful generally are especially useful here, and when more generally understood milk inspection will be greatly simplified.

Common honesty would do much to better matters, but unfortunately many individuals are not willing to sacrifice time, work and profits for the sake of keeping conscience clear.

A man that has had his training entirely in the city and has no practical knowledge of farming in general and milk industry in particular, be he ever so well educated, is not the man for this work, for the farmer will find in about one minute that he does not understand the business, and will only listen to his suggestions in a spirit of derision and let the advice, as the old adage is, "go in one ear and out the other."

The man that will sit on a milkyard fence with high collar and patent leather shoes, and ask the farmer if his cows will bite, is not the man to gain the latter's confidence and co-operation.

The above description of the man not wanted also suggests the man necessary for proper work here. A man educated, cleanly in habits, faithful and honest, and willing and anxious to observe every detail and, so far as possible, correct every evil is the man needed.

What has he to do? See that milk is not shipped when contagious disease exists on premises, see that cows have proper food and water, and are healthy, that stables are properly cleaned, lighted and ventilated, cows properly bedded and not confined too continuously, that hands, teats and udders are clean, that the dry process be used in milking, that milk utensils are properly cleaned, that no filthy or diseased milk is emptied into can, that a proper strainer is used, that no old milk is emptied into the fresh, that no chemical preservatives are added, that milk is properly cooled before can is covered, that cans are not opened on trains, that the milk does not stand around depots for several hours after being delivered before milk peddlers come to take it away, and that the peddlers do nothing to improve its quality, and he might extend his good offices even into the home of the consumer to good advantage.

Examinations for germs aside from tubercle would not be necessary if the foreign substances were kept out. It is not that the producers and handlers of milk do not understand these matters generally pretty well, but they are careless about their proper enforcement, they do not fully realize the great disaster that might easily follow carelessness or dishonesty in any minor detail.

The trite saying, "Eternal vigilance is the price of liberty," might apply here if changed to "Eternal vigilance is the price of pure milk."—Columbus Medical Journal.

AMERICAN LOCOMOTIVES IN ENGLAND.

By CHARLES ROUS-MARTEN.

APPARENTLY it is inevitable that whenever the slightest reference is made to the recent importation of American locomotives for British railways some ardent but ill-informed patriots should be stung by national jealousy into pouring forth torrents of enthusiastic nonsense. This seems rather a pity, as it is apt to engender ill-feeling, and also to inspire in the minds of foreign critics an undesirable sentiment of contempt in which the innocent as well as the guilty are hopelessly confounded. I am aware that it will be horribly unpopular just now to suggest the slightest doubt that American locomotives have been thoroughly tested in comparison with British engines and have been utterly and finally beaten. Yet I venture to take the risk in the interests of truth and fairness and science.

Nothing can possibly be clearer or simpler than the circumstances of the importation of these American engines. Four British railway companies found themselves so short of locomotive power that their work was seriously impeded, and something like a deadlock was threatened. They put in hand fresh engines to the full capacity of their own workshops, and ordered largely from British makers. But the latter were "full up" with contracts, and required nearly three years for the execution of the orders. In these circumstances what were the railway companies to do? Were they to sit down and wait until a British builder should be at liberty, and meanwhile let their traffic get into a state of deadlock? Some writers seem to think that this course should have been adopted, that at all costs and hazards British railway companies should refrain from purchasing abroad what they cannot get in Britain. Not so thought the railway companies; not so would have thought their customers and those very critics, had such tactics been adopted. Failing to obtain in Britain what they wanted, the railway companies did just as any ordinary customer would have done—they went elsewhere for the articles they required.

Now one form of criticism upon this procedure has been to revile the railway companies for not foreseeing years in advance that a flush of prosperity would come upon the country, and with it an increase of traffic. Mr. S. W. Johnson and Mr. H. A. Ivatt and Mr. H. Pollitt, all are most able men as locomotive engineers, but they are not worth a rush as inspired prophets. They never served their time in any prophetic workshop, and so they have just to content themselves with the mere normal foresight born of common sense, which is the attribute of ordinary mortals. They made such provisions as prudence and experience dictated, and most assuredly their shareholders would have been "down on them" had they done or attempted to do more.

So, the need of engines being urgent, orders were sent to America. At this stage I may eliminate the Great Northern and Great Central and Barry Railways, because what I shall have to say applies more especially to the Midland line. And I desire to say here that I do not write in the smallest degree as a partisan. I have not the slightest interest in praising or defending one engine or one country's engines at the expense of another or others, nor have I the faintest inclination to do so. I recognize no "patriotism" in such a case. I care not whether a locomotive be British or Yankee or French or Double-Dutch. My sole criterion of merit is its performance in relation to its requirements, its conditions, and its nominal power. To all questions of country and person in such a connection I am profoundly indifferent. I seek simply to get at the truth.

