THE SALT INDUSTRY OF TZELIUTSING

by

WALLACE CRAWFORD, M.D., D.P.H.

REPRINTED FROM
THE CHINA JOURNAL OF SCIENCE & ARTS
Vol. IV, No. 4, April, 1926, p.p. 169-175;
Vol. IV, No. 5, May, 1926, p.p. 225-229;
Vol. IV, No. 6, June, 1926, p.p. 281-290 and
Vol. V, No. 1, July, 1926, p.p. 20-26

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PREFACE.

Several years ago, the writer was asked to write a short article on the Salt Industry of Tzeliutsing. It appeared in the *North-China Daily News*, and was favourably commented upon.

It would not be out of place to mention here the volume which Mr. Lin, Acting District Inspector of Salt Revenue, Tzeliutsing, has written on the subject of the Salt Industry.

Mr. Lin's work is published by the Commercial Press, and is an exhaustive study of the subject. The work contains many tables and plans of the industry and the work of the Salt Revenue Department of the Government in Tzeliutsing. Mr. Lin is to be congratulated upon the excellent work which he has produced, and the Commercial Press for the splendid way in which they have published it.

The writer has two objects in presenting this article to the public, namely:—

First, up to date only two missions have entered this great field, where there is abundant opportunity for many more, or a much stronger concentration of forces of any mission. The facts revealed hereafter will be convincing as far as opportunity for mission work is concerned.

Secondly, trade follows the missionary. It will be our object to present every side of the industry here carried on, and show wherever possible costs of production, transportation, marketing, etc. This should afford an opportunity for the business man to compare prices of native and foreign methods, and also to get some insight into the opportunities for business in this hive of industry.

If these two objects are achieved the writer will feel that the time spent in preparing this work will not have been in vain.

I.

GENERAL REMARKS.

The whole province of Szechwan abounds in mineral resources. Anyone entering the province by the only gateway, the Yangtze Gorges, cannot help but see that coal is abundant, and as one presses inland, the colour of the earth assures one of an abundance of copper. Evidence of mineral resources is seen on every side. The gold washer is in evidence on the Yangtze foreshore, and, just after one escapes though the last great gorge at Kueichow, one comes upon the first salt wells of the province.

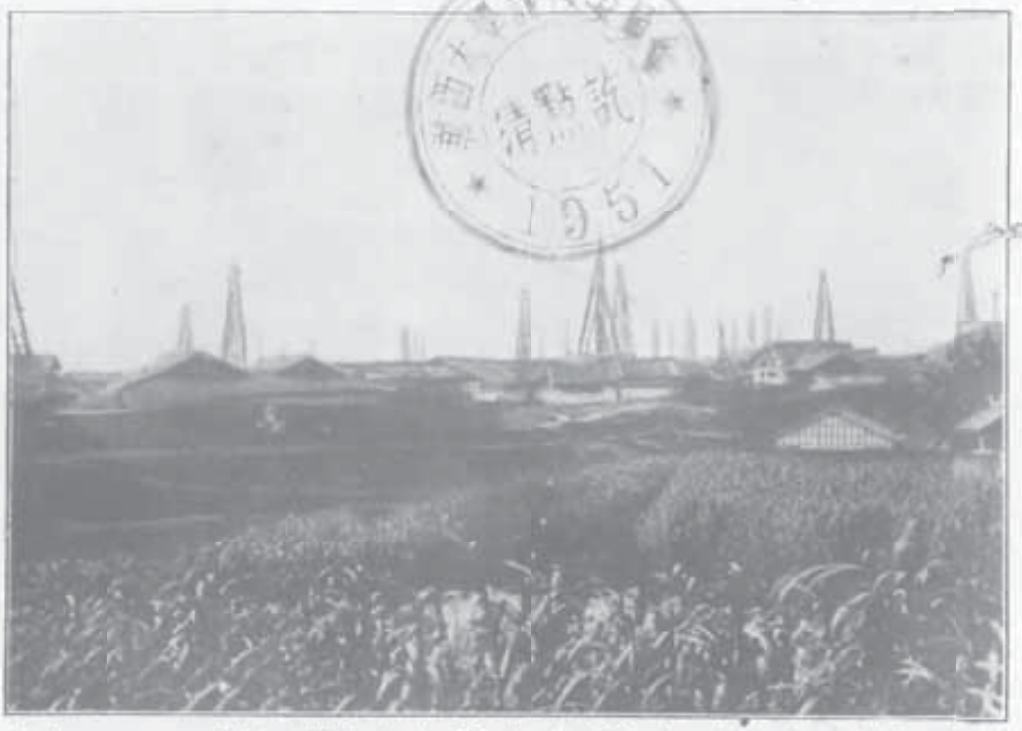
Up to the time of writing the only industry which has been developed on any scale is the salt industry. The total revenue to the federal government for this industry in Szechwan comes to nearly eleven million dollars per annum, of which Tzeliutsing supplies seventy per cent. Thus it will be seen that the great majority of the production of salt is carried on right in this district. It is stated that over fifty per cent. of the salt is manufactured at Tzeliutsing. Being the headquarters of the Government Salt Revenue Department, revenue is collected here for other districts as well as for Tzeliutsing.

The name "Tzeliutsing" which means "self-flowing well" is in great part a misnomer, if applied to the brine wells. The shallowest brine well of which we have heard is about thirty feet. But if the name be applied to the gas wells, it is quite true. There are places, not a few, where one can go along the road and touch a match to the gas. Even in some parts of the small river, one can see gas bubbling up, and it has been ignited by people sitting in boats.

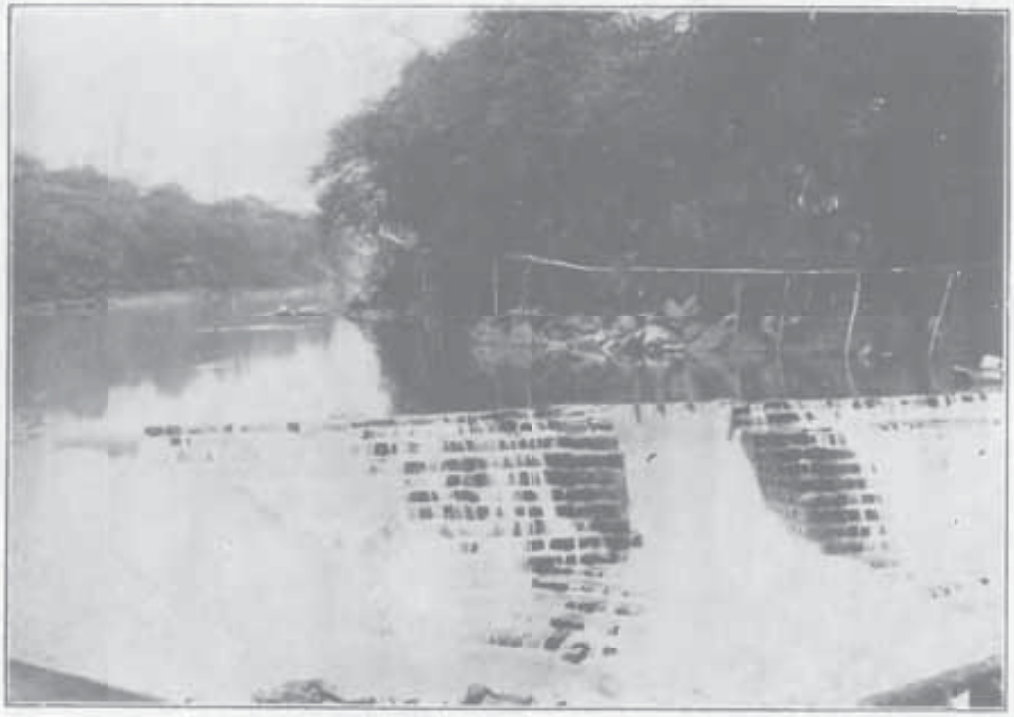
The district is divided mainly into two, Tzeliutsing and Kungchin, and in business the two are combined into the name of "Tzekung" They are known by the merchants as "the upper market" and "the lower market," Kungchin being the upper market.

The whole district comprises an area of about thirty by fifty Chinese miles or "*li*." The wells are not evenly distributed all over this area, and one may go for a considerable distance where there are nothing but farm lands. Then again, one sees the wells clustered together—"jammed in" would explain it much better—as it would seem that the searchers had found a particularly productive area. It would seem that nature had no settled plan in locating the wells and the gas, but simply had allowed them to spring up wherever they liked. Two areas are especially thick, one at a place known as "Ta Fen Pa" and the other, as "Chang Tu." It is of particular interest that these two districts are at the ends of the salt producing area. All through the district are distributed, here thickly, there thinly, wells, some producing brine, some gas, and some brine and gas together.

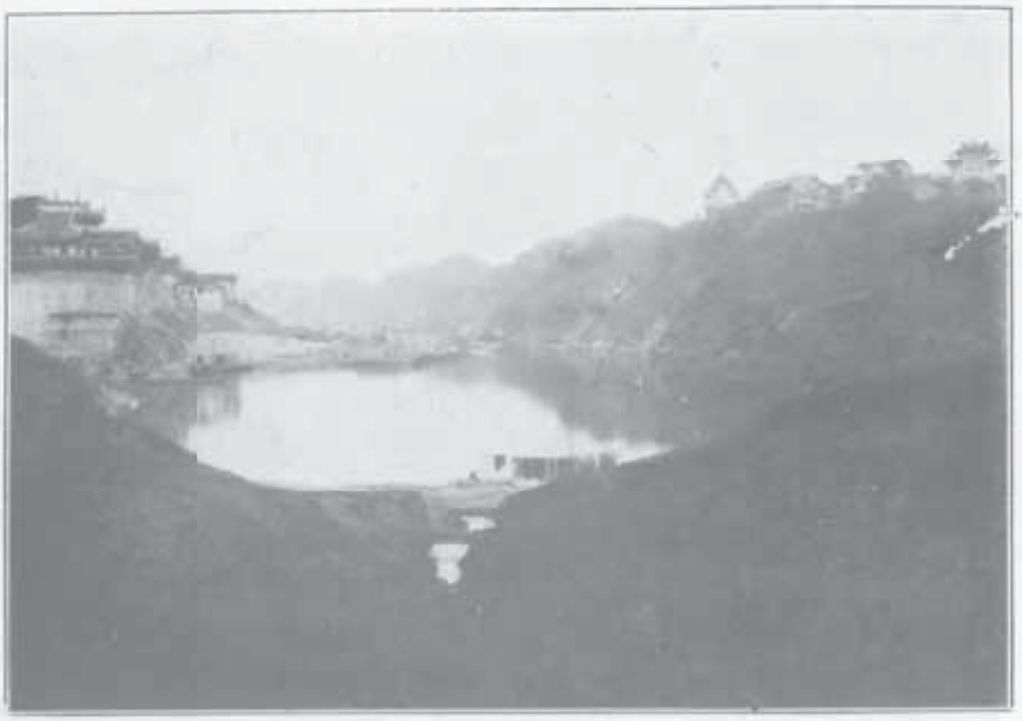
The history of the Salt Industry dates from antiquity. To get an exact date of its beginnings seems impossible. The well owners themselves do not seem to have any data on the subject. Indeed, to obtain this data, it is better not to lose time talking to the rich well owners, but to consult the mechanics who operate the wells. As to the date when the industry started, it would seem that it was first begun after



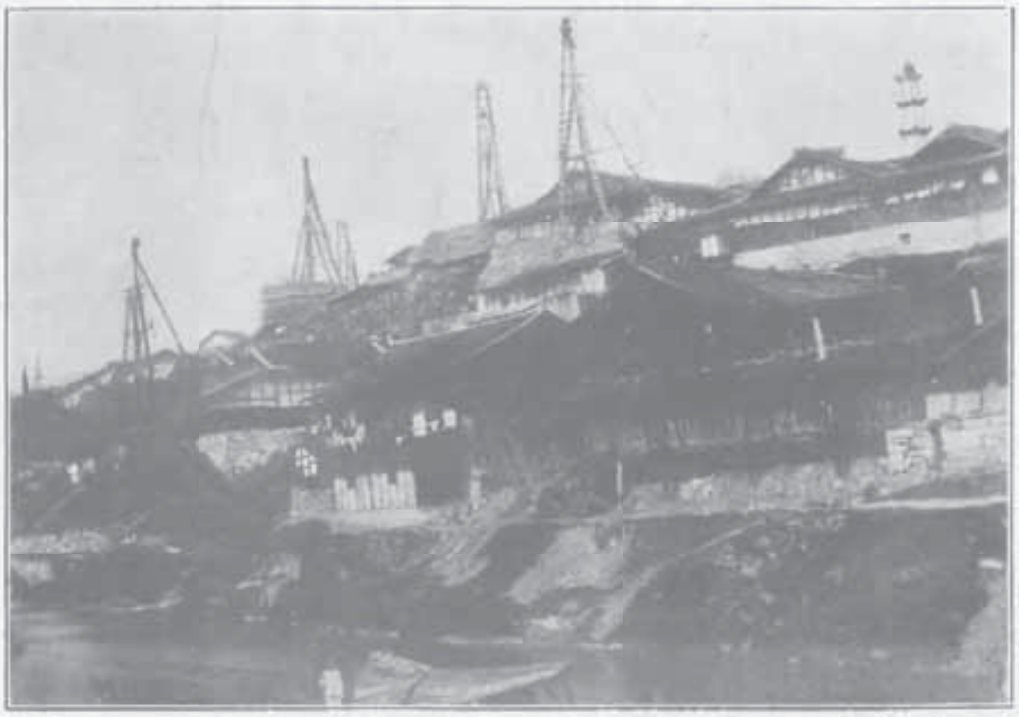
A dense group of Brine Wells in the Tzeliutsing District of Szechwan, West China



Methol of damning small Streams to ensure sufficient water for Boat Traffic down to the main R[illegible] Bamboo lead pipes may be seen on the right.



