POISONING OF TNT WORKERS MAY BE MUCH REDUCED BY CARE

Risks of Shell Loading Much Reduced by Cheap Safeguards, and Few Cases Result

UNLESS radical improvements are made in health conservation in plants where shells are loaded with TNT, and incidentally in conserving TNT itself, between 7,000 and 17,000 cases of TNT poisoning, resulting in between 135 and 475 deaths, will probably occur in such plants in America during the production of the 78,000,000 rounds of shells already ordered by the United States Government.

The estimate is based on experience in American munition plants. About 5 per cent. of the cases may be expected to happen within the first two days of the worker's exposure, and 75 per cent. to appear after from four to eight weeks, while 20 per cent. should develop after three, five or even after seventeen months of apparent immunity.

Deaths may be expected to occur anywhere from four weeks to eighteen months after the victim is first attacked by the poisoning and when he may have quit the work and wandered far from the plant and perhaps to parts of the country where the doctors would not expect or recognise his ailment.

These are not alarmist figures, whatever they may appear. They are worked out from data obtained during twenty months daily residential observation at a plant that did about one-tenth of the TNT shell loading done in the United States for the Allies.

It should be understood that in the munition zone labor is transient and is always shifting. At most of the plants it is not unusual to average from two to thirty different workers for each job in the course of a year.

Risk May Be Reduced.

It should also be understood that the TNT poisoning risk, by reasonable and cheap precautions and proper medical supervision, might be reduced by 80 or 90 per cent. or even more.

Last October, when munition makers and health and other Federal officials discussed the subject in Washington at the American Public Health Association's convention, the munition makers intimated that there is comparatively little TNT poisoning, and the slopping of molten TNT on the outsides of shell cases, from which it must be removed in a later handling, is unavoidable.

A supplementary conference of health officials and munition makers was held in New York in December to draw up a hygiene code for the munition plants on behalf of the Council of National Defence. At this time TNT poisoning was vigorously debated at length. The munition makers voted down a clause proposed for the protection of workers known to have had the poisoning. They also defeated the proposal to provide the worker leaving the plant with a memorandum to guide him and his doctor in case of his becoming ill later on.

Their arguments seemed to be that warnings of danger would make their workers unduly apprehensive and that lawyers of a certain kind would try to base damage suits on the memorandum. What they wanted done was the education of all the doctors of the country in the diagnosis and treatment of TNT poisoning, a thing which, if possible, would take several years.

The smaller risk figure predicted above, 7,000 cases with 135 deaths, is based on the general record of the plant studied during twenty months of production, the larger figure on the record of the plant during its first seven and a half months. And during that earlier period this plant used many protective devices, some of which are not yet in use in other plants. It has been considered relatively a model plant; it is situated near the heart of the munition zone.

TNT Poisoning New Problem.

TNT poisoning is a comparatively new problem. For brevity and clearness in stating it, all the high explosive compounds containing any trinitrotoluol will be designated by the familiar symbol. They are not used to send the shell to its mark, but as its bursting charge, which makes it explode when it lands. Trinitrotoluol is obtained by the chemical combination of nitric acid with toluene, which is a coal-tar by-product of the making of gas and dyes.

But pure trinitrotoluol, a poison as well as an explosive, is not the only bursting charge now used in shells. In England 70,000,000 shells are reported to have been loaded with amatol, a compound that is only one-fifth trinitrotoluol. Ammonal, alumatol and other mixtures are also used, each of which contains about one-tenth trinitrotoluol.

Thus it is apparent that while the danger of TNT poisoning was first perceived in England and while up to the end of 1916, out of 100,000 workers in all the English plants, 88 deaths and 181 jaundice cases from TNT poisoning were discovered, during a large part of that time the English workers were handling only about one-fifth as much trinitrotoluol as they would have done if pure trinitrotoluol had been used—the practice in this country.

Also amatol is a moist, dustless paste of the consistency of ice cream, whereas trinitrotoluol, before melting, is a yellow powder of crystals almost as fine as dust. Consequently, with amatol the risk of contaminating the air breathed by workers is much less.

