BRUSH MANUFACTURING

BY W. H. BOLTON

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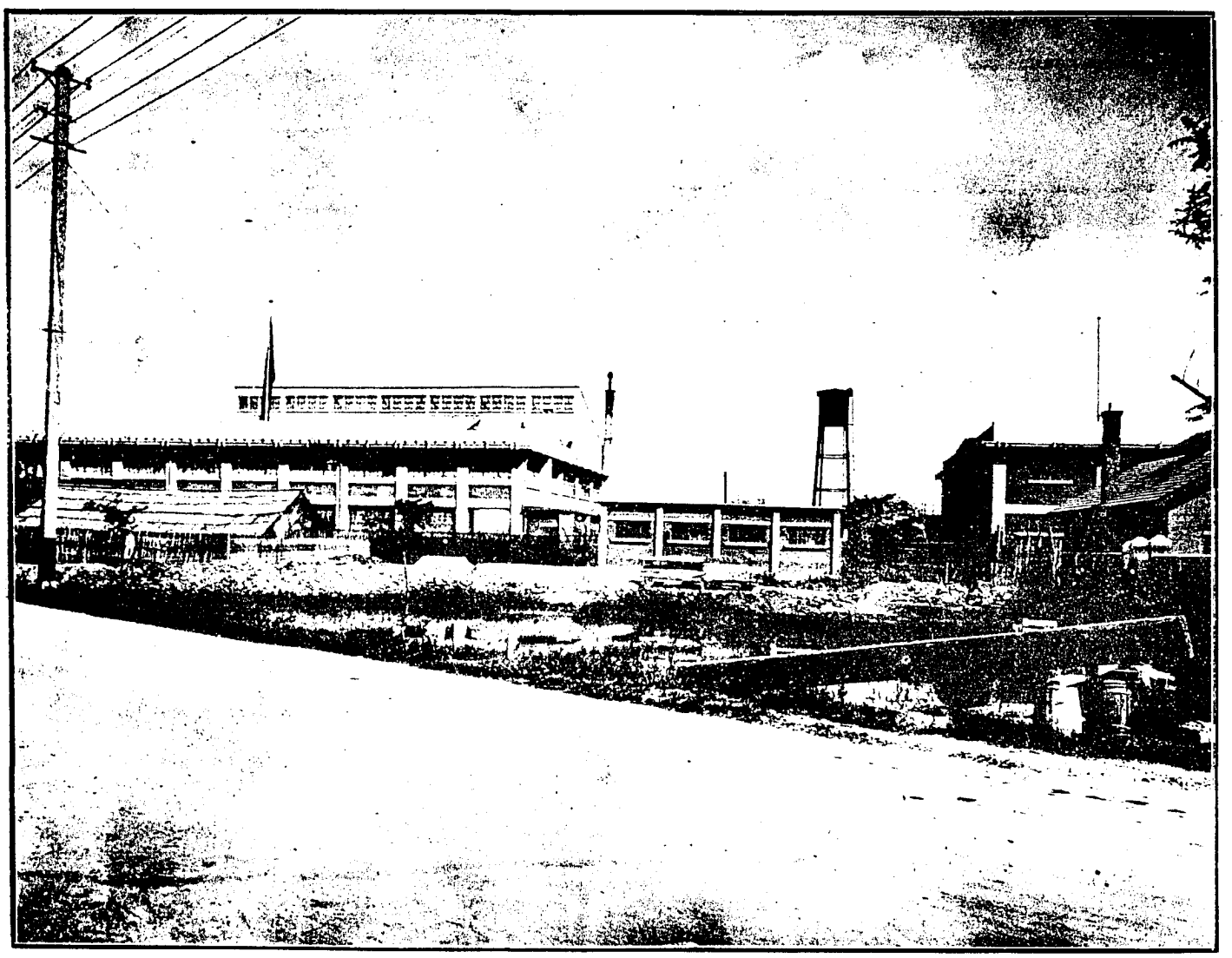
I have been unable to obtain any data as to the origin of brush manufacturing. Sometime in the 16th century a certain Beau Brummell in Paris ordered made several so called instruments for cleaning the teeth, supposedly in the form of a brush. Being unable to give anything authentic on the start of this industry I will have to confine myself to the development of the Florence Manufacturing Company, which I represent.