A pretty Scene looking down the River from close to the Salt Offices. Usually the Banks here are lined with Boats.



Houses on tle face of the River Bank and Derricks on Crests at Tzeliutsing.

the natives of the provinces of Shansi and Shensi immigrated to Szechuan and West China. The industrious men proceeded to dig wells, and finding the water brackish, and not unlike the brine which they boiled down "at home," proceeded to boil their find and it produced salt.

Another story has it that in the former Han Dynasty there were actually "brine springs" here. Then came an earthquake and covered the springs, changing the contour of the country hereabouts. The natives then proceeded to dig for the brine and later they developed the business of boiling it, in the same way as it is boiled to-day. This would explain the name "self flowing" and justify it. Otherwise the beginnings of this industry are obscure.

The Salt Industry is mainly divided into four divisions.

(1) WELLING THE BRINE.
(2) TRANSPORTATION OF BRINE.
(3) BOILING THE BRINE.
(4) MARKETING THE PRODUCT.

Before taking up the direct work under the above headings we shall consider the topic of "the Bamboo."

II.

THE UBIQUITOUS BAMBOO.

Possibly there is no more indispensible article or material in China than bamboo. One missionary who had a knack for such work made a list of the uses to which bamboo could be put. The list was not finished with four hundred and forty separate uses. If it were uprooted from the soil of China, it would be worse than losing a right hand, and there are those who venture to say that the sons of Han could not get along without it. Indeed, so many and varied are its uses around a salt well, that one wonders what would happen if it were suddenly cut off from use. It is the first thing used, for does not the geomancer use bamboo tickets from which to choose when he is trying to decide the location of the new well? And does not the mechanic use a bamboo rule when he first begins to measure the land upon which the well is to be dug? And bamboo makes the stem for the joss sticks which are burned by the priest as he performs his rites when the digging of the well is begun.

As the well is dug and the derrick is raised, bamboo ropes are used to haul up the logs for the derrick frame; bamboo ropes are used to splice the logs together, wedged tighter by the bamboo wedges. The drum over which the cable is run into the well is bound with bamboo.

The edging for the wheel which carries the cable into the well is bamboo, while the band that is first put into the well to carry the drill is of bamboo, as is the cable which is later used to carry the brine pipe.

The conveyer of the brine from the well is a bamboo pipe, fastened to the bamboo cable by hemp. The cable which brings up the brine is twisted bamboo, its manufacture, an industry by itself, carried on some two day's journey from here. The cables are carried in by men. The break which is used on the windlass that winds the cable is of split

bamboo, and it runs on strips of bamboo which are lashed by bamboo rope to the wooden windlass. The water buffalo is harnessed with bamboo to the windlass to draw the cable out of the well, while the driver "persuades" the awkward beast with a bamboo whip. The rope with which he is tied by the nose is of smaller bamboo, and his stable is divided into stalls made of old bamboo cable. The sides of the buffalo barn are made of old bamboo rope twisted about the upright posts. The well coolie wends his way home by the light of an old bamboo cable taper.

The brine runs to the boiling pans through bamboo pipes. The brine pipes are supported by bamboo pieces split finely so that they may be wrapped around the brine pipes, thus preventing their splitting in the hot sun. Old bamboo cable lashes them to the trestle work when they have to be suspended. Bamboo hoops support the great brine vats as they hold the brine preparatory to its being run into the boiling pans. Split bamboo, supported by old bamboo cable, serves to run the brine from the vats to the pans.

Bamboo matting is made to separate the boiling rooms, while bamboo baskets make splendid beds for the attendants on the boiling pans. Woven bamboo makes skimmers for the refuse on the top of the boiling pans, and the finished product is carried in bamboo baskets and crates. As a delicacy the coolie enjoys bamboo sprouts as he watches the the boiling of the salt, often boiled with bamboo fire wood.

The coolie carries his load of salt to market with a bamboo carrying pole, and his tally is recorded with a bamboo stick. His sun hat is made of bamboo, finely woven, to keep out the rain, while the mat upon which the pedler spreads his wares is of bamboo.

The perquisite of the labourers about the well is the bamboo when it is impossible to use it further in the industry, and this they either sell or take home to help them repair the home or to boil rice.

The expert boiler, watching the pans, blissfully smokes a bamboo water pipe, while his wife, not so far away, sews shoes, the soles of which are made of bamboo leaves, the darkness brightened by the light of a vegetable oil lamp made of bamboo. He dips the brine from one pan to another with the aid of a bamboo dipper and strains the refuse through a bamboo sieve.

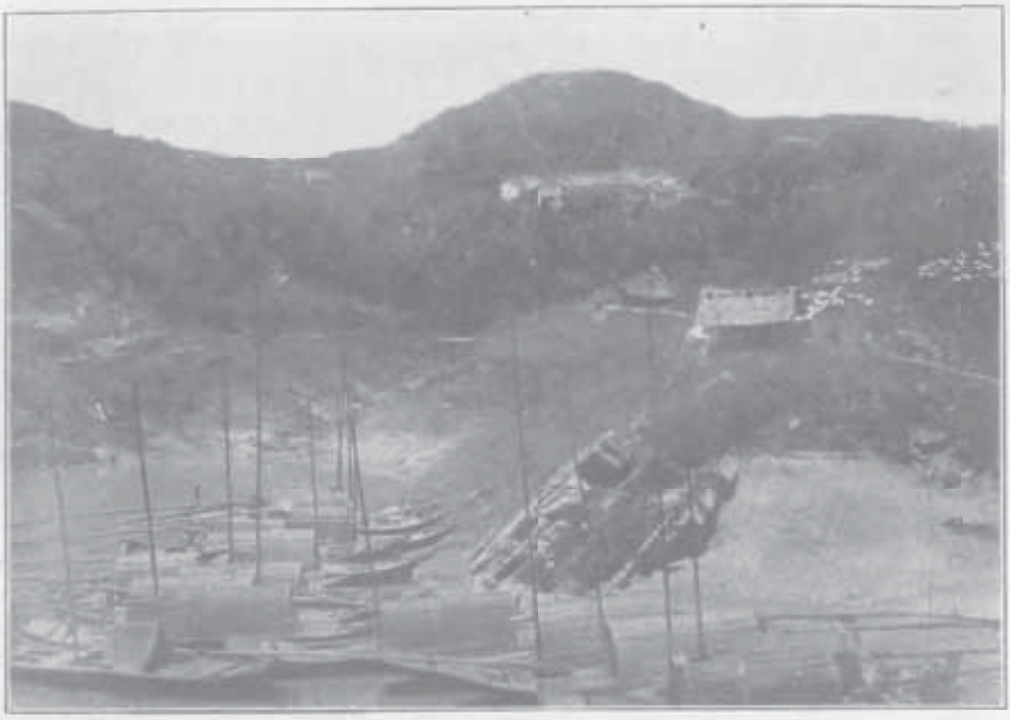
Bamboo guy ropes hold the mighty derrick secure when the great gales blow, and the wheel at the dizzy height at the top of the derrick is trussed with bamboo.

The subject of the uses of bamboo is not exhausted, as there are many other to which it is daily put. But the reader will readily see that, if bamboo were taken from the market here in Tzeliutsing, it would paralyze the salt industry.

III.

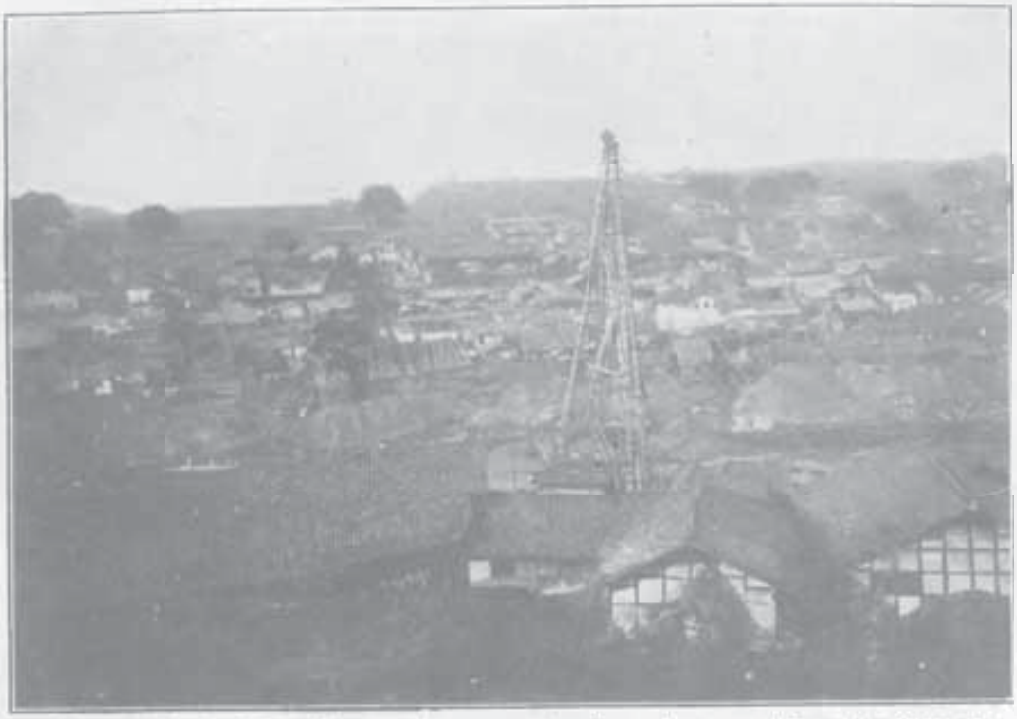
THE WELL.

I have many a time tried to get from well owners the method employed by them to "locate" a well. So far it has been of no avail. The



Boats ready to go down Stream with their Loads. Above, on the Hillside, the Temporary Residence of the Salt Inspector.

Boats crowded on the Foreshore just below the Salt Offices.



Often a single Derrick may be seen standing alone, making the Site of a Well. There seems to be no Method of ascertaining where Brine might run.

Buffaloes being driven round the Windlass to raise the Brine Pipe.

geomancers are consulted, to see if lucky places are struck. Someone has found brine on a certain location and because that particular line upon which he has located runs right through a certain other line decided upon by a geomancer, therefore, that location is surely lucky In talking with a merchant one day I asked him the question and his reply only exemplified what has been said above. "You take a stone and throw it over the left shoulder, and wherever it alights, there dig your well."

On the top of the highest hill, or in the deepest valley, no matter: if the "*feng hsui*" says that is the place to drill, the prospective well owner will begin. One well here is on the top of a hill, the well being known as "Tall Mountain Well." The majority of the wells here, and there are over three thousand, are on uplands, and not on the lowest levels, as one would expect. I have never heard any explanation for this, more than that it was a lucky place to dig: and whether the soil is soft or rocky, it makes no difference to the prospective well, it is all undertaken with the same vigour and expectation.

The site of the well being decided, a beginning is made with the killing of a rooster and the roar of firecrackers. Nothing would be staged properly without a feast; and when all is merry and the crowd happy, the digging is begun.

At first a hole about five feet in diameter is dug into the earth, the depth depending upon the distance at which solid rock is struck. This diameter is maintained for about eighty feet, sometimes for one hundred. I am not aware of the reason of this, unless it be the fond hope that some day, if brine is not struck, gas will be found: and then this space will be utilized to arrange the direction to be taken by the gas pipes to the fires. From this depth, the well is dug much smaller, the first installment being made about a foot in diameter, into which are forced cored timbers, which, when placed face to face, make a well some ten inches or a foot in diameter. Into this the drill is dropped and the true and tedious digging of the well is begun.

To commence these operations it becomes necessary for the well digger to erect the derrick over the well-hole. This structure may not be the permanent one, but it is so erected that it can be used in the permanent derrick.

The principle of the derrick is the same whether it be a temporary structure or the permanent erection. Skinned pine trees are used, and to get the necessary height are spliced together, end on end, with bamboo cable wedged by crude wedges. The trees are thus lashed together until the desired height is acquired, when the tripod is brought together in mid air, and a huge cross beam is lashed to the top of the derrick. A fourth upright is lashed to the tripod a little lower down, thus giving it stability and security. The top of the derrick is now guyed by bamboo cables to stones buried in the ground some distance from the base of the derrick. Often as many as ten of these guy ropes or cables are attached to one derrick, and it is seldom that the derricks are blown down by the wind. If a guy rope is too slack it is tightened by a second rope to which is fastened a great stone, this stone being suspended in the air, thus tightening the loose guy rope.