However, in England they have decided that most cases of TNT poisoning are caused not so much by inhaling the dust or fumes as by absorption directly through the skin or the mucous membrane exposed to them. Therefore they have instituted several precautions which they assert have materially reduced the number of initial cases of the poisoning. For example, workers are served with hot milk or cocoa free. Possibly a similar result could be obtained by having all workers rinse out their mouths with warm water several times a day, to get rid of poison-impregnated saliva.

Welding copper bands on loaded shells not the least dangerous of women's work in munitions.

English workers are also made to change all clothing before and after work at a house outside the plant and may bring neither food nor tobacco past this house, and after two weeks work where there is exposure they are shifted for two weeks to some department where there is none.

TNT is not an immediate poison. Of itself it does not directly cause death. What it does is to impair or destroy the functions of certain organs, the liver among them, and from this damage in fatal cases death in time ensues.

But if the risk of poisoning in itself did not impress, the elimination of economic waste involved in the reduction of that risk should certainly command attention.

In a loading plant with a daily output of from 10,000 to 15,000 rounds of 3 inch calibre shells, practically the same as the French .75 that is to be most extensively made for the United States, there would be in the poisonous processes of loading with straight trinitrotoluol a daily waste of from 400 to 600 pounds of the material at least, and more likely from 960 to 1,440 pounds, in vapor, fumes, dust, dirtied scrap particles and unrecovered spatters. That would amount to from three to twelve barrels of powdered trinitrotoluol, which was formerly sold at about $1 a pound.

With the 78,000,000 shells contracted for by the United States Government prior to Christmas of 1917 the total loss at this rate would be at least 3,120,000 pounds with the exceptional conserving methods used at the plant studied, and probably more than twice as much at most of the other leading plants.

If the Government would take adequate precaution to stop this waste it would be lessening the poisoning risk at the same time, for most of the waste occurs in those departments where workers are most exposed. The annual saving in TNT would easily be $4,000,000, a very small part of which would pay for the arrangements to end the waste and the risk.

Medical Protection Important.

During twenty months 56 per cent. of all the medical cases at the shell loading plant studied were TNT poisoning, and this takes no account of other cases not recorded because of insufficient data or of still other possible cases which developed after the workers had gone far away. The point is that medical protection for TNT workers is much more important than has been suspected. It means preventive measures taken by a carefully observing resident physician. Curative treatment after the accident has happened does not meet the need.

TNT poisoning shows itself in four ways. The mildest and simplest is a skin eruption, which almost always yields readily to treatment. The commonest is stomach and intestinal derangement, a catarrhal irritation of the membranous linings by the poison. In the lightest attacks the symptoms of this form are severe frontal headache, nausea and a bitter taste in the mouth. The stomach was affected in 60 per cent. of the cases at the plant studied.

Another and graver form, the most insidious and one of the most dangerous, is an anæmia, tendencies to which ought to be easily detected by a doctor making his daily rounds of the plant. But the form considered likeliest to have fatal results, unless it is taken in time, is TNT jaundice, which develops into the always fatal acute yellow atrophy of the liver. Both the anæmia and the jaundice are probably due to cumulative absorption.

Susceptibility varies as do the constitutions, dispositions and personal and hygienic habits of the individual workers. There are certain constitutions recognizable by a doctor in advance which should never be employed in the TNT departments, and this is particularly true of the alcoholic. A stomach or a liver weakened by chronic alcoholism proves particularly vulnerable to TNT, for these are its favorite points of attack. Habitual mouth breathers also should be excluded.

At the plant studied about 95 per cent. of the various and changing workers dwelt in more than twelve towns scattered from two to twelve miles from the plant. At the end of twenty months only about 7 per cent. of workers who had had poisoning attacks remained in the company's employ.

During the twenty months the plant had four different doctors, but the work of these doctors was principally to treat the patients as they reported themselves or were sent to the doctor's office. At no time was there preliminary examination of the condition of workers assigned to the TNT departments. There was no daily or weekly or any other round by the doctor for observation of the appearance of workers. Much of the time about 70 per cent. of them had bluish lips, which is an anæmic symptom.

When such conditions existed at a plant where unusual efforts were made to conserve efficiency and to protect the workers from the fumes and give them wholesome workrooms and where they were paid increasingly well for an eight hour day, it must be obvious that the poisoning risk would be worse at most other plants.