The orders, as I have said, were given to certain American firms. Those firms were, I am informed, quite as "full up" of orders as were the British builders. But it is in the United States a breach of the eleventh commandment, and contrary to all recognized principles of commercial morality, to decline a good contract or to "turn ready money away." So these contracts were undertaken without a moment's hesitation. It is not my business to explain how this was managed. But it was. The engines, Mr. S. W. Johnson has stated, in an interview with the representative of a London daily non-technical journal, "were to be of the same power as the Midland standard goods engine, and there were a few small details to which the manufacturers had to conform; but, generally speaking, the Americans had a free hand, and the engines were for the most part of their own design and pattern, and made in their own way."

Let it be noted here that the order was not that the locomotives were to be of the class and power that would be employed in America to do the work required, viz., to haul coal trains weighing 500 tons over gradients of 1 in 200 to 1 in 100. No; the American locomotives were to be "of the same power as the Midland standard goods engines." They were duly built and were delivered. Mr. Johnson says, "within a few months of the orders being given," although "some contracts which we let out to British firms in 1897 were not completed till February, 1900"—that, however, was largely due to the engineering strike. And Mr. Johnson continues: "Each American engine cost us £400 less than did those for which contracts were given to British firms immediately in front, and at such a reduction the American engines were put free on our railways just as English engines were."

Almost exactly identical, it will be remembered, was the experience of a British Colony some years ago. An order placed in Britain took two years to complete, and the engines had to be altered. One placed simultaneously in America was executed in five months, at £400 per engine less and without any trouble whatever. But this in passing.

Naturally when the engines were ready for work it became a matter of much interest to see how they would compare with British engines of nominally identical power. There was never any idea of ascertaining whether American engines were "better than British engines." No well-informed or reasonable person ever dreamt for a moment of regarding such an absurd issue as involved in the trial, for a reason to which I shall come directly. Mr. Johnson himself says emphatically, "I never had any doubt in my own mind as to which was the better engine of the two"—that is, of the two classes that were tried in comparison.

Now let Mr. Johnson himself tell what was done. He says: "In January of last year we commenced a six months' comparative test, terminating at the end of June, between these American and our standard Midland goods engines, built by Messrs. Neilson, Reid & Co., of Glasgow, and Messrs. Kilson & Co., of Leeds. The two types were set to draw similar mineral trains under the same conditions, and a careful account was kept of the total mileage covered by each, the total coal consumed, and the charges for repairs which belonged to each engine. The result was conclusive, and is briefly as follows:

	Per cent.
Fuel	20—25
Oil	50
Repairs	60

It must be said for the foreign engines that they worked their trains satisfactorily, but their inferiority on the three points named is, on the above showing, incontestable."

This result has been variously expressed, but is understood by the non-technical press as implying a complete proof that American engines are inferior to British. Of course, as I remarked before, no such comparison is really involved directly or indirectly by the test employed on the Midland Railway, which in its essence is obviously no adequate means of comparing the different methods of two nations. It may naturally be asked by a superficial thinker, "Is it not a fair comparison to have both engines made as nearly as possible of practically identical power, and then to try them together on identical work?" I reply, unhesitatingly, "No, it is not; unless it be clear that each class of engine is the one that would be used ordinarily for the same work in the land of its origin."

This is obviously so in the case of the Midland engine, which is the outcome of Mr. Johnson's many years' experience and judgment as to the type best qualified to perform the work which has to be done on the Midland line. He has designed and built an engine which is intended to haul 500-ton coal trains, and which does so in a most efficient and economical manner. Its design is not only practically efficient and handy, according to British practice, but it is also symmetrical and handsome in an exceptional degree, and worked—as British engines have to be worked—to the full extent of its capacity, it is probably as perfect a machine as could well be devised for its purpose, within our present knowledge. That may be frankly admitted.

But the point which vitiates the whole comparison between these fine engines and the imported American engines, and equally vitiates all deductions from the result, is the indisputable fact that this type of American locomotive is not, with respect to its dimensions, one which would be used in America for the same duty, viz., to haul trains weighing 500 tons British, or 560 tons American—1,120,000 pounds, as the Americans prefer to express it—at considerable speeds on roads with gradients of 1 in 200 to 1 in 100. For such duty in the United States locomotives of far greater power would be used than these which have only 1,214 to 1,364 square feet of heating surface, 160 pounds steam pressure, and cylinders 18 x 24 inches with 5 feet coupled wheels. An American engineer would assuredly use a boiler with, at the least, 1,750 to 2,500 square feet of heating surface, and 180 pounds steam pressure. Indeed, I believe that these very engines in question were built to use 180 pounds steam pressure,

so that to work them at 160 pounds is another handicap in their disfavor. Nor must the fact be overlooked that their piston stroke is shorter by 2 inches than that of their British competitors.