On the top of the derrick, and immediately over the centre of the well, is placed a wheel. The wheel is about two and a half feet in diameter, deeply grooved, and with an axle about an inch and a half thick. The axle rests on heavy timbers mortised into the huge cross beam. Over this wheel runs the rope or cable which carries the brine pipe into the bowels of the earth.

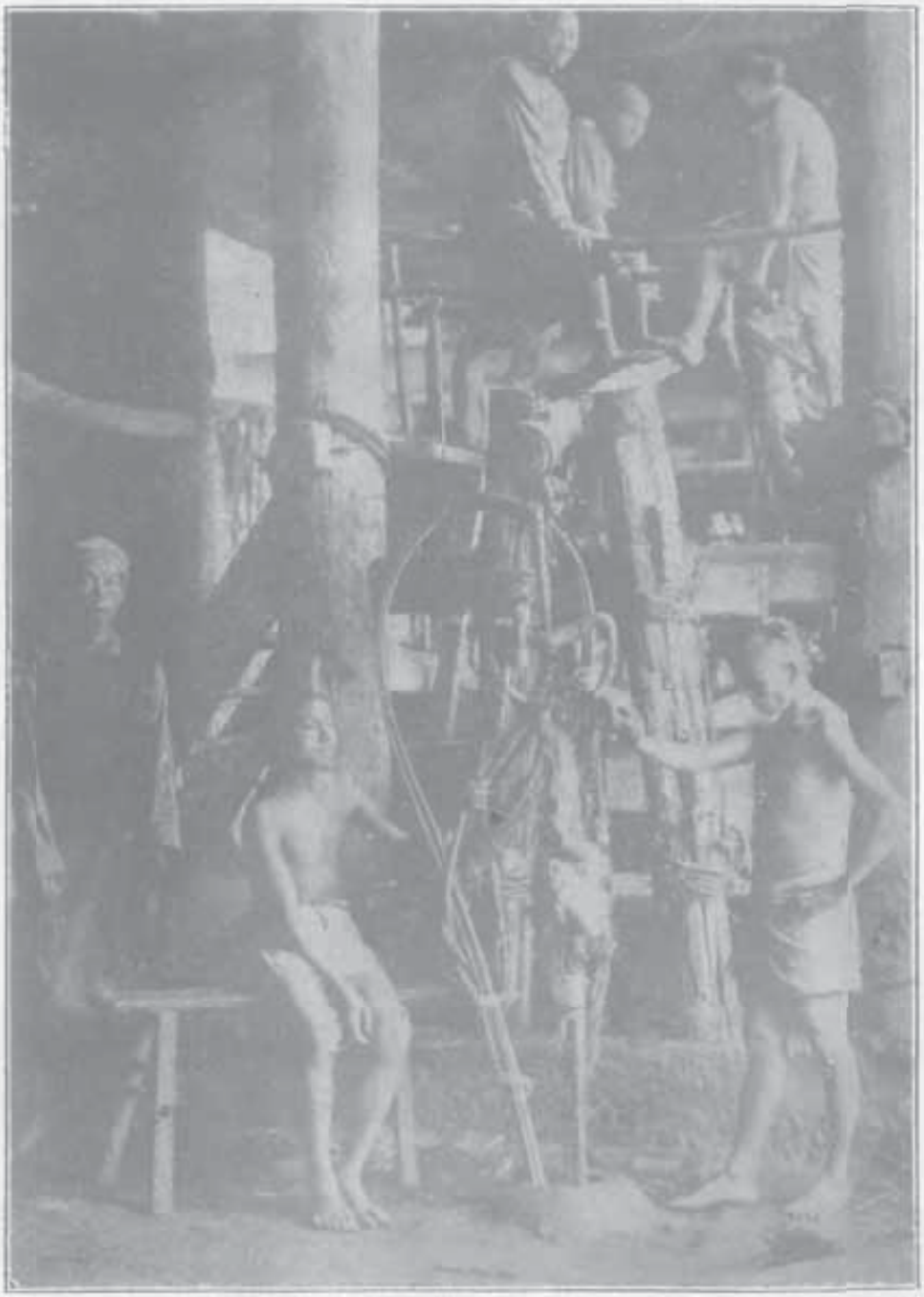
About twenty feet behind the base of the derrick is located another wheel, larger than the derrick wheel, but otherwise the same. The brine cable passes under this wheel, which is weighted heavily with stone, back to the drum or windlass upon which the cable is drawn as it comes out of the well.

At the base and in the centre of the derrick, is located the mechanism for drilling the well. Immediately behind the well hole, and about twelve feet from the earth, is erected a drum on a wooden axle. Over this passes the bamboo tape which is used for the drilling tools, as it is too far to the top of the derrick and the bamboo tape would not travel in the wheel groove, being often as wide as three inches. The tape passes directly back to the windlass used to draw the cable out of the well.

Immediately under the drum is erected a cross beam upon which rests a long "drill beam." This drill beam, which is a crude log, perhaps five inches thick and twelve feet long, is placed over an axis with the shorter end projecting so that the end is immediately over the well hole, the longer end running back into the derrick frame. Thus it will be seen that the heavier and longer end of the drill beam is away from the well, and will fly up away from the well hole.

To the shorter end projecting out over the well the drill is attached by the aid of the bamboo tape mentioned above, and, as this drill is lashed to the drill beam, it naturally drops down, and the back longer end flies into the air, stopped by a cross beam at the back end. Upon this longer end, the men step, thus forcing it down, and raising the drill in the well hole. By springing off simultaneously, the drill drops into the well and the drill beam flies up into the frame. The men again jump on the drill beam and the drill is raised to be dropped once more by the men springing off. This they keep up day and night in shifts timed by incense sticks which burn in front of the well god. The men spring smartly on and off the drill beam for a period of about ten minutes, when the end man is changed and a new one comes on at the opposite end of the beam, each taking his place at the drill-tape, and at each plunge of the drill giving the tape one quarter turn. In this way the drill in the well is gradually turned around.

It will be seen that well-digging is somewhat of a gamble; and unless one has money to begin with, he will find it more than difficult to complete his well. Often one owner will dig until his funds are exhausted and then sell the prospect to another man who will risk his fortune in trying to "strike oil," only to be ruined in turn by not finding brine or gas. Possibly the well is then abandoned or the second unfortunate finds a third prospector who is willing to risk further. The average well will cost about thirty thousand taels to drill and commence operations. The fastest are drilled in three months, while others take years to complete.



The Well Diggers.

The methods of cleaning the well of the debris cut by the drill are crude. If the drill is going through soft material the hole may have water poured into it and a bamboo tube with a suction valve at the bottom run down to withdraw the debris. Sometimes barbed iron hooks are let down and dragged out of the hole with the hope that the debris will be clogged on the barbs. It will thus be seen that, if the drilling is crude, the method of extracting the debris is much cruder, and this part of the work takes more time than the actual drilling.

Sometimes a big cavern is encountered and then the going is easier. Rock is "slow going," as the debris is hard to get out, and the drill, which is rarely of prepared steel, soon becomes dull. The changing of tools takes up a lot of time and gets the men out of sorts.

Gas is deeper than brine, according to the experts who know, and often a well becomes dry; it is then dug deeper in the hope that gas may be struck. It is not uncommon to have gas and brine from the same well, the owner having been lucky enough to strike both commodities at once. He has then the brine and the gas to boil it, and is saved a great deal of work and his money comes much easier. If the output is steady his fortune is assured.

In one place hereabouts it would seem that a great bed of rock salt had been struck. Indeed there are those who claim that it is all a great bed of rock salt. However, in one place there are several wells in a valley on the hill tops, where water is run into the wells on certain days and then allowed to stand on the rock salt and the resultant solution drawn to the surface and boiled. The handling of the water for these wells is done by a special firm and they have an igenious way of seeing that no other wells are using their supply of water. They run rice hulls into the well, and wherever brine is raised with rice hulls in it, they promptly demand payment for their supply of water.

The depth of the wells hereabouts varies. In other parts of Szechwan, the brine may be procured at a depth of from thirty to forty feet. Hereabouts wells run from eighteen hundred to three thousand feet in depth, and on an average of possibly two thousand five hundred feet. It is of interest to note that the rule used in measuring these wells is about the same as the English rule in length. This will give one a more exact idea of the depths of the well.

The height of the derrick erected over the well varies. Some are as high as one hundred and twenty feet, and a possible average is eighty feet. The height of the derrick is governed to a great extent by the aspirations of the well owner, who may have ideas as to how long a brine pipe he may want to use, and how many buffaloes he can afford for hauling the brine pipe out of the well.

Now that we have studied the making and preparation of the well, we are ready to look into the raising of the brine.

IV

THE MECHANISM OF BRINE RAISING

It is difficult to say exactly when the work of drilling, ends and that of brine raising commences. These thrifty workers will boil a questionable

quality of brine, with any amount of sediment in it, if they can get a small proportion of salt. So the brine boiling may be begun while the well digging is still in progress.

The bamboo pipe which is lowered into the well to raise the brine is of special material and preparation. Groves of this bamboo are located east of Chungking and the fully grown pipes are rafted all the way to Tzeliutsing. In no other part of Szechuan is this special kind of bamboo grown. It will be seen further, that, the transportation being so distant, the product delivered is more expensive, the carriage being more than the original cost of the material. The bamboo must also be rafted here as it would split if placed on boats and carried up. A split pipe is useless, so great care must be taken in its delivery.

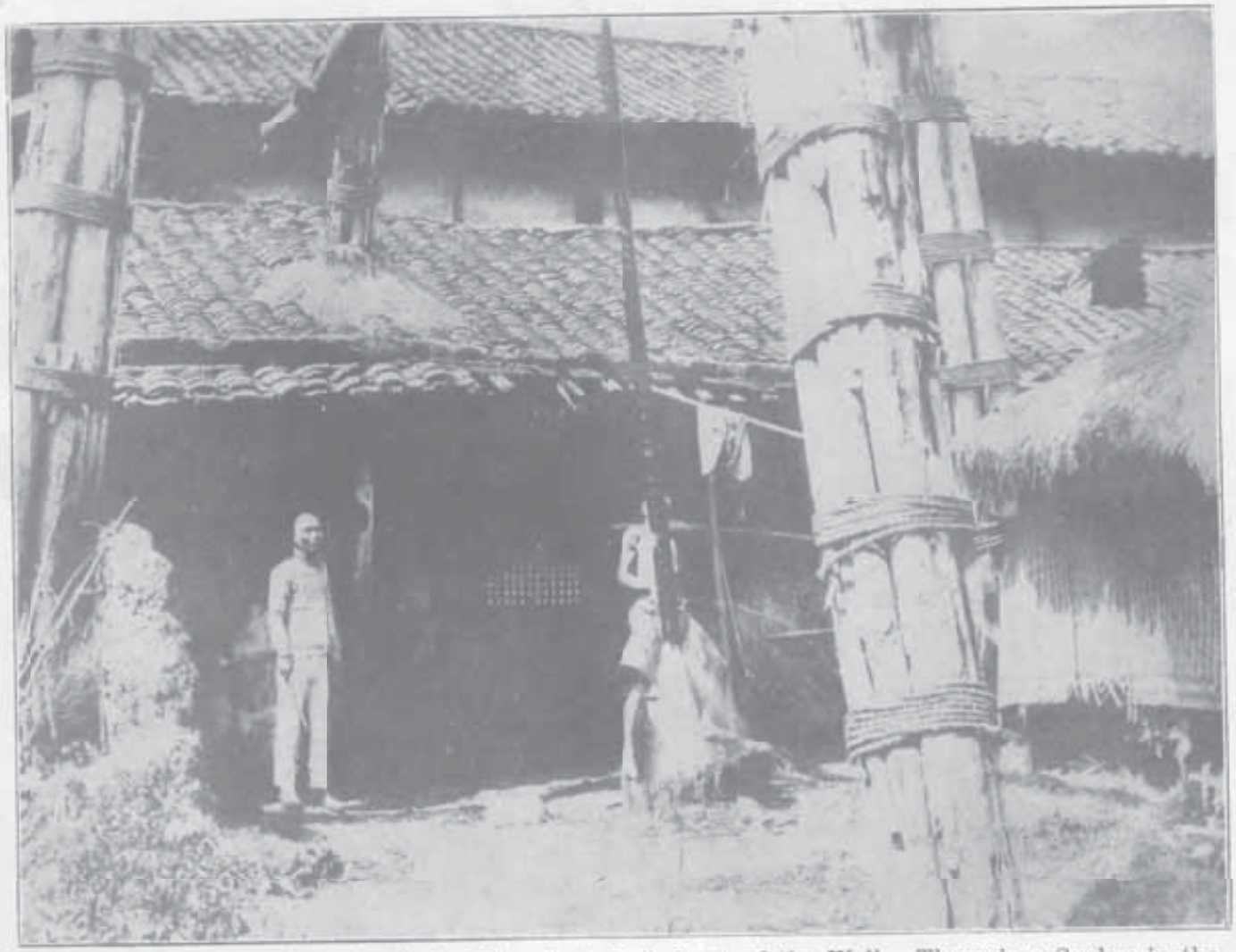
The pipes are about fourteen feet in length and six inches in diameter, inside measurement. The pipe is almost three quarters of an inch in thickness, and the green product is very strong. It is only after sunning and airing that they are easily cracked. To prevent the cracking they are bound securely with strips of bamboo, overlapping one another. These are tightened with bamboo wedges and will last ordinarily for about three years, but the binding must be changed annually and often more frequently. Men are hired to watch the pipes and to see when this wrapping becomes loose or broken. Sometimes the heat of the sun will crack the pipes despite careful wrapping.