Very naturally it may be asked, if such conditions with respect to TNT exist in the munitions industry of the United States, why have they been permitted to continue? The answer is that the munition makers themselves have not yet appreciated the facts that are being revealed to them here. TNT is a comparatively new commodity for extensive production in America and its effects and its production as an industrial problem have not been studied and classified.

What effect work weariness may have in increasing susceptibility to TNT was not determined at the plant studied. But during the twenty months the record of incidence of the TNT poisoning cases showed developments varying through the week in the ratios of 24 cases Mondays, 15 Tuesdays, 24 Wednesdays, 16 Thursdays, 32 Fridays, 52 Saturdays and 6 Sundays. The small number of Sundays was probably due to the fact that fewer workers were at the plant on that day than on any other.

There may be some light on these figures from another angle in the fact that every other Friday was pay day and saloons were many and convenient.

The records also seem to show that hot or perhaps humid weather greatly increased the risk.

One helpful conclusion arrived at was the relative risk in the several departments. Employees at such a plant divide roughly into three classes. The first, about 40 per cent. of the personnel, are office force, machinists, other skilled and unskilled workmen, guards, yardmen, &c., who have no production department work and rarely run personal risk.

The second class, about 30 per cent., are those occasionally exposed. They are engaged in plant production, but not in any of the TNT departments they come now and then in contact with some TNT fumes or dust, and they furnish less than 10 per cent. of the poisoning cases.

The third class, regularly exposed, are the workers in the TNT departments, about 30 per cent. as a rule. They come constantly in contact with TNT or its dust or fumes and furnish more than 90 per cent. of the cases.

This classification partly answers the munition makers who object to medical examinations and frequent inspections on the ground that it would be handicapping, delaying and expensive to have to examine all the tens of thousands of workers in the munition plants.

The regularly exposed workers may be subdivided into four groups according to their tasks.

The first are those who melt the powdered TNT and then stir it and pour it into the shell cases. This process necessarily liberates considerable TNT vapor and much fumes, and in the opening and emptying of the original boxes there is a relatively small escape of TNT dust into the atmosphere. About 40 per cent. of the TNT workers are in this melting and pouring department, and in the plant studied this department under improved conditions showed a yearly risk of 64 poisoning cases in every 100 jobs.

The second group, about 10 per cent., are those who cool the bursting charge of TNT that has been poured into the shell, remove the petticoated funnel from the orifice of the shell, strip the protective paper wrapping off it and shear or saw off with bronze saws the excess chunk of TNT that protrudes from the orifice. This group endure a little vapor, much fumes and more dust and contact than the first group, and in the plant studied, under improved conditions, showed a yearly risk of 32 cases in every 100 jobs.

In the third group are those employed at or near machine drills used in boring out of the TNT hardened in each shell a central cavity for the eventual reception of the detonating fuse. The boring creates much very fine dust, some fumes, but no vapor, unless some of the very fine dust in the air is converted in humid weather. This group include about 20 per cent. of the TNT workers, and they showed a yearly risk rate also of 32 cases per 100 jobs. But this risk rate would perhaps be too low for conditions elsewhere. It appeared during a year's operations with an unusually well selected class of workers.

In the fourth group are those who scrape adhering particles of TNT from the thread in the shell orifice and spray the cavity in the TNT with shellac. This process liberates a great amount of shellac vapored fumes and a medium amount of dust, and obviously the tiny particles are considerably handled. About 30 per cent. of the TNT process workers are in this department; their yearly risk rate under improved methods proved to be 17 cases of poisoning for every 100 jobs.

The TNT risk rate for all the other production departments outside the TNT process work was 3 cases for every 100 jobs.

As a result of the study at this plant the conclusion was reached that conditions should be amended at every plant so that the risk rates not only should not be exceeded but should so far as possible be reduced. All the rates at this plant before the improvements were made were much higher; in the melting and pouring department, 84, as against 64; in the cooling department, 81, as against 32; boring, 181, as against 32; charge shellacking, 125, as against 17; non-TNT departments, 8, as against 3.

The improvements were better sanitary conditions, vacuum devices to carry off dust and fumes, reduction to eight hour shifts, increase in pay with reduction in actual number of workers employed in a given time, larger plant output at a reduced cost rate, and so on.

Climatic conditions seem to have a bearing on TNT poisoning risk. How much they affect the process and the resistance of the worker exposed to unusual weather conditions while on his way to and from work remains to be determined by close analysis of data from plants in different localities.