This company started manufacturing brushes in 1866. Brushes are divided into two classes: toilet and domestic. The first comprise—tooth, hair, hand, clothes, shaving, bath, shampoo, etc; the second—paint, household and other brushes of this nature. Although the Florence Manufacturing Company manufactures all kinds of toilet brushes its big output is tooth brushes, and in this field it is the largest producer in the world.

At first tooth brushes were made of wood, bone, compositions of different kinds and rubber. Cellulose compounds, such as celluloid, pyroxylin, zylonite, and other trade names for the same article came into use later. Bone is still used a great deal but owing to the difficulty in securing proper long lengths, its tendency to split upon drilling and the property it has of absorbing impurities, it has had to take second place to the cellulose compositions, which do not split in drilling, are not easily broken and will not absorb outside elements and can be kept clean at all times. Originally the holes were drilled in more or less regular lines in either two or three rows, the slot being cut in the back deep enough to encounter each hole, the bristle was drawn by hand using either wire, linen or cotton thread and in a few cases silk The slots in the back were then filled with some resinous composition. Then the solid back brush was made, this had a tunnel drilled in from the end, one for each row of holes and deep enough to strike the bottom of each hole. Double thread or wire was used in drawing also by hand, finally the opening of the tunnel being plugged. This method was used to a great extent by the Japanese just prior and during the Great War. It made a better looking brush and there was less danger of splitting the bone, which was almost universally used, than when the slot in the back was in vogue. The trouble with this process is that if the thread or wire breaks, the bristle in that entire row of holes is bound to loosen and work out and as the Japanese use farmer, women and girl labor, cotton thread being employed and payment made at the rate of so much per 1000 holes, naturally the thread was constantly being broken and the operator would never remove the entire row and start over again but would plug the end of the tunnel, knowing well it would be very hard to detect this upon inspection after completion of the brush. Of course when the consumer starts to brush his teeth with one of these defective brushes he has the pleasure of picking bristle out of his mouth after each performance.

At present practically all large manufacturers use drilling and stapling machines, that is the one machine drills the holes, bends the bristle, drives it into the hole, then seals a staple over the knot to hold it securely. We go a step farther and have a secret process of shrinking the hole after it is filled so that the opening is smaller than the knot, this



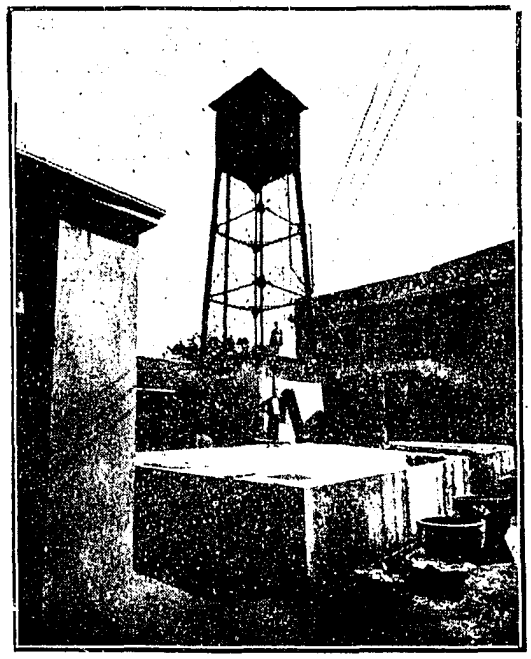
Plant of W. H. Bolton Bristle Co. at 32 Brennan Road, Shanghai

makes it impossible for the bristle to loosen. The drilling and stapling machines used at Florence are uncanny. The orginal invention came from Germany but after years of improvements it has been developed to its present perfection. So complicated are these machines that it takes three months nearly to assemble and set them up, and as we manufacture all of our own the increase of output is controlled by the ability to produce these mechanical wonders. The latest one perfected will drill and fill 48,000 holes in an eight hour day.

The handles come to us in slabs of pyroxlin cut to the required length. These are thoroughly cleaned and then molded under hydraulic pressure of 1500 lbs. per sq. inch. The company makes its own dies and as tool steel is used it is a long and expensive process to furnish one die. Then constant attention is given them so that they are kept to a mirror-like polish.