Good pipes cost two taels each, and some specially large bore ones come as high as three taels. It is a risky business delivering the pipes, and if they become useless for the purpose for which they are intended, they sell for one-tenth the original price. We once secured several hundred of them in this way and used them for scaffolding, for which purpose they answered splendidly.

Ordinarily the pipes run through the air on trestles. But there are times when it is necessary to bury them. The pipes are then treated with a heavy coat of a preparation made of lime and wood oil beaten together and applied on hempen rope and bamboo strips. This preparation when well dried will withstand the elements for five or six years.

When the pipes are to be used specially for the well brine, they are further treated to a process of coring, ridges being planed in them at intervals of three of four inches. These cored places are then bound with hemp specially woven into a strong cord. This keeps the brine pipe from cracking as it comes to the surface with its load of brine. The lengths of pipe are spliced by being telescoped and are then bound with small iron bands. Their manufacture is a speciality by itself, and a mechanic who can do this work commands a more than ordinary wage.

At the lower end of the brine pipe is a suction valve. This is not unlike the valves used in an ordinary pump. It is located a few inches from the bottom of the pipe, and is opened by an iron key on a crude handle. The other end of the brine pipe is fastened to the bamboo cable by hempen rope lashed round the pipe. This cable then runs over the wheel at the top of the derrick, then down behind the derrick and under a great wheel, about thirty feet from the well mouth, and back



Releasing the Brine from the Brine Pipe, just Pulled out of the Well. There is a Sucker in the bottom of the Brine Pipe. The Operator takes a Crooked Piece of Iron and Releases the Sucker when the Brine Falls into a Tub and is Piped into a nearby Reservoir.

to the drum or windlass around which it is wound by the motive power, buffalo, mule, donkey engine, or man power.

The drum or windlass upon which the cable is wound, is a huge crude wooden structure, set on a vertical axle, which is tipped with iron rods some two inches in diameter. The lowest of these rests in a huge stone, of special consistency, which does not wear out quickly. The upper tip of the wooden axle runs in a hole in a great beam which traverses the building and is built into its structure. The spokes of the great wheel, which are some eight feet in length, are mortised into the rim, and lashed to it with old bamboo cable. Each piece of the rim will have about four spokes fitted into it, and the spokes will be lashed together and trussed with old bamboo cable. The cable from the well is wound around this crude drum or windlass by the motive power.

After the brine has been run from the pipe, the latter falls by its own weight into the well, the cable being released from the drum by reversing. The drum thus spins with incredible speed, and three minutes is enough for the brine pipe to reach the bottom of the deepest well. The speed of unwinding is controlled by a bamboo brake which is attached to the drum above the place where the cable is wound on it. It is almost uncanny, the complete control of the running of the brine pipe and cable which can be exerted by this bamboo brake.

The water buffalo is attached to the windlass by means of crude poles which are lashed to the spokes of the drum. There may be as many as seven of these poles, but the average drum has five buffaloes to draw it.

The harness of the buffalo is the irreducible minimum, consisting of a whiffletree, lashed to the pole by a piece of old bamboo cable. The tugs are of bamboo cable, and attached to a yoke of wood at the shoulders of the beast. A bamboo rope is run through the nose, and all is ready for the beast to begin his task of raising the brine pipe. The driver uses a piece of discarded cable to "persuade" the great beast to his task, and each time he strikes the animal with this improvised whip, one is reminded of a log being dropped into the mud on the foreshore. It does the trick, and the lazy buffalo bends the more assiduously to his task.

Ordinarily the complete act of raising the brine, releasing it, and lowering the tube for a second load takes from twenty to twenty five minutes. From the time the brine pipe reaches the bottom of the well, to the time the buffalo starts it on its upward journey may be ten seconds, but it is more often five.

Man power is rarely employed hereabouts, as the wells are deep and the load too heavy. The same system of raising the brine is used where man power is utilized.

Mules or horses are much quicker than the buffalo, but they are rarely used now, as they were for the most part commandeered in the late military troubles and have not been replaced. The buffalo is still the popular motor.

Some ten years ago one enterprising well owner invested in an English donkey engine to raise the brine. The price of this staggered other owners, but, seeing the results of this venture, which were most satis-

factory, others proceeded to purchase a machine made in Shanghai and Hankow. These machines last some three to five years. The English engine is till running and is among the best in use. The short life of the other engines is due to two causes. First, the quality is poor, and shoddy. There is no finish to them, and they are as crude as they can be made. Secondly, the engineers are calloused, and demand every last ounce of energy from the machine. More often than not the steam gauges are so covered with dirt that is almost impossible to read them, and the safety valve is commonly tied down to save that much energy. Were it not for the occasional " blow out " the engineers would be more careless than they are, if that were possible. There is no idea of conservation of energy, or coal, but one obsession—to get all the power out of the machine possible, and, when finished, scrap it.

Engines of two powers are imported, the fifteen and the the thirty horse power. The smaller engine can be landed at the well side for about seven thousand taels and the larger one at eight thousand.

Of late, steel cable has been tried out, but it does not last long in the well. However, the steel cable is not run into the brine any more than possible, the old fashioned bamboo cable being lashed to the brine pipe and then onto the steel cable. Even with the steel cable being used and the donkey engine, the cable is nearly always run around the old fashioned drum. If anything should happen to the engine, it would be much easier to return to the water buffalo if the cable were still around the drum.

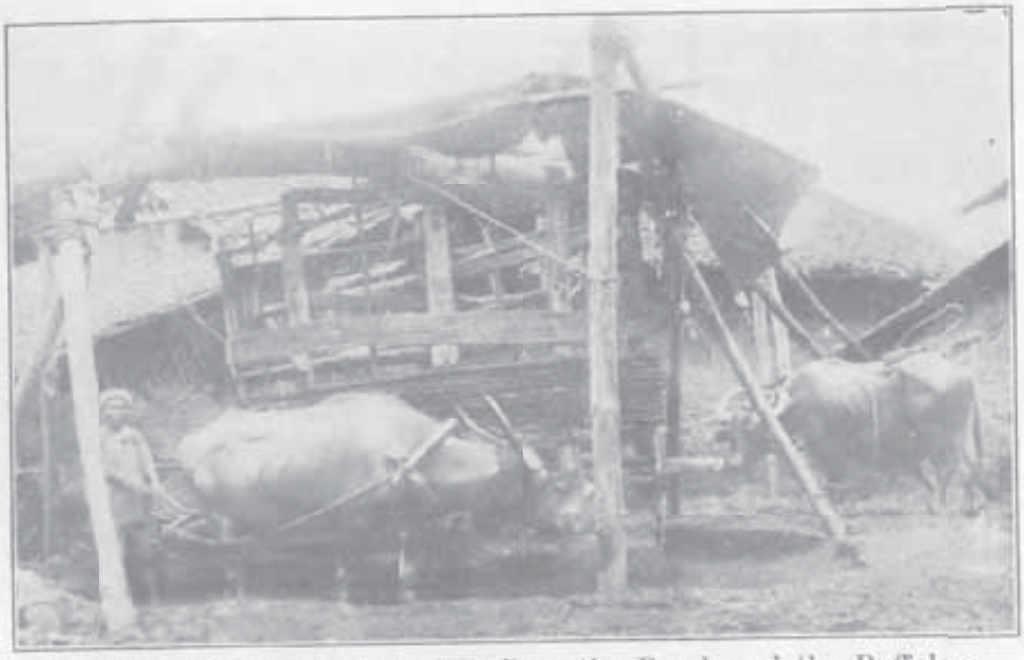
There is an abundance of coal at the mines at Wei Yuan, but the price has more than doubled since the engines came upon the scene. Engine owners now pay as high as twenty five cash per catty of sixteen ounces for the coal. Formerly it cost only ten cash.

The water buffaloes remain the popular motor power, and they are still in great demand hereabouts. The biggest wells keep in constant use as many as one hundred head, and must be constantly buying new cattle to replace the worn-out beasts. The average life of a buffalo in a properly operated well is three years. He is then sold for buffalo meat, or some poorer well purchases the discard and his life is then most miserable.

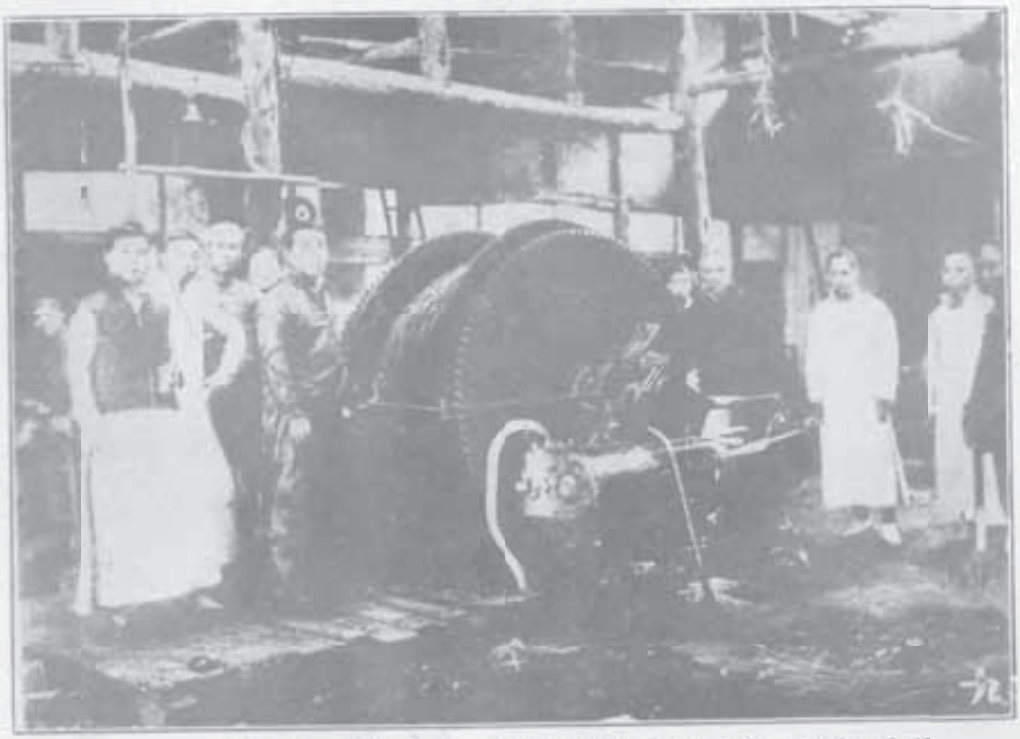
Buffaloes are to be seen coming into Tzeliutsing by every road. They are imported chiefly from Chungking. Men make a special business of purchasing them for sale to the merchants. A good buffalo to-day is worth from ninety to one hundred taels, and some fetch a higher price, according to their size and weight. A fair estimate of the number of buffaloes in the industry here would be ten thousand.

With such a great herd of the animals in one place, it is not to be wondered at that the pest gets among them and they die off like flies. Some four years ago, the foot and mouth disease attacked the buffaloes here, and in less than a week some three thousand of them were dead. The native does not know enough, or is unwilling, to kill off those which are ill, and thus help to arrest the endemism. They hire a so-called veterinary who knows practically nothing about their troubles. How the pest stops before it goes through the whole herd is a mystery.

The buffalo feeds on green grass, cut by coolies with a hand sickle; and it will be seen that great areas must be reserved for the cutting of



The Old: a close-up of the Windlass, the Break and the Buffaloes. The Break is the Wide Band seen above the Cable.



The New: a Donkey Engine. There are now some 200 of these used at the wells.

this grass, which might otherwise be under cultivation, and provide even better fodder than the green grass cut by the coolies, which is often more weeds and waste than green grass. There are those who claim that the endemism among the cattle results from some of the weeds cut by these coolies in the spring of the year. They are also fed rice straw in winter when the grass cannot be cut.

Their staple diet, however, is the horse bean or "fu tou," which is grown hereabouts in abundance and is fed to the buffaloes daily. The beans are dried before marketing and subsequently must be soaked for hours before they are fed to the cattle. About a peck of these beans is the daily ration.

All over the place will be seen water tanks of various dimensions. These are about forty feet by eighty, and vary in depth according to the contour of the ground. If they can be built in the valleys, they are much deeper, and, naturally, less expensive. If the locality is flat, then considerable stone work must be erected to form embankments for holding the water. In these great water tanks, the buffaloes disport themselves daily, and in the hottest weather they will be allowed to go down to them several times a day. If the well is close to the river, this serves instead of artificial pools and great expense is saved the well owner. Buffaloes will not stand the hard work without this water. At the good wells, the buffalo is changed each time the brine pipe is brought to the surface.