Women in gas masks finish H. E. shells.

NEW YORK UNIVERSITY TRAINING CIVIL ENGINEERS FOR WAR

AMERICA'S daring attempt to accomplish in months what other great nations have been able to do only after years of systematic preparation for war has imposed an excessive strain upon its engineers. In Washington the cry is for engineers, and more of them. Without their expert services all would be delay, confusion and waste, inflicting a poignant wound upon America's faith in its own resourcefulness. In the hands of men "over here," chiefly captains and lieutenants of industry in peace times, is the answer to the question not only how much we can help the hard pressed Allies in their death grapple with efficient autocracy but how quickly that help can be given.

When the vision of what America ought to do was conceived by President Wilson expressing the mind of the people and when Congress appropriated the billions necessary to carry it out, that was only the beginning of this modern labor of Hercules. Only the engineers could give reality to the vision by spending the money in such a manner as to transmute the people's stream of gold into the things they sought.

Here at home thousands of these men are toiling day and night to make the victory of the army and navy possible. Some of their work is spectacular, but much of it is merely prosaic, for the engineer is practical above all things and must express his imagination, however vivid, through the unromantic processes of mathematics and the monotonous throb of machinery. He is beginning where the nation might have begun years ago had its policy been based on an ultimate aim of war, as Germany's was, and if the nation had so begun the engineers' task to-day would not have bordered so closely on the impossible. For him it is not to ponder on these things but to concentrate on the immediate task in hand.

Crux in Ships.

To make the army's victory possible our engineers are adapting the 221,000 miles of railroads in this country to a task which these roads were never intended to perform—the functions of a tremendous strategic system for the strain of the sudden participation of America in the greatest war. They also are feverishly trying to respond to the desperate cry of the Entente nations for ships. Upon them rests the main burden of the construction in an incredibly short time of immense shipbuilding yards and the rushing to completion of the greatest programme of merchant marine development ever conceived by any people.

American engineers are constructing for the first time a real army of the sort the dream of Tennyson. In a short time, if plans are worked out—and the nation unanimously believes they will be—America's host of airmen will be larger than our Regular Army was on that April day when President Wilson delivered his fateful message to Congress. Each of these 100,000 or more airmen will require at least three machines, and America's engineering talent has already begun to supply the tremendous output of airplanes.

Another phase of the work of engineers is the production of motor vehicles for military use in unexampled numbers, for this is a war of the gasolene horse. An idea of one aspect of this can be gained from the fact that in the war of all wars, which is preeminently one of artillery, the guns are rarely drawn by horses, but are moved almost entirely by motors. Besides that they are completing great cantonments to house the 1,500,000 men whom America has already called to arms and the 800,000 more soon to respond, as well as possible millions.

The engineers are preparing, in part by reshaping existing facilities to adapt them to the immediate purposes of war, a $100,000,000 system of army and navy terminals on the Atlantic coast in which to store and from which to ship the immense volume of supplies of all kinds needed for the constantly increasing American units massed behind the French lines of defence.

Expanding Munitions Plants.

In record time the engineers are expanding America's munition plants and constructing new establishments for the production of war supplies, as well as reconstructing those previously called into existence by the needs of the Allies. They are readapting the coal mining industry to the greatly enlarged needs of war, including the expanded demands of the Allies' requirements. The iron, copper, zinc, lead and other mineral deposits of the country are being drawn upon by engineers for the maximum output so that the unprecedented quantity of these materials required in the manufacture of the munitions supply which a modern army needs may be provided.

Steel, the backbone not only of peace industries but of war industries as well, is being manufactured on a colossal scale day and night.

The system of forts and mines which protects the American coast is being amplified to meet not only the normal requirements of a great war but the special necessities of the present conflict, in which for the first time our coasts are menaced by the possibilities of U-boat forays. This work is being done chiefly by the engineers of the army and navy, but a great deal of assistance is provided by professional and mechanical talent drawn from civil life.

Back of all this work lies the readaptation of the railroads of America, for without transportation the whole scheme of war preparations would obviously collapse. Unity has at last been established under the supervision of Secretary McAdoo as Director-General of Railroads. With great Government appropriations to draw on, the reconstruction already begun will be hastened. New cars must be built in great numbers and turned out as rapidly as possible from plants working with three shifts each day. Locomotives completed and ready for heavy strain must be rushed out of the shops. Roadbeds must be strengthened and kept in perfect repair to meet the excessive traffic. Terminal facilities must be developed and utilized to the maximum to handle the remarkable bulk of exports without tying up thousands of sorely needed cars.