Florence Manufacturing Company

The end hole in the handle is drilled automatically, but we still have one youth who drills 30,000 handles per day by the old method, and he is so accurate that he has not been replaced as yet by a machine. Although I do not want to be



Water tower and filter supplied by Artesian well, Bolton Bristle Co.

liable for a fine on advertising, still I think it might be interesting to note the development of the Florence Manufacturing Company. It was the pioneer in numerous, important different phases of the care of the teeth. It was the first manufacturer of tooth brushes in America. Prior to 1866 the United States had to go to England, Germany, France and Austria for its brushes. It has standardized the shape and design of the tooth brush and was first to adopt the efficient three rows of bristle, and to drill a hole in the handle so that the brush might be hung on a hook. It was the pioneer in the practice of putting each brush in a separate sanitary container, and of thoroughly sterilizing each brush after it is boxed. It was the first to place an identifying mark on each brush so that every member of the family will know his own. It was the first manufacturer in its field to advertise, and through this means to instruct the public as to the correct method of brushing the teeth. It was the first brush manufacturer to cooperate with the dental profession, also the first to put dental clinics and tooth brush drills into the public schools. It was the first manufacturer to sell a tooth brush with an absolute guarantee back of it.

The one thing that impressed me most on my first visit to the plant at Florence, was the family-like atmosphere that prevails throughout the entire organization. It is doubtful if there is another large manufacturing plant in the country where so many employees own their own homes, more than 80% of the workmen are property owners, the company advancing money to help them, either to build or buy. Everyone from the general manager down is known and called by his first name and I don't believe there is an employee that is not known personally and addressed as John, Harry, Jim, etc. by the general manager, assistant manager, and superintendent. They in turn are called Bill, Jim and Fred. The surprising thing is that advantage is not taken of this close relation, but everyone seems to feel that it is his plant and that he is to a certain extent responsible for it. Production does not suffer. Last year 14,000,000 prophy-lac-tic tooth brushes were made and sold. Labor troubles are unknown; and the degree of education among all employees is remarkable, the majority of both sexes having a high school education. The 25 cent lunches that are served at the plant are certainly a great medium for exchange of ideas and promote good fellowship. Although the cost of the meal is more than twice the price asked, the company makes up the difference and feels that it is money well invested.

Education in Oral Hygiene

Although the following does not come under my classification still I would like to say a word or two regarding the propaganda for care of the teeth, or oral prophylaxis and hygiene, that has stirred the American public so during the past few years. It is a recognized fact that dentistry has advanced to a higher degree in the U. S. than any other country, also that the free dental clinics have done wonders to promote good health and a higher degree of mentality. Bacteriolgists and pathologists have proven beyond doubt that bacteria which are normally present in every mouth, by being allowed to enter the blood stream through puorrhoeal pockets and abscessed teeth, change their form and become entirely different organisms, and that circulating through the blood they find certain localities peculiarly adapted to their habits where they multiply rapidly. For example the joints, and we have arthritis or so called rheumatism, the valves of the heart and we have endocarditis, or valvular heart trouble. And it is well known that certain specific diseases are directly traced to infected teeth and pyorrhoea. Personally I think that the pendulum has swung a little too far, and in a great many cases of obscure diagnosis that the teeth were blamed and extracted without warrant. However the Ray has done wonders along this line. Pyorrhoea is caused by lack of circulation in the gums, the blood becomes stagnant, the white blood corpuscle breaking down into a pus cell, a shrinking of the gums, establishment of pus pockets and in time a loosening of the membrane or rather a destroying of this tissure that holds the teeth in their sockets, and final loss of the tooth. The great evil of this pyorrhoea is the fact that these pus pockets form a foci of infection, in other words they allow the bacteria to get into the blood stream, also this pus which is swallowed causes certain stomach troubles. These two factors together with the distinctive bad odor given the breath are enough to warrant our taking every means possible to prevent this condition as well as try to overcome it when once established. As I said before pyorrhoea is caused by lack of circulation in the gums. In the former generations, where the inhabitants had tough meats, hard foods, etc. the teeth received enough exercise in crunching and tearing the food to keep the blood circulating in the tissures around them, but at present we have to have tender succulant meats, soft foods well cooked so that the teeth get very little exercise, consequently our only hope is massage. If after brushing the teeth every night and morning you will rinse the brush in cold water and then brush your gums vigorously, always brushing towards the teeth, that is up on the lowers and down on the uppers, both inside and out, I believe you will eliminate all tendency toward pyorrhoea. If the disease is already established you must visit your dentist and have him remove all irritating deposits, then this massage will harden the gums, cause then to tighten around the teeth and prevent further occurence of this very active disease.