The engine is relatively the cheaper motive power. Taking fifty buffaloes as an average for each well and the average cost per buffalo at ninety taels, we have an initial outlay of Tls. 4,500.00. The majority of the engines are of fifteen horse power, and cost about seven thousand taels. But it will take twenty five dollars a day, at least, to feed the buffaloes, and not more than half of this sum would be needed to supply fuel for the engine. Again, one has to consider illness and possible death of the beasts. Furthermore, the engine will raise, in a given time, three times and sometimes five times as much brine as the buffalo. Thus the engine is the cheaper method of brine raising.

Some years ago a gas engine was imported and attempts were made to operate it with natural gas. Power sufficient to operate the engine by itself was generated, but the variable pressure of the gas prevented the raising of the brine pipe in addition. If the gas were collected in tanks under pressure, gas engines would answer for brine raising.

V

THE BRINE.

The brine raised from the wells may be divided into three kinds; at least that is the classification locally. Black, yellow and white are the different grades, which are valued according to their colour. Black brine is the best variety and produces the greatest quantity of salt per catty of brine. White is the thinnest brine raised and boiled.

As the brine is raised to the surface in the pipe, it is emptied into a tub at the side of the well and run to a vat some thirty feet away, where it is allowed to settle. From this vat it is necessary to raise the brine to

a height sufficient to permit it to run to the boiling pans. In case the pans are at the same well, which is often the case, the task of transporting the brine is easy. If, on the other hand, the brine must be transported any great distance, it must be raised sufficiently high to allow it to gravitate in the conducting pipes to the boiling pans.

The unit of measure for brine is the "tan," which weighs three hundred and sixty catties. In a "tan" of brine there are three hundred and sixty "wan." The quality of the salt is gauged by the amount which can be boiled out of a "wan" of brine. This varies, the highest being three and six tenths ounces. This quantity is boiled from the brine which is the heaviest and richest in crude salt. Even a one ounce brine will be boiled, especially if the gas is handy and the output of brine is not strong. It often happens, however, that the brines are mixed together and the merchant risks the results. An average well will produce enough brine to supply ten boiling pans steadily.

It is just possible that the fringe of the industries within this industry has hardly been touched. That there are by-products is self-evident. As one stands at the edge of a well, and watches the brine pipe emerge from the bowels of the earth, one gets smells of various vapours. At some wells Sulphuretted Hydrogen is very evident, and at others obnoxious odours are strong. A visitor to the wells one day stood too close to the mouth of one, and, as the brine was being discharged from the pipe, the gases that escaped were strong enough to overcome him temporarily. He had to be carried home.

When the brine is boiling, one gets the same variety of odours, and to some people the smell of the brine boiling rooms is peculiarly nauseating.

Saltpetre is a common by-product of the industry, though it has not been manufactured here.

Some three years ago, samples of all the salt procurable hereabouts were bottled and sent to Peking, ostensibly as samples for the Chief Inspectorate.[1] It developed later that experts had analyzed these and found that there were at least twenty one by-products yielded by the salt. In addition to these, there must be other chemicals in the skimmings of the boiling pans.

One cannot but think that some day the products at present discarded will be of greater value to the world than is the salt produced. This awaits the confirmation of chemists and laboratory experts.

VI

TRANSPORTATION OF THE BRINE.

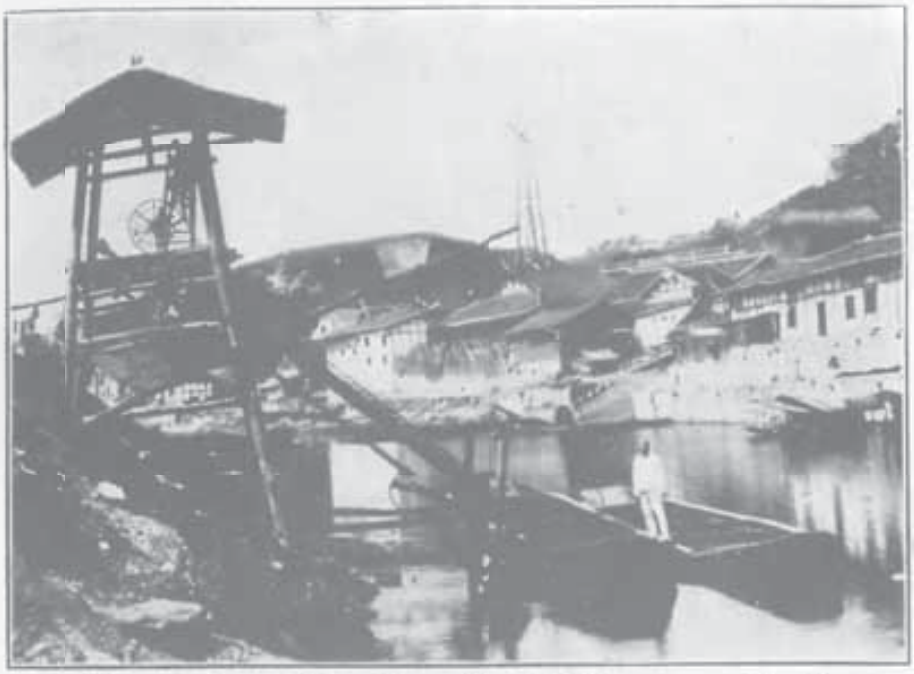
The brine is emptied from the brine pipe into tubs at the well mouth. From here it is run by gravity into vats. From these vats it is carried in three ways.

(1) BY GRAVITY
(2) BY COOLIE
(3) BY BOAT

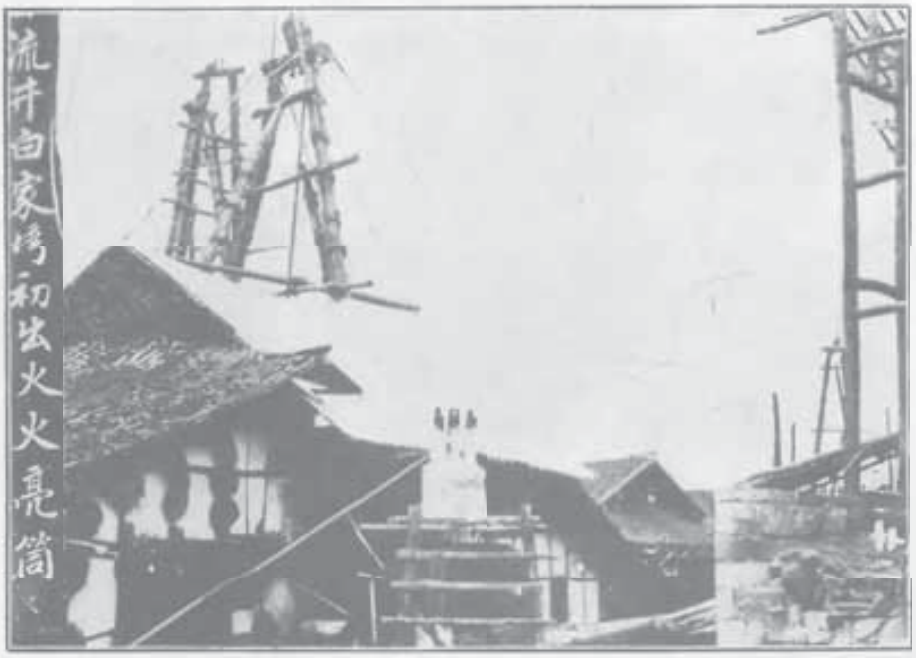
If the salt well happens to have gas in connexion with the well, the process of getting the brine to the boiling pans is simple, coolies being

Five Lines of Bamboo Pipes which Conduct the Brine to the Boiling Pans.

Coolies Carrying Brine up the Trestle Work to the Nests into which it is Poured and allowed to Run to the Boiling Pans. The Bamboo Pipe-line leads off to the right.



Arriving at the Boiling Pans, Treadmills are used to Draw the Brine, by Man Power, up to the Pans. A man can be seen working a treadmill and drawing the brine up to the level of pans.



Dividing the Gas. The white object on the platform has five pipes at the top, like chimneys, by which the gas is divided, subsequently being conducted to the pans by separate pipes.

called to carry, or "tiao" it up to the pans, which are always above the well mouth. But this is not always the case. It more often happens that the brine has to be transported miles from the well where it was raised.

If the method of gravity is to be employed, a small house is elevated on poles and two men are placed in it with a tread mill to draw the brine up to a small tub in the centre of the house. The brine thus raised to this tub is allowed to flow by gravity as far as it will, when it is again raised and let run to another level. This method is used in places to carry the brine for miles over hills, in some instances the distance exceeding ten miles. Thus a special business is created, that of transportating the brine; and special companies undertake this business. It becomes the second division of the industry, the business being known as "gien."

To carry the brine over the country, bamboo pipes of about six inches in diameter are used. As these would not stand the sun and wind, they must be specially prepared by being wound with bamboo strips, which are so applied to the pipes that they overlap. The binding is tightened by bamboo wedges driven tightly between the pipe and the binding strips. If the conduits must go underground, they are subjected to a heavy coat of lime and wood-oil cement, which when dried is impervious to the weather and will endure for six or seven years, which is twice the life of the pipe when simply bound. The conduits are joined by telescoping the pipes one into another, and cementing them with the wood-oil-lime cement.

Where great heights are to be scaled, derricks with stout houses on the tops are erected, and mules are utilized to raise the brine, instead of tread mills. The brine then gravitates as before to the base of the next derrick, where it is raised another twenty feet or so, and so on over the ridge.

The second method of conducting the brine is by coolie carriage or "tiaoing" it in buckets. There used to be a way of paying for this work, by so much per step, but it is paid now by the load of three hundred and sixty catties, called a "tan." I do not know of any coolie carrying this much at one time, but there are some who will carry almost three hundred catties for short distances. These human horses have immense pails suspended from each end of a carrying pole. They do not carry in the usual way, but with the carrying pole squarely across both shoulders, and upon the pad of fat and muscle which they have developed across the top of the shoulder blades. These coolies begin carrying when quite young, and develop exceptional powers of endurance.

Often the methods of conduit and coolie are combined, and the coolie carries the brine to a tub, out of which it runs into conduit tubes to be carried away to the boiling pans. Hundreds and hundreds of coolies are occupied in this trade, and as many as a dozen conduit pipes may be seen lying together in places where they near the boiling pans.

In the third method, where streams are available, boats are used to convey the brine to the boiling pans. The brine is run out of the well tub, into the vats and then into the boats, which are huge, flat-bottomed affairs made specially for carrying brine. When full, they are towed or

poled to the boiling pans, and the brine raised by treadmills to the vats beside the boiling pans, there to await running into the pans. This method is not extensively employed as the streams available are few. In some places the three methods may be used to convey the brine to the boiling pans.

Throughout the carriage of the brine, it is wonderful to see the care with which it is handled and the very small amounts which are lost. If a conduit by chance is injured so that it leaks, this is immediately reported, and repairers are at once despatched to the spot. There always seems to be any number of coolies with pails to catch the escaping brine, and they are recompensed for each pail they return to the owner.

VII

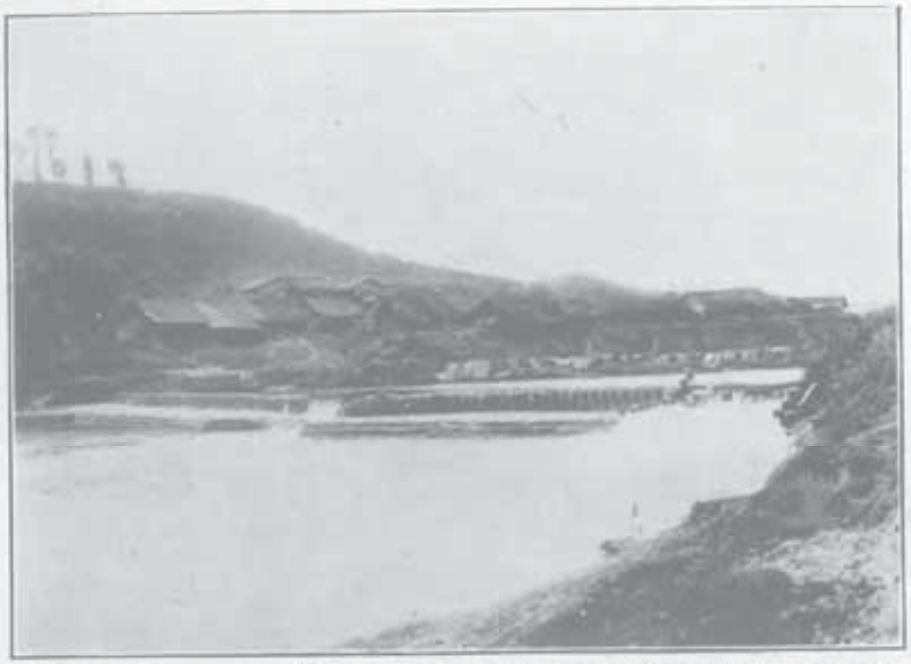
BOILING THE BRINE.

Boiling the brine is carried out in two ways, boiling by gas and boiling by coal fires.