As to ships, no one would have believed at the beginning of the present war that its duration and result would depend largely upon the merchant marine of the United States. Had that fact been realized by the Allies they most certainly would have been far less confident of the results than they were when they took up arms against Germany. Since February 1, 1917, when the ruthless U-boat war began, and even before that, the facts have been apparent. Not only the Allies' victory in the field but the maintenance of their civilian populations without the impairment of life and energy by starvation depends on the rapidity with which America can hasten to completion its unique shipbuilding programme. When it is realized that the tonnage of American shipping before the war had fallen to only 8,800,000 tons, including 3,000,000 on the great lakes, while Great Britain's was 22,000,000 tons, an idea may be gained of the proportions of our deficiency.

Already the engineers have worked something akin to magic in constructing new shipyards where formerly there were only wide stretches of undeveloped land and in expanding previously existing yards. At the great plant at Hog Island, where the building of 120 ships is being undertaken, and at Port Newark, where 150 are to be turned out at a rate never before conceived necessary, land has been filled in and graded, shipways constructed, machinery plants, lighting, heating and water systems installed and housing facilities provided for armies of workmen—20,000 men at Hog Island alone.

The Pacific coast has set itself resolutely to build an armada of wooden ships from trees which stood in the forest when the war broke out in plants employing thousands of men newly sprung up on marshes and mud flats. Expert engineers long ago finished the task of restoring the seized German and Austrian ships, which it had been confidently believed in Berlin could not be done within at least two years.

Secretary Baker's testimony before the Senate committee of inquiry as to the haste in preparing the new army cantonments gave an idea of the great demands made upon the engineering forces. A group of military cities in different parts of the country built to house comfortably 1,500,000 men in the first contingents and capable of expansion sufficient to house five times that number was constructed in a comparatively few weeks. Streets were graded and laid out and all the necessities of a soldier's life were provided.

In the arsenals and munition plants the engineers are busy not only on output but also on quantitative output, and also on new devices and in recasting machinery equipments to provide for the manufacture of such devices developed by civilians.

How is the Government to meet the great need of engineers with which it is suddenly confronted? A general appeal for patriotic service is not sufficient, for unskilled man power will not supply the lack. Appeals to civilian engineers to volunteer, which have already been made with the most urgent emphasis, will not cover the case, even though the response might be unanimous, for the truth is that America is undermanned with engineers in proportion to the extent of its population and the variety and total mass of its material riches. In its extremity the Government must call for help upon the educational institutions of the country, for the only practical way to make up for lost time and opportunity is by training new men to supply the technical needs of warfare.

A recent development at New York University shows how this process works. Two agents of the War Department called at the university to inspect its facilities for the technical training of men to be taken from the new draft, the questionnaire of which includes inquiries as to mechanical knowledge and experience. The agents were informed that the university was able to train 860 men, including 500 in draughting, 50 in radio signalling for airplanes, 20 in concrete work, 20 in gas engine repair work, 20 wood specialists, 20 in maching repairs, 20 electricians, an equal number of battery repair workmen, 10 in blacksmithing and a large number in acetylene welding.

It is understood that 200,000 of the new draft quota will receive technical education before being put into service. The university has facilities for housing and feeding 1,000 on the campus by making use of facilities heretofore available for its usual summer school.

The School of Applied Science at the university received later from the War Department inquiries as to proposed courses for training, as a beginning, 100 men as airplane and gas engine mechanics, wood and metal workers. Estimates were requested on the basis of one training period of two months, beginning April 1, and three periods of two months each extending from April 1 to October 1.

The school authorities replied promptly in a spirit of thorough cooperation with the War Department's undertakings. The Department has accepted the outline of the course and other details and the first of the drafted men to be instructed have arrived at the university. These studies are under the direction of Prof. Collins P. Bliss of the department of mechanical engineering. The university is already conducting courses which directly prepare men for some of the technical services needed in war.

Other Courses Under Way.