To get some idea what constant drilling by dentists and clinics in the schools have done to promote care of the teeth in America, there are sold every year over fifty million tooth brushes to a population of about one hundred and ten million people, while in England for example, less than three million have been sold to a population of about forty-eight million. The style of tooth brush popular in England is entirely different from that in the States, the English prefer a large brush, while from scientific as well as practical reasons the small brush, is better. It will do all the large brush does and is so shaped that it can reach the posterior surfaces of the distal molars which cannot be accomplished by a large brush due to the masseter muscle.

Chinese Great Users of Toothbrush

The Chinese are great users of the tooth brush. I have no idea how many or of what proportion to the population, but I do know that the use is increasing. Seven years ago I started, I believe, the first tooth brush manufacturing plant in China along modern lines, that is drilling the holes, shaping the handle, etc. being done by machinery. Brushes were made in Canton of bamboo handles, the holes drilled by hand and filled with bristle that was crudely tied, the knot exposed on the back. To-day in Shanghai alone there are more than thirty factories making tooth brushes along advanced lines.

Where second dressing of bristles is sorted at Bolton Bristle Co.

The essential features of all toilet brushes are the backs or handles and the bristle and method of securing the same. To my mind the most important feature is the bristle. Substitutes have been tried, tooth brushes made of rubber had a run but were never satisfactory, they did not clean the interproximal spaces of the teeth and after a short time became filthy. In hair brushes wire has been and is still used, but it injures the hair and irritates the scalp. Another material that is used is casein. This is drawn out to represent bristle and you can see in the stores to-day hair brushes made of a very heavy material and exceedingly stiff, this is a casein product. Brushes filled with this material give good satisfaction for awhile but in time the fibers break and each time the brush is used fly in every direction soon making the brush useless.

Differences in Bristle

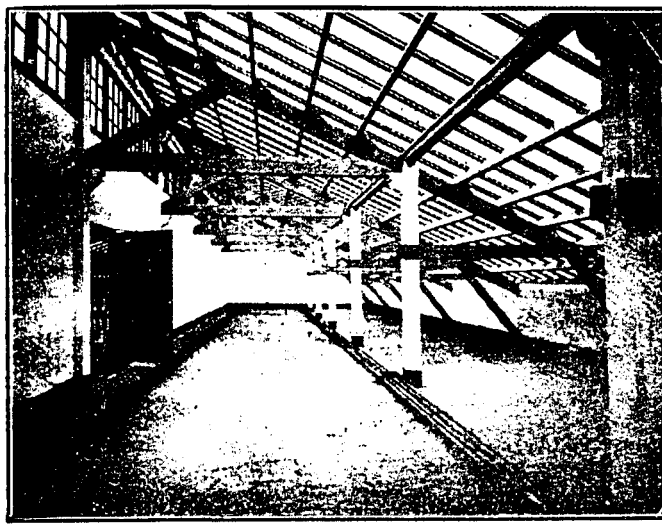
Bristle might be called stiff hair. Practically every country produces more or less bristle, but the main supplies come from Russia and China, the bristle from these respective countries differing both as regards assortment of lengths and texture. China bristle will average if it is good cargo 70% up to 3" and 30% over 3", while Russian are just the opposite 30% up to 3" and 70% over. This is accounted for by the fact that China is a pork eating country and the pigs are not allowed to grow to a proper age. It stands to reason the older the hog the longer and stiffer the bristle. Russian bristle contains a certain amount of thin hair known as wool, this is due to the fact that the pigs living in a very cold climate grow this wool to keep them warm. It is an objection, as all this wool has to be combed out, as it would spoil the brush if allowed to remain in the bristle. The Chinese product has very little of this wool, consequently is easier to dress and has less waste. As prices run according to sizes, every quarter inch from 2" up bringing a higher price, and as the longer lengths are harder to procure, the Russian bristle taking it in its regular assortment as it comes from the pig commands a higher price than Chinas. Manchuria produces a similar but inferior bristle to the Russian. Siberia a better product, while around the Urals we get the best.