It may reasonably be asked, "Why, if the smaller dimensions suffice for the British engine, should they be insufficient for the American?" The reply is that all American locomotive practice is based upon the principle of allowing a margin of power. In all classes of work this is the rigid American rule, and, in pursuance of that rule, I assert, with considerable experience of American practice in various parts of the globe, that had the American builders been instructed to supply an engine to do certain specific duty, they would not have produced the type now seen on a few British railways, but one of far greater power. And, therefore, as the American locomotives have worked under conditions not suitable to their type, they necessarily have worked under a serious disadvantage. For when you try one locomotive which is specially designed on the spot for particular work against another built in a different country on a different design, and brought into the comparison merely as possessing approximately identical dimensions, you handicap the latter very adversely. Virtually you pit an engine, admittedly and specially suitable for its prescribed duty, against one which, while nominally of nearly equal power, is practically much less strong, because its type and design presuppose it to have a margin of strength which, under these conditions, is absent, and because also its type is only employed in its country of origin for the specified work, with greatly larger dimensions.

Therefore the recent Midland trial only proves that identical dimensions for identical work will not suit engines of totally different designs and modes of construction. But it did not require one to rise from the dead to tell us that. I need hardly say that I implicitly accept Mr. Johnson's figures, and that I am perfectly satisfied as to his desire to make the comparison as fair as possible. I do not touch the question whether the American engines would show as well in the hands of British drivers as when driven by men who had always been accustomed to that type of locomotive. Neither do I touch the question whether British drivers would be anxious to make American engines appear superior to British engines in any such trial. I pass by both of these factors in the problem. I simply say that while on the whole no exception can be taken to the fairness of the methods adopted for trying on the Midland Railway those two different classes of its own engine, such a trial affords no test whatever of the relative merits of British and American locomotives, or methods of locomotive practice.

Another point is raised by some remarks of Sir Ernest Paget, the chairman of the Midland Railway, who also was interviewed on the subject. Sir Ernest said: "The American engines are not as good as ours. They do not cost as much, and they are not so well finished. Under all the circumstances nobody would expect them to be so well constructed. But in America they make their engines on an entirely different principle, and with quite an opposite idea to ours as to their future. In America you go and take an engine off the peg, as it were, and from then onward work it right out till it dies, giving it no rest. Their contention is that by the time it is done for and worn out something better will have come along. On the other hand, we make our engines as good as we possibly can to start with, and then we tend them most carefully, rest them, clean them out, and do everything to make them last."

This raises the whole question—Which plan embodies the wiser policy? It is no doubt an attractive method to make engines as good as possible to start with, and then to tend them most carefully, and do everything to make them last. But it is at least open to argument whether an engine-life thus artificially lengthened be really advantageous to its owners. May it not imply the crowding of a line with ancient locomotives which, while seemingly too good to break up, nevertheless are unable to take standard train-loads, and which consequently necessitate either the use of pilot engines or the running of additional trains? To many working time tables a list is appended of reduced loads which are to be given to the older locomotives. The reduction of a train-load to suit the deficient power of an old engine involves a proportionate addition to the number of trains that have to be run, for the load has to be taken, whether in five trains by new engines, or in six trains by old ones. That the workmanship of the American engines is enormously inferior in point of finish to that of our British engines is too obvious to need demonstration. Indeed, I drew special attention to the fact in my articles on the locomotives at Vincennes, where even the special Exhibition engines displayed in some parts a roughness of finish that was absolutely startling and almost horrifying to British eyes. But if it be asked whether the engines were less efficient for their rougher workmanship, it is not easy to give a satisfactory or conclusive reply. Similarly it is an open question how far the practical usefulness of a locomotive is discounted through the use of cheaper materials for certain parts, e. g., steel for copper in the fire-box, steel for brass or copper in the tubes. The cheaper materials should not last so long. But American builders, as Sir Ernest Paget justly remarked, do not desire their engines to last so long. They deem it cheaper to use them up quickly and build new ones with all the latest improvements. It must be of dubious benefit to have on a railway scores or even hundreds of engines thirty to forty years old, however often repaired and rebuilt.

But on one point I desire to be particularly clear and emphatic. In certain cases an American engine may be found more suitable than a British engine, through the convenience due to the accessibility of its working parts owing to their outside position, and if the American be designed for the particular work it has to do, my experience leads me to believe that it will show results quite as good as those of a British engine. Moreover, it is the American practice to build far more powerful locomotives in proportion to the work required than is done in Britain. But comparing engine with engine on the basis of efficiency per unit of nominal power—reckoning the capacity of the boiler

and fire-box, as well as of cylinders and wheels—and also on the basis of performance per unit of nominal power, I am firmly convinced that no locomotive exists in the world that is superior to the British.—The Engineer.

TRADE SUGGESTIONS FROM UNITED STATES CONSULS.