Military mapping and surveying is under Prof. Douglas Trowbridge, assistant professor of civil engineering. In addition, Prof. Trowbridge is conducting a practical course in military engineering, including war bridge work and pontoon construction. It is proposed as a practical demonstration that the students shall build a bridge on the campus, where the topographical conditions are favorable.

Another intensive course of war study at the university is in the theory of radio communication from airplanes under Dr. Hazen G. Tyler. The men who are taking this course are expected to give particularly valuable service to the army forces.

While the university is thus bending its facilities and energies to aid the Government in making up for deficiencies in technical preparations for war, its alumni have entered the service of the country in large numbers. The average proportion of graduates of the School of Applied Science from 1895 to the present time who are now in the Federal service is 40 per cent., and of the teaching force of the school 24 per cent. is serving the Government directly in uniform.

Of the class of 1917, 42 per cent. are in the national service; class of 1916, 47 per cent.; 1915, 42 per cent.; 1914, 44 per cent.; 1913, 36 per cent., and 1912, 48 per cent.

With such a spirit of patriotic cooperation as these figures emphasize it is easy to believe that the country can count upon its educated technical men to rally in the emergency with all their intelligence and training, as well as with their ardor. America in the past has led the world in the development and use of mechanical science and invention as applied to warfare, but it must now overcome the handicap imposed by years of indifference to these things in the sweep of an unexampled peace tide of material prosperity. The manner in which it has begun the task which faces it is a just encouragement to every patriot.

CHINESE LABOR ARMY IN FRANCE MOST HAPPY

By H. R. WAKEFIELD.

IT is an open secret that there is now a large army of Chinese laborers in France.

It was a great and daring experiment to bring 100,000 Chinamen thousands of miles across the world and graft them onto the extremely complex organization which already existed. It was an organization of men who were leading lives of consistent and inevitable overtime, working continually at the highest pressure. And on these men was thrown the additional responsibility of making a success of Chinese labor. They had to squeeze some precious minutes out of their crowded hours in which to cope with this new problem.

In one sense this experiment was certain of success. No one who had had experience of the Chinese coolie had any doubt that he would work, tirelessly, ingeniously and with a fine natural versatility, provided that, and this is the point, he could be made happy and contented, that he could be made to feel certain that his family would be provided for, that his food and housing came up to his expectations and that he was sufficiently amused in his leisure hours.

It must always be remembered that the Chinaman has the thinnest of skulls and the quickest of brains, that he is a magnificent judge of character, that his mental processes are profoundly logical and that a lightning sense of humor pervades his being. Since they have been in France the Chinese labor companies have worked magnificently, and this must be attributed very largely to the care taken of them.

Let us see how this has been accomplished.

Chinese Kept Contented.

On arrival in France the coolies are at once sent to the Chinese labor base and depot, which is under the control of two officers, both of whom have a lifelong knowledge of China and the Chinese. It goes without saying that they are accomplished Chinese scholars. Here the coolies go through all the preliminaries to starting work. They are medically examined, fitted out with their kit, they have their finger prints taken, officers are allotted to them, and then they are formed into companies and sent to their destinations.

At the base five certain technical officers specially chosen for their knowledge of the Chinese race and the Chinese tongue. A large percentage of these were formerly missionaries. They give the coolies little lectures on the habits and customs of France, instil into them the rudiments of military discipline—no salute equals in impressiveness that of a Chinese policeman—and tell them anything which is calculated to make smooth their life in the new and strange sphere.

These officers have also the duty of making periodical visits to the different camps and settling any little difficulties by their knowledge and tact. There has been marvellously little trouble since the Chinese arrived, and such as there has been could always be attributed to misunderstanding, never to ill will. As can readily be realized, it has been impossible to meet fully the demand for Chinese speaking officers, and it has been found that this system of itinerant arbitrators and advisers best meets the difficulty.

Oriental View of Graft.

It is necessary to put considerable restrictions on the movements of the coolies in such places as base ports. Consequently they are fined small amounts if they break bounds. This they quite understand, but since, looking at the matter from their Oriental standpoint, they firmly believe that all such fines go as a matter of legitimate squeeze into their C. O.'s pocket, they cannot quite see why, once they have contributed to his income, they should not walk where they please. That is just one little instance where a technical officer can do much to reconcile two perfectly sound but slightly divergent views of discipline.