Different brushes require different kinds of bristle, the hair brush needs a very stiff article, thus the longer length bristle and the butt cut only is necessary to produce a good brush. Clothes and hand brushes use a softer grade; for shaving brushes a very soft bristle is required. Then again color enters into the proposition, while formerly hair brushes used nothing but white, now a great many are made of black. Clothes and hand brushes use more black than white, while in shaving brushes white only is used in the better grades, and with tooth brushes white entirely. A black bristle cannot be bleached white, also a yellow bristle will not yield a white color unless injured to such an extent by bleaching that it is useless. In China where there are probably eighty thousand piculs of black there are not over eight thousand of white. The paint brush manufacturers are the boys that use the black. Here again again comes in the factor of texture. Varnish brushes require a soft bristle with a long flag, while wall and paint brushes can use a stiffer article with a short flag. The Northern China bristle is softer and has a long flag, making an ideal bristle for varnish and kalsomine brushes. Shanghai black is very good for wall and paint brushes. Hankow is practically the same as Shanghai, while Chungking is the market for the stiffest bristle in the whole of China. It takes about three and one-half million hogs each year to supply the China bristle output. If this country was left to its peaceful pursuits bristle would increase as more pigs would be grown, but under present chaotic conditions China is not able to produce enough pork to supply its demand, and steps are underway for the importation of hogs either alive or dressed. If the pigs were allowed to reach eighteen months of age, China would furnish an assortment of 70% and 30% as I have previously stated, but when rice is high they are killed much earlier, consequently we have a larger percentage of short lengths. The best and longest bristle comes from along the spine, the side and belly produce a much softer and shorter bristle, while the tails have nothing but hair. Old wild boars have been killed where you could get bristle up to 9" in length and as stiff as wire, this is classified as shoe bristle, because it is used by

shoemakers to draw their waxed thread in sewing shoes. During the war this article brought as high a price as $100 gold per pound. Needless to say there is very little to be had.

China Bristle

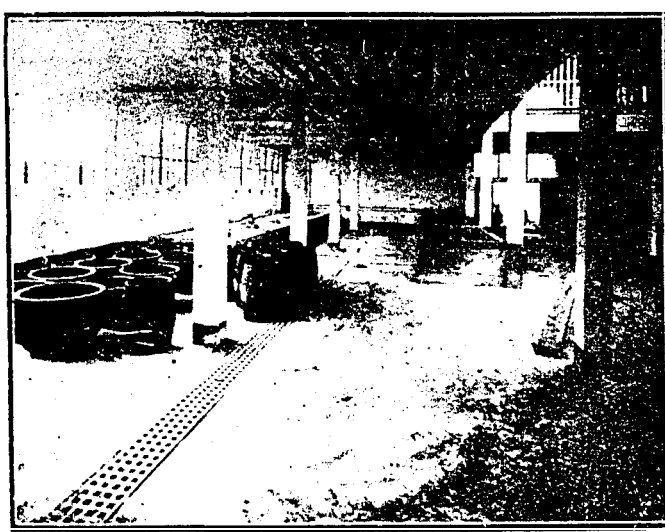
The reason that America produces practically no bristle is due to the pigs being raised for pork only and quickly fattened, thus yielding fuzz instead of a stiff hair. In China the animal has to hunt for his food in consequence of which he produces a stiff wiry hair. Coming to tooth brushes Szechuen produces the best bristle for this use. It is stiffer



Drying-room of the Bolton Bristle Co.

has less wool, is tough and even down to 1-1/2" is bristle not hair, 3" Szechuen is stiffer than 4" Siberian or Russians. The white is very free from black and yellow, while Siberia has 10% wool, 10% black, and about 10% yellow mixed with the white. Hankow white also has much more black in it than Szechuen.