Where coal is utilized for the boiling, a tunnel is dug, about five feet deep and four feet wide. From each side of this are dug the fire holes, and over the fires are located the boiling pans. There is no superstructure, the pan being simply set up on five iron rods, and the open space between the pan and the hole closed by surrounding the pan with flat slabs of sun-dried mud. This is then plastered and the boiling pan is ready for the brine. The coal fire is started : and, as there is no chimney, the smoke escapes as best it can all around the rim of the pan and out through the stoking hole or any other crack or crevice that it can find. It will be seen that in this way it is impossible to produce the fine white salt, such as is boiled down over gas fires. The coal-boiled salt is black with soot and dirt and debris. It is not skimmed and the product is much inferior to the gas-boiled. This product called "pa" or rock salt is chiefly exported, there being consumers who prefer it to the crystal or "wha" salt.

In the manufacture of the rock salt, old and broken pans are used, as they can be riveted together with crude iron rivets and clamps, and the crevices cemented with a solution of lime and brick clay. This cement apparently does not interfere with the quality of the salt produced. For the crystal salt only perfect pans are used.

The boiling pans are of crude cast iron about five feet in diameter and much like a great saucer. They weigh about twelve hundred catties, are extremely clumsy and very brittle, not a few being cracked in transportation. They are manufactured at a place called Chechiang, just above Chungking and are brought by boat to the market here. There is crude iron ore hereabouts, but the merchants claim the product will not stand the strain, so they must purchase these in a much more distant market. A pan laid down at the boiling house costs $110. The life of a pan is indefinite, and is shortened only by the carelessness of the attendants. If the brine is allowed to dry unduly and the pan become overheated, it naturally cracks and is then useless for crystal salt. With proper care the pans last for years.



Often Temporary Dams are made by Filling Salt Bags with Sand. The Runway for the Boats is to the Right. During High Water the Dam is Washed Away.

The River at High Water. There are immense numbers of boats, about 5,000, on this stretch of river extending about 120 li.

Boiling goes on twenty-four hours a day and three hundred and sixty five days in the year, the New Year's holidays being taken in shifts, as the gas must be utilized.

When gas is struck in a well, it is allowed to flow out by a side exit to a place where iron tubes have been erected. Here it is lighted and allowed to burn at will day and night. The iron tubes are multiplied until through each flows a quantity of gas sufficient to keep a fire under one pan. If the well is a big one there will be a great flare in the sky until the pans are set in place and the gas used to advantage.

The laying of the pans for gas fires is not the same as that for coal The pans for gas fires are arranged in a straight line, with the tunnel immediately under the centre of the boiling pan. Each pan is elevated a little above its fellow, the row running up hill to give the gas opportunity to flow the full length of the tunnel, it being lighter than air. As many as forty and even fifty pans may be put in a row. The rows of pans are parallel, with a path between each pair. Here and there are vents for the extra gas if there should be any. The gas that comes out of these vents is also kept burning, but is put to no use save to light pipes for the men. This is a great waste of good gas and heat.

As the brine crystallizes, it is dipped into settling baskets of bamboo, and allowed to drip. The drippings are caught in a stone trough below and reboiled. The fires under the pans are practically never put out, and as soon as one pan of salt is crystallized, more brine is run into the pan and the process repeated. Gas fires will crystallize a pan of salt in about twenty four hours, while the coal fires take some three days. For exportation, there is less wastage with the rock salt than with the crystallized product.

It is estimated that there are some five thousand brine wells in the district and some three thousand gas boiling pans. If one wishes to rent out his gas, he can demand and receive a rental of sixty taels per annum for each fire, the expense of putting the pans in place and maintaining the place being the tenant's.

To insure the better crystallization of the salt, bean-curd water is poured into the pans with the brine. This is made in the usual way with the soya bean, soaked in water and turned out with a stone mill. About two gallons of the bean-curd water is added to each pan of brine. The result is a much better quality of crystal, though what difference it makes to the palatability of the salt, I cannot say.

In other parts of China the sun-drying process is utilized, but nowhere in West China is this method employed. The condition of the atmosphere is such as to preclude this method, and the rains are too uncertain.

This chapter should not be closed without a note on the great waste of the gas. It has been asserted, and I think it is correct, that there is more gas wasted in Tzeliutsing in one year than would be required to supply the demand, under proper supervision, for ten years.

As the gas cannot be piped down hill, owing to the pipes not being sufficiently strong to withstand the pressure, each works must be erected to accommodate the flow of gas; that is to say, it must be erected on

higher ground than the well from which the gas is escaping. Each successive pan must be higher than its neighbour, as it is placed in the row, away from the well. Now if iron or metal piping were used, it would reduce the distance of piping the brine, and the gas could be controlled, and conserved. Where it is necessary to pipe the brine, the iron pipes would be cheaper in the long run, even if the initial outlay were higher.

Again, if gas reservoirs were installed and each consumer were compelled to use a gasometer, the cost would be less than at present; and a great many more patrons could use a more constant gas supply, which would do more and better work. This in itself would be a big business for anyone.

VIII

TRANSPORTATION.

Salt exportation may be divided into two classes, the "Piao" or retail salt and the "Yin" or wholesale salt.

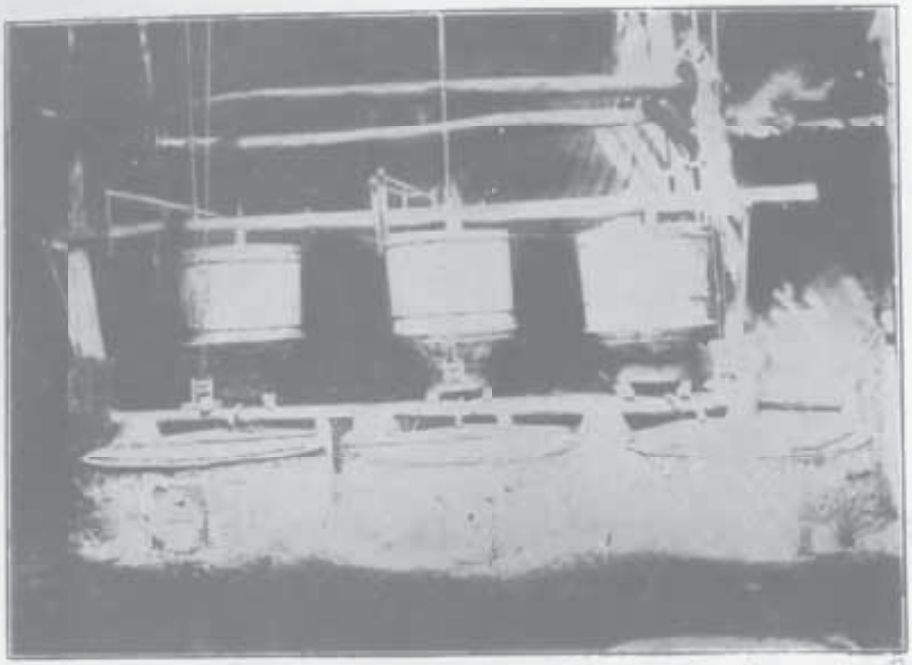
Virtually the only way in which retail salt is sent out of the district is by carrying-coolie. This method is so common that it need not be enlarged upon here. But the exportation of the wholesale salt is such a big question that it demands our careful attention, as it is in this that one of the biggest channels for foreign business lies. With the betterment of travelling conditions, missionary effort will also be expedited.

When the boiling process is completed the salt is placed in bamboo baskets made especially for the purpose, weighed, sealed and lashed for carriage. This work is all done by experts, who can make as much as a string of cash per day at the work. The crystal salt bundle or bale averages about two hundred catties in weight, while the rock salt only one hundred and sixty.

After bundling, the salt is carried into the Government storehouses, from which it is released upon permit. It is then loaded into small boats, which take it to the junks, which, in turn, convey it to the outport, Ten Gin Guan. Two men will carry these bags to the boats. They, also, can earn as much as a string of cash per day at the work. The boats congregrate at the Government weighing depot, where the packing is inspected, and about ten per cent. of it carried to the scales. If this portion proves correct in weight, the release permits mentioned above are exchanged for discharge permits, upon payment of the salt tax. The junks are then free to discharge their cargo at Ten Gin Guan.

Retail salt is not baled in the same way, but is carried openly to the Government release offices, of which there are some eight in various localities. The salt is cut in forty, eighty and one hundred and twenty catty weights. Thus, any peddler may take a quantity suitable to his strength. When he purchases a load of salt, he is given a release ticket, after paying his tax. This is stamped at the door, and viséd at certain offices on the main roads from Tzeliutsing.

These offices are known as checking offices, and tend to restrict the carriage of illicit salt. The majority of the peddlars carry one hundred and twenty catties, and sell it in small quantities along the road. Some of these men do a four or five days' journey with their wares.



Three Gas-heated Boiling Pans. Behind and above the pans are reservoirs for the brine waiting to be run into the pans.

Boiling Pans Unloaded from the Boats and Waiting to be Carried to the Wells.

In some parts mules are used to carry the rock salt to the river-bank. During low water, there is a considerable trade in this way from Kungchin, the falls in the river being too high to permit the boats to pass over, thus necessitating a portage of about fifteen *li* to the Government weighing scales.

The average export from the weighman's yards here is seven "tsai" or cargoes of salt per day. Cargoes of salt are made up as follows. Fifty bags of salt make a "chang" of crystal salt, and nine "chang" make a cargo. Of the rock salt, it takes twelve "chang" to make a cargo, as the bags or bales are lighter. From here to the nearest port, where the regular cargo boats can come, is about one hundred and forty *li* by river, but not more than ninety by land.

It would seem as if the transportation of the wholesale salt had passed into the hands of a monopoly over this stretch of river. The price per cargo is at present taels one hundred and ten. There are some five thousand boats on the run, and three or four cargoes are carried by them, on an average, yearly. It takes five of the boats to carry a cargo of salt to the junks at Ten Gin Guan. One cannot but think that the volume of business done on the river could be efficiently handled by thirty per cent. of the shipping that now chokes it. If the boats now between here and the port were placed end to end, they would more than bridge the entire distance. The monopoly, however, keeps them on the river and keeps up the price for exporting the salt.

The transporters association of the city are and have been anxious to find a better way than the present one for exporting the salt to Ten Gin Guan. They have approached the Federal Government, and through the local Government Salt Revenue Office, have held conferences with the interested parties. An agreement was reached whereby the transporters were to put up one half the expense of a railroad to Ten Gin Guan, while the government took responsibility for the other half, the transporters paying the Government a consideration for the loan. The project would have gone through had not political upheavals interfered, and the usual Chinese difficulty of "paying the piper" arisen. When the Yunnanese and the Szechwanese began hostilities, the agreement was dropped. But these astute business men have not abandoned the idea, and will welcome any scheme which will assist in getting their salt to market more cheaply. The writer was a strong advocate of the steam line, and spoke well of the project on every occasion. Indeed, it is by far better than the present method, but one is not convinced that there is not even a better way.

Some three years ago an engineer was visiting Tzeliutsing, and we talked over the question of the road. This gentleman had not been over the road, but he had been in China ten years, and had some understanding of Chinese customs. He suggested to the writer that the idea of a motor road be considered. We then took this matter up and soon concluded that the easiest way to get a steam road through this part of the country would be to get a motor road first, prove its efficiency and economy, and then consider the steam road later.

Some of the arguments against the immediate installation of a steam road were as follows :—

(1) The Road Bed.—If a motor road were desired, the present roadway could be utilized, though it would be better if a new road were surveyed. But if it were necessary to construct a road independent of the present thoroughfare, and that were a steam road, a width of at least sixty feet would be required for the road bed, while thirty feet would answer for the motor road.

(2) Survey of Road.—This could be done away with if the present roadway were used as a motor road. It cannot be gainsaid, however, that a survey would be better; but one must remember that, here in remote Szechwan, any innovations which are to be introduced will be expedited if they can be brought in slowly and quietly. The matter of a survey brings up more than one question, such as graves, buildings, ancestral tablets, and *feng shui*. It is possible to use the present roadway, save possibly in two or three places where the grade might be found too heavy for the cars. The matter of a survey could be gone ahead with later. As a matter of fact, one survey of this piece of roadway has been made by a Chinese engineer who studied engineering in Japan. It is said to be a very good survey, and, with a few changes, would be available.

Nearly a year ago, steps were taken and an engineer was brought in. It was found to the surprise of the local gentry that the engineer was a German, and they promptly proceeded to have the gentleman recalled. It is said that he surveyed three miles of road at a cost of seven thousand dollars. Just who put up this money is not stated.

(3) Diplomatic difficulties would be fewer with the motor road.

(4) Initial Capital.—In the case of a railway, the estimated budget would rise to one million and a half taels : a properly surveyed motor road, with fully qualified engineer and assistant employed for one year, fifty one-ton trucks, garages, repair shops, additional supplies for breakages, etc., could be acquired for two hundred thousand taels. Without the survey, this sum would be materially reduced.

(5) Importation of Initial Equipment would be infinitely easier. The completed cars could be shipped by boat right to Ten Gin Guan, and be put in work at that end of the line.