At the base also is the hospital, under the charge of a doctor with a most catholic knowledge of Chinese diseases. He is obviously both father and mother to the ailing coolie. All his staff are Chinese scholars. As an instance of his regard for his patients he has presented canaries to all the wards, for the Chinese are passionately fond of the song of birds.

The officer in charge of the finger print department is one of the greatest experts in the world. By his magic art he can identify any coolie in two minutes, so that substitution, of which delicate science the Chinese are past masters, can be infallibly detected.

At the base also are the experts who censor the beautifully painted letters from the coolies, and the registrar paid a visit there 4,000 coolies were being fitted out preparatory to going up to their work, and there were others waiting to take their places.

A Chinese labor company consists of five officers, nineteen other white ranks and 875 coolies, of whom thirty-two are gangers. Companies are merged in groups of three or more companies under a senior British officer.

Camps Are Models.

Chinese compounds are modelled, so far as possible, on the lines of British hut camps. If left to themselves the coolies would undoubtedly arrange them on principles of picturesque but insanitary chaos. But here the British passion for order and soap and water intrudes, with the result that for spick and span, well scrubbed neatness the average Chinese compound would satisfy the soul of the strictest theorist of camp discipline. The officers of some of the camps offer prizes for the best kept huts and the coolies enter thoroughly into the spirit of the ingenious and untiring welfare campaign of which they are the objects.

Every compound has its own washing hut, with hot and cold water; a drying room; its recreation hut, sometimes fitted up as a tiny gymnasium, sometimes with a little stage, always made as inviting and comfortable as war conditions permit, and a canteen fully stocked with everything to rejoice the coolie's heart, from a handsome and reliable timepiece at 5 francs 75 centimes to tinned spaghetti and tomato.

Though a British soldier is in charge of these canteens, he usually has a Chinese assistant. The writer visited one such, which had just taken on a very tall and solemn coolie as canteen assistant. He had only been there a few days, but he got full marks in a severe viva voce examination conducted by his C. O. on the names and prices of his stock in trade. Yet "tinned salmon" and "three fifty" and so on were the only English words he knew. He pronounced their names as if they were incantations. He maintained throughout a majestic self-possession.

Chinese kitchens are fascinating temples of plenty. Alluring aromas arise from the huge boilers where the try, which records the essential particulars of their careers. When the rice and stew is simmering, and on the long tables are rows and rows of those glistening and highly sustaining steamed rolls which a perspiring and incredibly deft fingered expert turns out at the rate of well over a thousand per diem.

Chinese cooks are masters of their art and some of the officers messes employ them. Out of the somewhat placid ingredients of army rations they can coax creations worthy of the chef of a transatlantic Ritz-Carlton. As bargainers they are supreme and the despair of French market women. They have an eagle eye for the carefully camouflaged defects of a cauliflower and their patience is simply demoralizing.

The great festival of the Chinese is New Year's Day, celebrated on February 11, when they are accustomed to give themselves up to rejoicing, which, however, is slightly alloyed by the fact that it is also settling day for all debts contracted during the previous year. No work was done by the coolies in France on that day. This meant a considerable amount of extra work for other people, but the burden was cheerfully shouldered. Every effort was made that the coolies might enjoy their holiday.

In one camp the writer visited they had constructed a vast dragon, sustained and propelled by twenty worshippers and illuminated by many lanterns. The rents in his armor were being repaired, and doubtless he made a triumphant progress round the compounds to the strains of the two stringed fiddle, the banjo, the cymbals, drums and many kinds of music.

Queer Music Enjoyed.

Chinese gramophone records have been obtained from America. The writer listened to one such tone poem which suggests the mingled strains of a margarine scramble, war dance, domestic altercation and air raid; but the coolies were entranced.

At another camp the group commander was trying to arrange that his coolies should become acquainted with all the exciting thrills connected with fishing from the end of the local pier.

There is no space here to deal with the work of the coolies. Suffice it to say that they well earn all the care and good will which they receive.

Any man of British birth who was inclined to feel pessimistic about the capacity of his race would derive a miraculous tonic from seeing what a genius for improvisation, what a happy capacity for understanding and satisfying the bodies and minds of men of a race profoundly alien to their own his countrymen had brought to the solution of the problem of coolie labor in France. For that problem has been splendidly solved and the success of this great experiment is assured.