The Chungking black is the best dressed of any Chinese bristle and commands the highest price, the native dressers put up an absolutely solid bundle, doing this by cutting the flag down to a solid size. However in dressing their white they put in four sizes at least, that is a 4" bundle will have 3-3/4"—3-1 2"—3-1/4"—and often 3" and under in it. I buy nearly all my cargo in Chungking and practically all of it in the raw state, namely undressed. After drying it is shipped here to Shanghai where we dress out the waste, dirt and skin,



Soaking the bristles

wash it, bleach, sterilize and then dress it out 90% solid without cutting the flag. Sorting bristle as to sizes is quite an interesting procedure. It is all done by hand, the bristle worked back and forth until the butts are all pushed out so that the bundles will have all flags and butts together respectively, then bundling it in 1/4" sizes from 2" up to 6" and over.

In buying, the great factors are to estimate the average length, the amount of skin and dirt and also the moisture. I really think bristle is the most crooked game in China, all kinds of snide, ingenious devices being resorted to for cheating. One pet scheme is to take the bristle and soak it in a

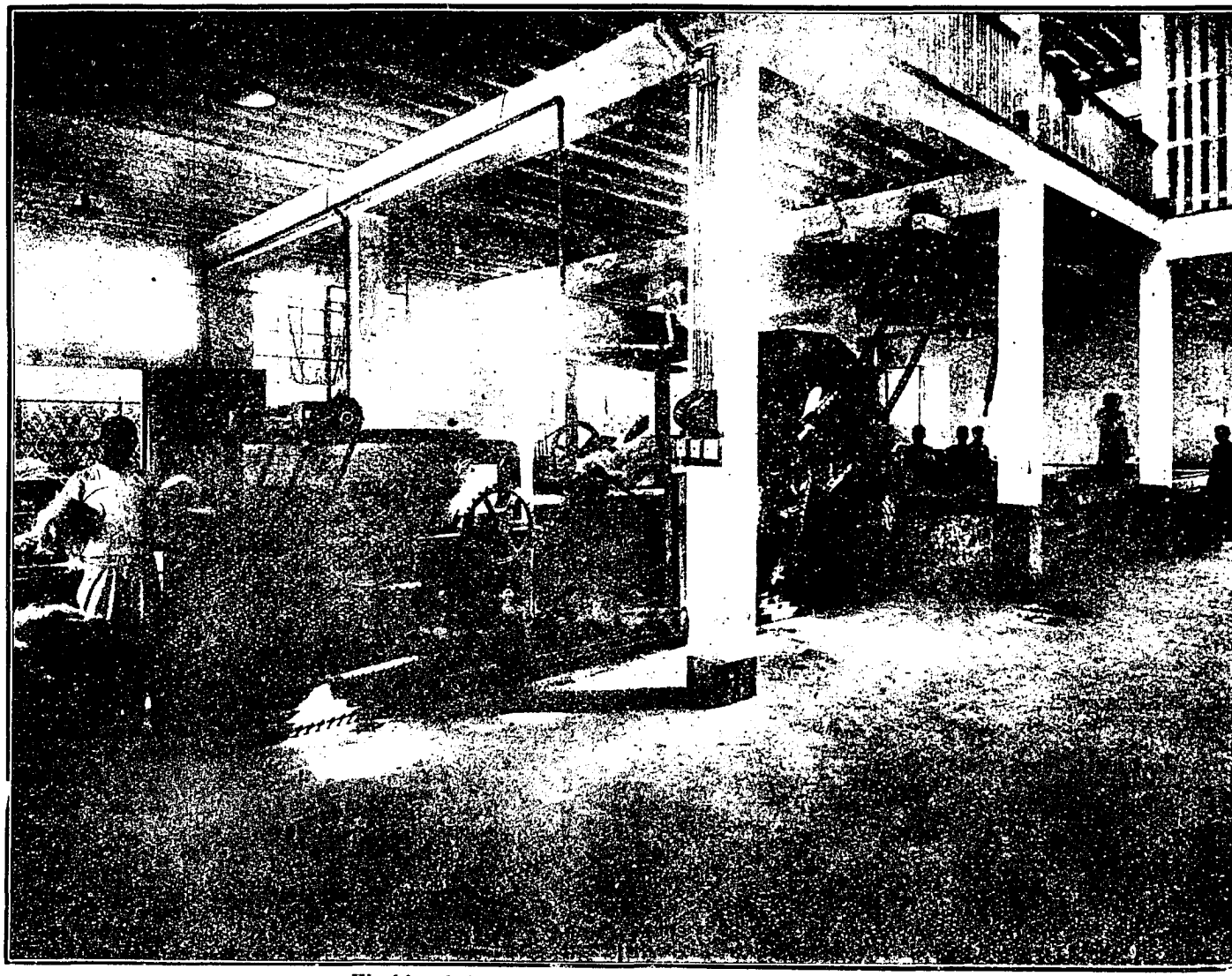
solution of acacia bark so as to make it nice and sticky, then sand and mud is sprinkled on it; even after drying, quantities of this dirt adheres, and, as all cargo is bought by weight, unless you are wise you pay a fancy price for the cheapest commodity in this country, that is dirt. By another good one they used to work four to five years ago I was able to sell my waste, which ordinarily brings from $5 to $8 per picul and is used as fertilizer, for $50 per picul. Upon looking up where it was disposed of I found that some local dressers had taken from 2-1/2" to 3" bristle, put it around the outside of the bundle and the middle was full of this waste. They were selling it to the Japanese at $150 per picul.