Prevention of Frost by Cannon and Smoke—The last number of the *Gironde*, a Bordeaux newspaper which represents the wine growers of that region, contains an article by Mr. Bellot des Minières on the subject of preventing frosts from injuring early fruit. His theory is that it is not the frost which blasts the budding fruits, but the sun's rays following a night of frost and finding in the grape, already sensitive from the cold, an object unable to withstand their heat. After many experiments, which he says have always succeeded, Mr. Bellot des Minières recommends the accumulation at various points in the vineyard of combustible matter, capable of producing a thick, black smoke, and setting fire to these heaps of fuel at sunrise, so that a veil of smoke may cover the entire ground, protecting the vine by its opaqueness against the sun's rays and maintaining the general temperature of the vineyard at a point which will counteract the effects of the frost. The smoke, which acts as a warm blanket, lifts gradually enough for the vine to adapt itself to the changed temperature.

Since I reported on the subject of firing cannon for the prevention of hail storms,* the use of cannon for other allied purposes has been discussed in agricultural circles. Dr. Marangoni, professor of physics at the Royal Lyceum of Florence, Italy, has declared his belief in the efficacy of the use of cannon for the prevention of frosts. He says:

"There are astonishing resemblances between the state of the atmosphere which produces hail and frosts. . . . An absolute calm is necessary for both. . . . In the phenomena of the white frost . . . the calm creates a very cold layer of air near the surface of the earth, saturating the otherwise dry air and at the coldest moment the frost is formed. . . . The important object to be achieved in the case of both hail and frost is to break up the calm before either is formed."

He recommended that the cannon be fired horizontally over the ground to be protected. Under his direction, cannon were fired horizontally over the vineyards of Count Balli, at Asti, and he relates that a strip of vineyard 500 feet wide over which two cannon were fired was entirely protected, while the vines on each side were badly injured by the frosts.

At the central office of the agricultural societies in this part of France, I was told that extensive preparations are being made to test the efficacy of cannon against frost in spring.

One of the gentlemen who is working on this question said to me:

"The frost is formed by the stored heat of the sun combined with an excess of dampness; . . . the firing of the cannon produces perturbations in the atmosphere, causing a slow transition between the coldest hour of the night and the coming of the heat of the sun."

It has just been determined to hold an international cannon congress in Lyons next November, in which this subject will be fully discussed, and I am requested to say that American representatives are invited to be present and to take part in its deliberations.

As an invasion of grasshoppers is announced for this summer in southern Algeria, cannon are to be tried against them also.—John C. Covert, Consul at Lyons.

German Wine-Trade Directory.—Consul Schumann sends the following, dated Mainz, April 22, 1901:

It may be of interest to the wine and kindred trades to know that there is published in this city a directory containing the names and addresses of all the wine merchants, manufacturers of sparkling wine, distillers, wine-room keepers, agents, and wine-commission brokers in Germany. The price of the directory is 12.60 marks (\$3), postage to foreign countries included. The directory may be obtained from the publisher, J. Diemer, No. 19 Grosse Bleiche, Mainz, Germany.

Tea in Caucasus.—Consular Agent Harris reports from Eibenstock, April 26, 1901:

The cultivation of cotton in the Caucasus has been attended with such success that the Russian Government has decided to introduce the culture of tea into that province. In 1900, nine trial plantations were laid out in the districts of Osurgei and Kutais. The results have been such that new plantations will be laid out in the districts of Mingreli and Sentum. Plants and seeds have been collected for this purpose from the best tea provinces of China.

Demand for Steel Rails in New South Wales.—Consul-General Guenther, of Frankfort, May 4, 1901, quotes from German newspapers a dispatch from Sydney to the following effect:

The Government calls for bids for furnishing several hundred thousand tons of steel rails, which shall be manufactured in New South Wales and be delivered within four years. This involves the establishment of large iron works in the colony. A deposit of \$48,660 is required as security that the contract will be carried out. It is also stipulated that the price of the rails shall not exceed the price in Great Britain and America, plus the freight.

Demand for Railway Equipment in Italy.—Under date of April 29, 1901, Consul-General Guenther, of Frankfort, says that according to the Secolo, the plan for an increase in the rolling stock of the Midland Railroad of Italy has been approved. The plan, says the paper, contemplates the purchase of 30 locomotives, 40 passenger cars of the second class, 90 freight cars, 46 reservoir cars, 50 freight cars (flat cars), and 18 bogie cars, at a total cost of \$1,782,000. The rolling material to be abandoned will be replaced or renewed by 32 locomotives without, and 14 with tenders; 2 parlor cars, 30 passenger cars of the first class, and 50 of the third class; 2 bogie cars and 70 closed and 30

* See Advance Sheets Nos. 807, 916, and 946 (Consular Reports No. 241, 246, and 247).