If we began with a steam line, it would be almost impossible to haul the parts of engines, cars, rails, etc., up to Ten Gin Guan, except in the highest water. Even then, the cars and engines, would have to be sent up in pieces, and assembled. It would be much better if the steam road were begun at Luchow, the nearest port for steamers, which only come up here in high water.

(6) Prejudice of the people.—This point has been dealt with in "point 2" under "survey of the road"; but cannot be too much emphasized, as it will be an important factor in beginning a road of whatever character. If the motor road were begun first, it would not be as foreign a system as the steam road, as it would be more accessible and the people would take to it much more readily than to the smoky, ponderous engines.

Pack Horses and Mules are used a great deal to carry the Salt to the River Front and also Inland for Retail Consumption.

Preparing Packs for the Animals at the Government Stores.

(7) No steam road could be in operation here in less than two years. A motor road could be in use in six months.

(8) Ease of Projection of a Motor Road.—Just as soon as this were found to be more than an experiment, steps would be taken to extend it, and the same equipment would be enough to make a longer haul of the salt, or to carry other products. Branch roads could be run from it, and these tributaries extended without any interference with the main road or importation of foreign material, until more cars were required.

As soon as the scheme were seen to be a success, steps would be taken to extend the road to Luchow, where the big salt junks would then load, all the year round.

Because of the freight which would be brought back by the empty cars, it would soon be found necessary to extend the main roads from here to (*a*) Junghsien, from which city, paper, medicines, dyes, oil, and coal are constantly coming; (*b*) Wei Yuan, from which place come chiefly coal and paper, but there are other exports; (*c*) Suifu. This port is on the junction of the Min and the Yangtze, but there would be a lot of trade to and from it with Tzeliutsing. There are other neighbouring cities, but the road could not be built so easily to reach them. Possibly one could include (*d*) Tzechow, from which place we get medicines, tobacco, bamboo, candy and sugar; and to which we send large quantities of retail salt.

The coal trade from Wei Yuan would in itself demand special cars and equipment for its trade. The passenger traffic between here and Ten Gin Guan, and the country seat of Fushun, each of which is said to be about twenty three English miles from here, would be almost sufficient to pay the return trips, and would grow tremendously when the people saw with what ease and speed the trip could be accomplished.

(9) Social opportunities afforded by such an innovation. One ventures to prophesy that such a road would be immensely popular with these rich merchants, the result being that many pleasure cars would be imported and other resultant pleasures introduced, one of the items most lacking in the place at present.

There would be also an opportunity for the missionary to do more itinerating work, with greater ease and efficiency.

One cannot close this chapter on the transportation of the salt without mentioning at least one of the drawbacks to any real advance in this line in West China. I speak of the soldiery, so called. The wide awake merchants know, to their sorrow, that any innovation in the shape of transportation introduced by them will be made use of by these vandals. If there were any idea in the minds of the soldiers of keeping the system in shape, it would not be so bad; but not only do the military ruin the system, but they abuse the men to whom it belongs for not keeping it in shape at their own expense, for them to use or abuse as the soldiers please. It will be easily seen, then, that no company would be willing to proceed with any scheme of transportation unless some guarantee could be given that it would not be seized by the soldiers and run to ruin by them, with no compensation for the owners.

We have heard rumours of a scheme originated by General Yang of the Second Army, to inaugurate a company composed of his own officers, who will forego their pay for several months, the money thus accruing to buy two ships for upper Yangtze service, install a road from Luchow, and handle the transportation of salt from Tzeliutsing to Luchow.

One cannot but hope that something may come of the aspirations of General Yang, as it is only through the Military that anything will be accomplished for some time to come in West China, they having all the power and controlling every project which is undertaken. And, until the merchants of Tzeliutsing can be assured of a stable civil government, or protection from the Federal Government, they are not going to "find" their money bags for any scheme, however rosy. It takes no stretch of imagination for those who have lived hereabouts for the last five years, to form a mental picture of what would happen to such a motor road, were it put in operation and the soldiers were to come along and "borrow" the use of it for a short time. Ruined cars, stagnant traffic, no salt moving, people angered against the innovation, and the whole wreck thrown back at the Transporters' Association, without so much as by your leave or one word of thanks or thought of remuneration for the damage done to the system. It is virtually certain, however, that one of the first places where a new road, and in all probability a motor road, will be built is in Tzeliutsing, as soon as quiet is restored in this province.

Governor Liu Hsiang has been making plans for a long time now to open a motor road from Chungking to Chengtu. This road would not come nearer than one hundred and twenty *li*, at Luei Chang. If Governor Liu's road were promoted, a spur could be run down here, but it would not materially help out the situation in Tzeliutsing, as the main road for this place would be out to Ten Gin Guan, Tzeliutsing's natural port.

Salt can be manufactured to-day for about thirty cash per catty. Transportation is the biggest problem for the merchants, and it will be the first improvement they will undertake when order is restored in these parts: but nothing will be done as long as the soldiers dominate affairs as they do to-day.

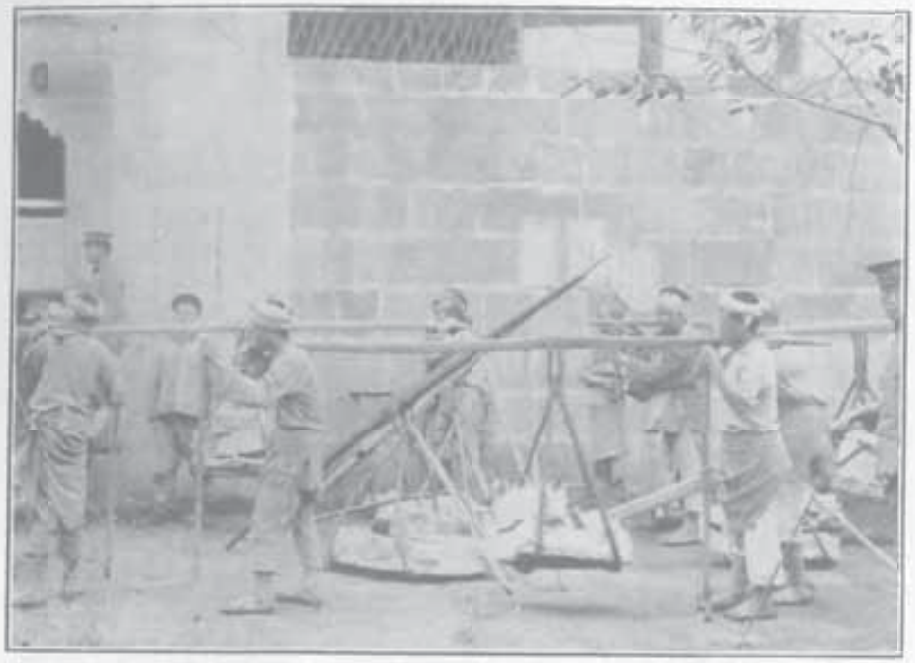
IX.

BY-PRODUCTS.

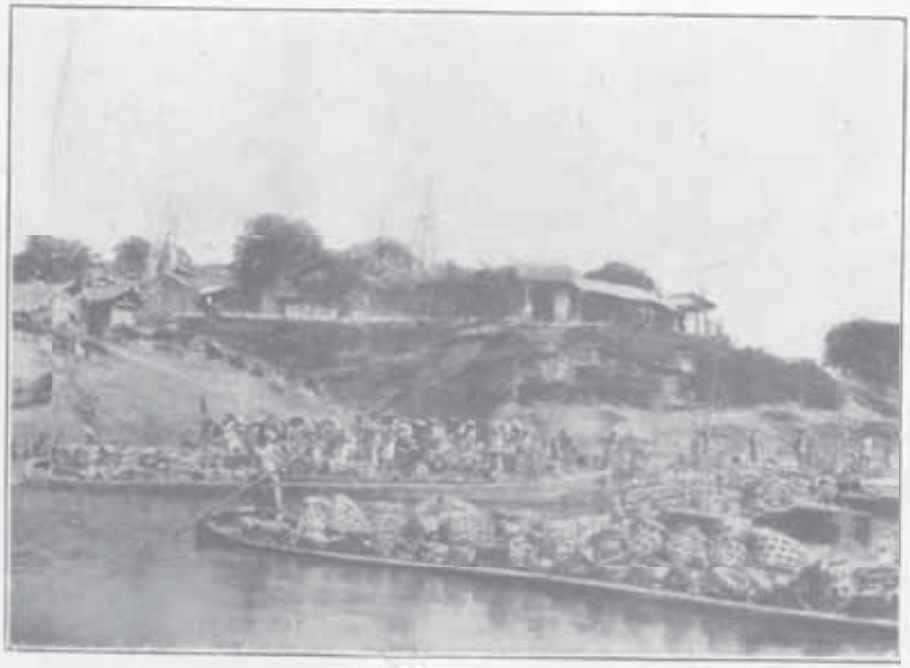
In an industry as great as the Salt Industry at Tzeliutsing, it is not to be wondered at that there are a number of important allied industries. Chief among these are to be mentioned the following:—

Buffalo Horn Products
Bone Products
Argol Fuel Products
Bamboo Materials for the main Industry
Associated Necessitated Farm Products.

The production of all sorts of commodities from the horns of the dead buffaloes assumes proportions large enough to make it an important allied industry to the main work of the place.



Two-man Loads of Rock Salt being carried into the Government Storehouses. Salt Police are seen near the door on the left.



Small Boats Loaded with Packages of Salt. It takes twenty of these boat loads to make a "Cargo" of salt.

Salt being weighed as it is carried into the Store for Storage against Release for Shipment later. These Stores are built by the Government and help to reduce Smuggling, as they prevent the Accumulation of Salt on the Boilers' Premises.

The Government Store House. Salt being carried in for Storage preparatory to Release.

The buffalo is never dehorned, as is often done with cattle in Western countries. The Chinese claim that it weakens the buffalo and shortens his term of efficiency. I have never seen a buffalo without his great spreading horns. Even when he becomes fierce and vicious, he is controlled by other means than dehorning. But as soon as the buffalo is dead, his horns are taken off and fetch a price of fifty to sixty cash per catty. If the beast happen to be a white one, his horns will bring as much as thirty cents per catty, as white buffaloes are rare, and the white horn makes a prettier article for the market than the black.

The horn is purchased by the horn workers in as large quantities as possible, and sorted into the different lots for which each piece is best suited. Not very much of the original horn is usable as it is taken off the beast, but it must be cut into the desired shapes. This is done by heating the horn and driving it into moulds, and allowing it to cool while in the latter. It is then cut (sawed) into the desired sizes, after which begins the smoothing and polishing. If the piece is to be round, it is put upon the lathe and turned into the desired product.

Most of the products are of round or oval shape as the bone lends itself to this kind of an article. The biggest class of articles are horn boxes.

The instruments used in the manufacture of the horn articles are simple and crude. Chisels, hammers and saws are practically all that the mechanic uses, aside from his lathe. This latter is simplicity itself. Worked by foot power, it does not permit of continuous driving, but must be reversed, and run over again, instead of making a regular and uninterrupted stroke. The article to be turned is driven into a wooden form, or, if the piece be flat, it is stuck to the turning arm with rosin. This is a very effectual if cumbersome method. There being no steel of any account in West China, all the tools are made of iron, but one occasionally sees a steel-edged tool. These are very expensive.

Among the articles made from the buffalo horn are :—

Horn Boxes	Images
Combs of all kinds	Dominoes
Brush Backs	Knitting Needles
Back Scratchers	Crochet Hooks
Dice	Buttons
Powder Horn	

About two years ago, after the cholera epidemic, many young children were left destitute by the loss of both parents. Some of the local Christians conceived the idea of opening an orphanage for these destitute boys. It was begun as an industrial orphanage and part time was spent in learning trades. One of these was the making of horn articles. As the apprentices became more expert, the manufacture of chessmen was tried, and now the orphanage produces very credible sets of chessmen, manufactured out of the horn. The sets are in two sizes, the smaller being about the size of the average set of chessmen, while the larger are nearly twice this size. The smaller sets are marketed at three dollars fifty while the larger ones sell for five.

Even the shavings and cuttings of the horn are carefully saved and sold to the farmers, who burn them and use the ash as a fertilizer. This brings nearly as much as the new horn, and is easier to reduce to ashes.

The bone of the buffalo is also made use of in commerce, but the industry is much smaller than that of the horn. From the bones are made hair-pins, dice, dominoes, brush backs, crochet hooks, knitting needles, combs, etc.

But the bone is most valuable as a fertilizer and is made up in coolie loads and carried several days travel overland to be utilized for this purpose. The bone is burned and only the ash used. One might wonder why it is not burned on the spot and the ash carried out instead of the heavier and bulkier bone. The answer we receive to this question is that the seller cannot be trusted by the buyer, lest he should sell him any sort of ash and not the pure article. It is estimated that nine-tenths of the carriage would be saved if the ash were produced on the spot. But this is another case where one merchant in China cannot trust another. With a modern incinerator, one could make plenty of money in this business alone, after his reputation had been established.

