

Sugar: Work at San Cristóbal

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Work on the more than 250 plantations in Veracruz mattered nationwide. Since the 1520's the manufacture of sugar and rum there had sweetened fortunes and lives locally and elsewhere, but as capital surged into the industry in the 1900's, moving its center from upcountry to lowlands north and south, the work carried an ever broader impact. From 1901 to 1910 it produced a fifth of Mexico's sugar, a sixth of the Republic's rum, and the highest hopes for much greater production along both lines. This work was of course essential to several big and powerful sugar firms, Mexican and foreign, and to the companies that sold them equipment, supplies, and transportation. It also drew vital income to thousands of poor rural families as far away as Jalisco (not to mention Japan or Korea), which every year sent men, women, and children down to the Gulf Coast's cane harvest. It became critically important within Veracruz. Occurring in all 18 districts, it yielded in sugar and rum together by 1910 the state's fourth most valuable product (less than oil, textiles, or coffee, but more than corn), brought income directly to probably 50,000 Veracruzano sugar workers, allowed hundreds of small local firms in other businesses to thrive, and directly and indirectly accounted for maybe a fifth of the state's revenue. If it stopped on many plantations for long, the entire state would be in danger of disaster.

As industrial workplaces, sugar plantations were odd in their integration of agriculture, transportation, and manufacture—fields, roads, and tall-chimneyed factory. Unlike a textile mill, a cigar factory, or a coffee plantation, a sugar plantation combined in one place and under one general manager the operations of raising a crop, a very expansive crop at that, then reaping it as raw material, conveying it from the fields to the factory, and transforming it into commodities for shipment to market. Sugar plantations were therefore extraordinarily extensive, isolated, and multifarious. One of the biggest, San Cristóbal, comprised almost 100,000 acres of bottom land on the left bank of the Papaloapan River. Its western boundaries were only a few miles from the town of Cosamalopan, a district seat, but home to only 3,000 souls. [Do you want notes from the margin?] It was 30 miles west to the nearest railroad, the Veracruz and Isthmus, 50 miles east downriver on the steamer to the nearest respectable town, Tlacotalpan. Of San Cristóbal's vastness, 2,000 acres were in cane, the rest jungle, savannah, and patches of corn and beans. On the cleared land were miles of internal cartroads and railroad, corrals, barracks, the bustling

complex of the sugar and rum factory, below which a pier allowed steamers 12 feet of draft. Downriver in the same district lay Paraiso Novillero, 25,000 acres, usually 1,500-2,000 of them in cane, with its own wild stretches of grazing grounds, rubber groves, orchards, food plots, roads, etc., plus an electrical plant, an ice plant, and a hospital, its factory and pier. Work on a plantation took place then out in the open weather and inside big noisy buildings. Its sounds were as characteristically of animals and tools as of engine and machines.

Cane was not only expansive. A perennial, gigantic grass, "in the ground for the whole year," it was also a row crop, which required continual cultivation. Ripe, it weighed from 20 to 60 tons an acre. At best, however, it would give only 10% of this weight in sugar. And past ripe, it quickly lost its sweetness.

The operations and amount of work in the sugar and distilling industry were therefore extraordinarily seasonal. And so too the force for work changed through the year. For six months the industry was in "dead time," an old artillery term adopted by plantation managers for the period of making ready, a time when plantation chimneys stood clean in the sky and bells pealed the starts and stops of six 12- or 14-hour days a week spent in preparation of fields and factory by permanently resident workers, on San Cristóbal some 600 men and boys. Then came six months of *la zafra*, the old Spanish word (from Arabic) especially for the cane harvest, the time the Louisiana men called "the campaign," when plantation chimneys smoked and whistles screamed the shifts for six or seven 12- or 18- or 24-hour days a week in the full, frantic rush of cutting, transportation, and production by battalions of the residents and migrant harvest gangs. This industrial bisection of the year was heavily lopsided on any particular plantation. No place had a six-month *zafra*. On small plantations dead time lasted 10 or 11 months, the harvest happening in its season, but only for a month or two. On San Cristóbal dead time usually lasted at least eight months, the seasonal force for the harvest then increasing in a few weeks from 600 to around 1,500, for at most four months of production.

Consequently, again unlike other industries, the organization, assignment, and outfit of a plantation's laboring force varied through the year. An old-line manager kept records of his force in long lists of 60 or 70 tasks, operations, locations, and function. An up-to-date manager tried to keep his records divided between field, transport, and factory, and subdivided into 12 or 15 departments. But either way the work in dead time or in harvest repeatedly compelled the redistribution of elements of the force from one

category to another. If the general manager's disregard of the specific abilities among his workers did not go so far as a master's inevitable indiscrimination among his slaves 150 years before in Veracruz, or 50 years before in Louisiana, or 25 years before in Cuba, it went far enough to get the necessary work done in the necessary sequence. On all parts of the plantation a manager's subordinates continually had to disband groups of workers at some details and reassemble them for others, often in a different division, often from week to week. Typically at least 80% of the resident workers and 90-95% of the migrants were listed and used as *peons*, common laborers, or, as the Louisiana men called them, hands. Those who had acquired skills, plowmen, for example, or ditchers or drivers, were suitably used when the need for their competence arose. But otherwise they went wherever ordered and worked as if they were no more than muscle and bone. The many without notable skills were routinely ordered about as general laborers. Only a few men in the factory were semi-skilled specialists or regular craftsmen.