Care of Toothbrush

Bristle suitable for tooth brushes must be stiff, able to stand up under moisture, capable of being bent double without breaking, and be of a good white translucent color with plenty of luster or brilliancy. If it was possible to keep the white pig absolutely clean, no bleaching would be necessary to give you the proper color; one would only have to wash it to remove the grease. This in China at least, is impossible so we have to bleach. More bristle is spoiled in this process than in any other way. The Chinese can bleach a dirty bristle so that it is an absolute pure white, but after it has been put into a brush it soon breaks, thus it is useless. I do not try to get color at the expense of injuring bristle, but rely more on a thorough washing with a special soap, and live steam under 15 pound boiler pressure. Our bristle is not a lily white, but it is tough and will stand lots of abuse, also it is very slippery so as to work well in the machines and has a brilliancy that makes it attractive. Just a word regarding the care of a brush. If a brush is allowed to stay wet, and during our humid season this very easily occurs, the bristle soon gets soft and mushy and its usefulness is gone. If you can take the time to dry your tooth brush, either in the sun or by artificial heat, each time after using, it will last a great deal longer, The easiest and most economical method is to have two brushes, using one in the morning the other at night. This gives twenty-four hours for each one to dry in and, if well shaken before hanging, is usually time enough.

A great many have the habit of washing their hair brush in ammonia water. This very soon turns the bristle yellow and has a tendency to make it brittle. The better way is to dip just the bristle into a strong solution of borax, this will clean it without changing the color or resiliency of the bristle. We hear a great deal about anthrax. Several cases have been reported where infection from a shaving brush has caused anthrax with fatal results. Although some authorities claim that anthrax spores are carried by bristle, personally I doubt it, I have never seen or heard of a case, where nothing but pure bristle was handled. Anthrax spores are most prevalent in horse hair, goat hair and cow hair. Some manufacturers mix horse hair and goats hair with bristle in their shaving brushes, and I believe in every case of anthrax due to this kind of infection you will find either one or both of these hairs, not properly sterilized, mixed with the bristle. It is very hard to detect these after a brush is made up, as only a small percentage can be used, otherwise the brush would flatten out when wet, as both horse hair and goat hair mat in water and it takes a preponderance of bristle to keep them up. Needless to say not a trace of horse hair, goats or cow hair is allowed around the plant at Florence or Shanghai.

In manufacturing tooth brushes great skill is necessary to grade the bristle so as to get a uniform texture. Brushes are usually sold as soft, medium and hard. To produce the same degree of texture where you have Hankow, Chungking, Manchurian, Siberian, Russian, French and several other kinds to cut and mix, is a physical impossibility for any man, however clever, to make two batches alike, where he has so many different kinds to handle. On the other hand where but one specific quality and so many pounds of each size each time are taken the same result is obtained There is no other tooth brush manufacturer able to do this for he cannot have any fixed system of weights and sizes, of the same quality of bristles where he buys from brokers, having to take whatever they have in stock. This, together with the better facilities that China offers for cheap labor to pick out the yellow and black, is the reason for the Florence Manufacturing Company having a plant in Shanghai.



Washing bristles at the Bolton Bristle Co., Shanghai