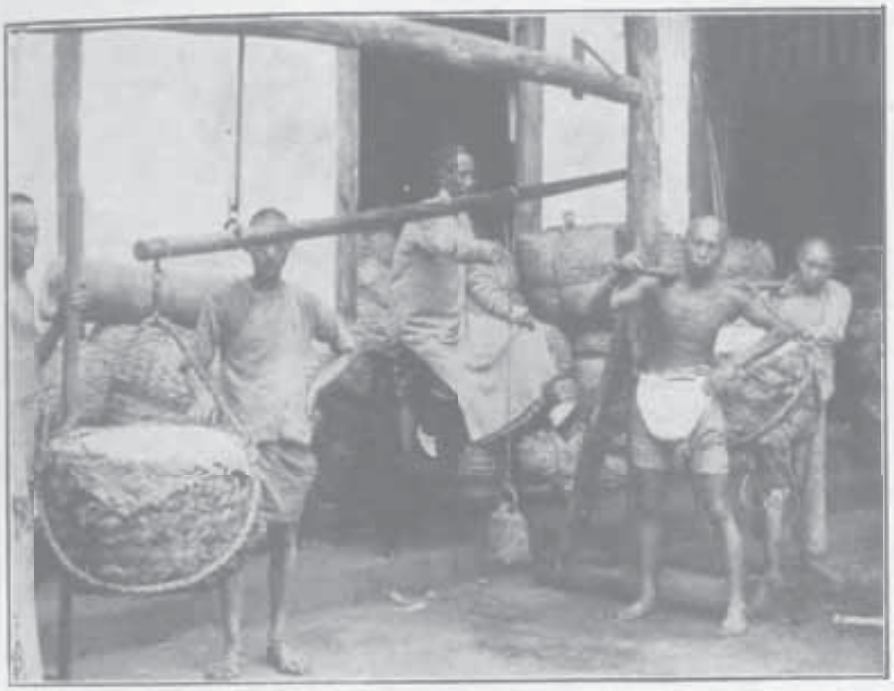
The excreta of the buffalo is the perquisite of the coolies around the well, and they also receive the sweepings from the stalls and mangers of the beasts. This is made by the coolies into large round flat cakes, which are set out in the sun to dry, and, when sufficiently hard to stand handling, are placed up in the framework of the building to dry further. When quite dry it is peddled about by the coolies and sold as fuel. This product sold for some eight or ten cash each, up to a couple of years ago, when the price rose to as high as thirty. But in a place where other fuel is scarce and very dear, this makes a good and cheap substitute, and is in great demand. The Chinese will not admit that the manure would be more valuable as a fertilizer for the land.

Naturally, the industry influences the nature of the crops, and, as beans are one of the staple foods of the buffalo, it is not to be wondered at that many tons of these are produced. One may go for miles along some of the level roads and see little else than beans. The fields are capable of yielding two crops annually and need little attention: it is simply necessary to cut holes in the sod, add a little fertilizer, and the bean will grow well in such a soil. One wonders why such an intelligent race as the Chinese have not seen that the flower of the bean is capable of producing much honey, and, if the farmer would but keep bees, tons of this commodity would be possible to him.

In season, tons of grass are cut from the hills, these being reserved by the companies for grass growing, and controlled by them.

Whether it is natural to him or not, the water buffalo consumes great quantities of rice straw. It is very coarse, but it would appear that the buffalo munches it with satisfaction. However, as the cost of straw is high, it is not surprizing that the grass cutters scour the neighbouring hills to gather even the smallest quantity of grass. Tons of straw are marketed daily.

From what has been written in preceding chapters, the reader will gather that large quantities of bamboo are used here. The biggest item,



Weighing in Crystal Salt for the Retail Market.

Horse and Mule Loads leaving the Government Stores.

A big Higher Primary Boy's school capable of boarding 100 boys has been erected and a Girl's Boarding school for 120 girls. Later, in 1919 a large Women's Bible School was erected, being operated by the Woman's Missionary Society of the Canadian Methodist Mission.

Thus it will be seen that the Canadian Methodist Mission has an extensive plant in the place, and for the most part it is not badly staffed.

Upon the entrance of workers of the Canadian Methodist Mission as residents of the station, the C.I.M. negotiated with that mission, the result being that the former Mission withdrew from the Wells proper, and the field was left to the workers on the spot. The C.I.M., however, retained their work in the Kung Ching district and carry it on to this day.

The District Geographically.

If a line were drawn from Kiating to Chungking, it would pass close to, if not through the cities of Fushun, Tzeliutsing and Junghsien. The cities of Suifu, Luchow and Tzeliutsing would make an isosceles triangle with Tzeliutsing at the northern point, which is just 270 *li* or roughly 70 English miles from each of these two cities. The city of Tzechow is north some 30 miles.

At the present time the cities occupied around Tzeliutsing by missionaries are these just named, that is, Tzechow, Junghsien, Luchow and Suifu.

The population at the Wells themselves has been estimated as one million. Possibly eight hundred thousand would be a truer figure. I have asked several merchants here and they assert that the labourers in the Salt Wells alone would number five hundred thousand.

Another missionary is authority for the statement that, if a line were drawn through the Tzeliutsing District, East and West, cutting the city in two, the population on each side would run well up to two million souls.

X.

THE SALT GABELLE.

The Chinese Government has appointed a Revenue Department, under which the administration and collection of the Salt Revenue is operated. This Salt Revenue Administration has been conducted under various auspices since its inauguration. In 1909 it was under the Provincial Governments in the control of the Viceroys and Governors. In 1910 an attempt was made to co-ordinate the Administration under a Central Salt Bureau with Duke Tsai Tze at its head. However, before this Bureau could get under way, the Revolution broke out. With the re-organization of things, the Administration was placed under the Ministry of Finance, and in 1912 a special department was organized for the administration of the Salt Revenue.

In January, 1913, China negotiated with foreign powers for a loan, and the Salt Revenue was one of the guarantees of this loan. The Group Banks arranged that the Salt Revenue should be held as a special account,

of course, is cable, but there are other commodities necessary around the well, and these are all made locally. The raw material is mostly imported as the local growth is not sufficient for the demand. This is one reason why the bamboo cable is made where the bamboo grows, and only small quantities of it are produced locally. But such articles as chopsticks, sieves, scoops, carrying-poles, baskets, brooms, strainers, ropes, covers, beds, pipes, whips, mats, partitions, in fact, anything which can be made from bamboo and utilized in the salt industry, are made on the spot. These constitute the main allied industries in the manufacture of salt, and each in its way is important to the main industry, but would not be peculiar to the place were it not for the production of salt itself.

There are other minor industries in Tzeliutsing, but they are subsidiary to those mentioned above. Every city in West China is noted for some one manufacture. Tzeliutsing is noted for its salt, with these industries, as mentioned above; but of others there are few or none worth mentioning.

XI.

THE MISSIONARY HISTORY AND GEOGRAPHY OF TZELIUTSING.

Mission History in Tzeliutsing.

About thirty years ago the "Wells" were visited by the members of the China Inland Mission as an out-station. They journeyed into the distsict from Kiating and Luchow. A thriving work was opened up in the two places, Tzeliutsing and Kungchin, and to this day that Mission has a work in this latter place. Later, possibly by ten years, the workers of the Canadian Methodist Mission also itinerated into Tzelintsing and shortly after that opened a resident station one day's march west of the place at a station called Jung Hsien. From this station regular itineraries were made to the Wells and a work opened up in this way. The China Inland Mission opened the city of Fushun, one day to the East of the Wells and two days North of Luchow, on the big river.

Unfortunately the work opened by the C.I.M. developed too fast for its proper supervision and it was found necessary to curtail it indefinitely.

The Canadian Methodist Mission came here to reside in the year 1907. Rev. R. O. Jolliffe with Rev. G. W. Sparling, and Dr. W. J. Sheridan were sent to the station by the Mission. These men took up residence in native quarters until property could be purchased and a plant begun. The Pastor's house and the church were first erected and later three houses for the itinerant pastor, the educational man and the doctor were erected. The Hospital was started in 1914, but the work was held up on account of the world war. The Men's Wing of the hospital was completed in 1918 and the Women's Wing was opened in 1920. The hospital is an up to date building with good equipment and can accommodate 150 patients without pressure.

This is the Government Retail Release Office for Crystal Salt.

Crystal Salt prepared for the Wholesale Market, to be Shipped down River, even as far as Hankow and Shasi. The tying of these is a separate Industry.

Later the Reorganization Loan Agreement was signed and Admiral Tsai Ting Kan was appointed Chief Inspector with Sir Richard Dane, formerly of the Indian Service, as Foreign Advisor. This gentleman was later appointed foreign Chief Inspector as a colleague of the Chinese Chief Inspector. [1]

As the new department gained strength and experience, it originated a scheme of inspectors, Chinese and Foreign, known as District Inspectors. These were made up of Chinese, French, British, Danish, American, and Italians. In each District a Chinese and a Foreign Inspector were appointed.

The first Inspectorate for Szechuan was located at Luchow, but this was found to be impracticable, as the source of the greater part (70 per cent.) of the salt was at Tzeliutsing, some three stages away. After recommendation to the Chief Inspectors it was agreed to move the District Inspectorate to Tzeliutsing, where a proper and effecient supervision of the Revenue and Administration for the district could be maintained.

This Inspectorate has been functioning ever since in Tzeliutsing with a Sub-inspectorate at a place called Wu Tong Chiao, where there are more salt wells.

That the Salt Gabelle, especially since its efficient inauguration, has been a great financial boon to the Chinese Government, cannot be denied. One has but to look at the following table to see what revenue has accrued to the Government since it launched this scheme; and, were it not for the general political upheaval in the nation and particularly in the provinces producing the majority of the revenue, the returns from the system would have been far greater.

This last statement is particularly true of Tzeliutsing. If Chengtu has been the political centre of the province and Chungking the commercial centre, Tzeliutsing has been and is still the financial centre for Szechuan. More fighting has taken place with a view to the occupation of "The Wells" than for in any other spot in the province. If any general had his hands on the money bags, he controlled the province.

A general, on reaching Tzeliutsing, would demand from the Inspectors all the funds on hand, and get them, often at the point of the bayonet. The safes were opened to them only after every other method of persuasion failed. On one occasion the writer knows for a fact that a Yunnanese general withdrew from an interview to prepare his men to attack the offices. Only after friendly overtures to the Inspectorate, did the latter agree to hand over the funds on hand. But it has become a common occurrence and now the District Inspectors are forced to hand out all the collections save those required for the actual overhead expenses of the offices. At the present time the Governor of the Province can count on almost one million dollars per month being forwarded by his deputy from Tzeliutsing.

With the introduction of this system of collections by the District Inspectors, one need not be surprised that there were difficulties in the way. No new scheme is ever introduced without troubles. But as the Inspectorate has grown, it has increased in efficiency and the collections

have correspondingly increased. The export of salt and the revenue collected from it for the last few years is as follows :—

Year	Salt	Revenue
1914	4,357,756 piculs	$5,008,479.47
1915	4,934,193 do.	$6,422,890.31
1916	4,808,322 do.	$8,398,123.93
1917	4,870,034 do.	$8,162,038.18
1918	4,736,070 do.	$8,969,013.24
1919	3,835,032 do.	$7,126,197.44
1920	4,594,083 do.	$9,458,723.55

The figures for the year 1921 are not yet available, but it is to be noted that up to September 20 of that year 62,765,534 piculs of Salt passed through Ichang. The duty into Hupeh is $1.50 per picul.

At the moment salt can be produced and placed on the market for about thirty cash per catty. But the market price in Tzeliutsing is somewhere near ninety. That is to say, the revenue collectable from salt makes the cost more than double the original producing cost.

The district has been subdivided into many smaller districts, where the salt is collected, inspected by the Government, as to weight of containers, etc., and then discharged from these collection stations. Some of these are small as in the case of the retail release stations, but there are several large storehouses where the great bulk of the salt is collected, examined, approximately ten per cent. of it weighed and then release tickets given the merchants upon their having paid the revenue at the Inspectorate.

There is, of course, a great deal of smuggling. This is dealt with by the Salt Police, maintained by the Salt Gabelle. They are more or less efficient, as this branch of the service is chiefly under the supervision of the Chinese themselves.

There are checking stations at all the main entrances to and exits from the district, where the merchants have to show their release tickets, whether wholesale or retail. These retail merchants may purchase their salt in lots of forty, eighty or one hundred and twenty catties, which weights are convenient for the coolies to carry.

At the checking stations are located the Salt Police who watch for the smugglers. Of late the smuggling has been less than formerly. There was a time when the Salt Police were the best trained soldiers in the province, but with an official in charge who has no inclination for the proper upkeep of the force, its efficiency is lowered.

The overhead expenses of the Inspectorates run all the way from five to twelve per cent. Some of the offices are careful of their expenditures, while others would seem indifferent. One might venture to say that about seven per cent. would be an average, and then, with careful watching on the part of the Inspectors, it might be lessened.

The Salt Gabelle is a splendid institution for the Chinese, not only from the standpoint of the financial results, but also from the example of control which it gives to the merchants and those who come in contact

Making Cakes of the Excreta of the Buffalo, mixed with the Sweepings of the Stables. This is the Perquisite of the Coolies at the Wells. They peddle it about the Streets, selling it for Fuel.

Government Retail Release Stores. Crystal Salt on the Right, Rock Salt on the Left.

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