Dead time commenced with the rainy season, in May. Out under fresh hot sun in the morning, downpours every afternoon, the land showed systems already drawn over and amid systems still in ruin. The *cañaverales*, the cane fields, subdivided into *suertes*, lots as long as a quarter-mile, preferably east-west and no wider than 100 yards, lay clean and plowed, and the rows of stubble and new plantings duly covered. But the drainage ditches above, across, and below most lots were broken and clogged, and the headlands full of grass, potholes, and ruts. The manager's man in the fields was the overseer, who on horseback exercised command through several foremen. His main concern for the season was to protect the cane's growth. As soon as possible and then periodically all summer foremen had numerous ditching gangs out with *coas*, Mexican spades, redigging and clearing drainage down to the nearest creek or river. The daily rains shortly brought the shoots up in the rows. They also brought weeds. And as the cane grew, rats and moles came to eat it, and foxes, skunks, and snakes to eat them, but never fast enough. Accordingly through the summer the fields needed four or five *limpias*, "cleanings," so that after mid-June on any working day before and after the rain foremen had scores of men and boys out in field gangs, wielding mattocks to clear weeds, kill "the enemy," throw dirt up along the rows, and hoe it back. Under another foreman a road gang or two would be rebuilding the headlands, which doubled as fireguards. If the place had a railroad, yet another foreman had a gang remaking the bed and bridges, realigning track, laying more rails. Far out around the edge of the fields, sent by a foreman in charge of fences, men were fixing

the stone, wire, wood, or cactus protection against grazing animals. Farther out, under a foreman in uncleared land, a bush gang would be chopping down trees and brush for a new field. And sent there daily by the *boyero*, the ox-boss, plowmen kept plow oxen submissive and broke calves to the yoke by furrowing drainage, and drivers kept cart oxen trained by hauling logs off. Around and across the whole plantation, answering to the foreman for security, mounted guards patrolled on the lookout for trespassers, thieves, and malingers.

Away from the cane fields, preferably along rises and hillsides, most plantations had plots of corn and beans. Ordinarily five times in the season foremen would send older men there for some days, to plant the *temporal* (rainy-season) corn and beans and pick up the *tornamil* (dry-season) corn in June, weed the crops in July, weed them again and plant more beans in August, fold the corn stalks down and pick *temporal* beans in September, and plant *tornamil* beans in October. When not in the fields or at work elsewhere, these men did duty in the storehouse near the factory, shelling corn and beans.

Also out in the open but away from the fields, not far below the factory, were the corrals and pens for the oxen, several score of them on a small plantation, several hundred on a big place. There the ox-boss ruled, plowing and carting bosses shouted orders, plowmen and drivers congregated for assignments and returns, and a few old and many young ox-herds brought the beasts from pasture, helped plowmen and drivers yoke teams, helped unyoke the beasts on return, fed and watered them, and gathered the weary to take back to pasture.

Meanwhile in the buildings everything was up for repair, starting with the buildings. These, even on a small plantation, were many: the storehouse, the general manager's house, the shacks and huts where resident workers lived, the stables, the implement and tool sheds, the barracks for harvest hands, and the factory, whether an old-fashioned set of separate structures, a *casa* for each of the main processes, or a modern complex of attached and interconnected "houses," including the distillery. Most notable under the rains of dead time, they all had roofs. For the season the manager's man everywhere inside was the resident general machinist called *el ingeniero* [?], "the engineer." And as the rains became daily, his paramount concern was to have leaking roofs patched, most urgently the sheet-iron over the factory. Never soon enough, the foreman for maintenance put his most reliable men to making the roofs and windows of the manager's house and the manufacturing houses tight and dry. Then he concentrated on having laborers

transferred from the fields to the gangs for buildings and grounds, put his regulars and the others to sweeping and scrubbing the areas of production, scraping and painting exposed iron frames, whitewashing walls, and sooner or later detailed them into the factory yard and the cabins, stables, and sheds, where he had some stay to clean, tighten, and oil the plows. If as usual, despite the rain, an expansion of the factory was on the summer's agenda, his men also did the construction. Now and then at the nearest railroad station on the plantation's pier a shipment of new equipment or ordinary supplies, lubricating oil, lime, etc., would arrive. Detailed by the engineer, another foreman would lead a gang of men down to get the load onto a plantation [?], back to the yard, and into storage.

On the factory floor for the first few days the machinery and other equipment stood quiet and empty. It was not from nostalgia that a bell marked the hours; there was no more steam for the whistle. This was ominous mechanically. In most other industries, as a rule, operations went for 50 six-day weeks a year, maintenance of machinery recurred from week to week, and major repairs and new installations happened seldom and caused only a few days of interruption. In a sugar and rum factory, ordinarily in operation around 90 days a year, but then almost constantly and often at maximum capacity, the equipment suffered for the rest of the year the one condition harder than such heavy use—not being used at all. A reminder from St. Matthew served as the season's standard warning: “moth and rust doth corrupt, and thieves break through and steal.” Moths would be the overseer's problem. Thieves were for the guards to catch. But rust, even under a dry roof, was a relentless threat to the treasures in the engineer's domain.

As “the duly appointed guardian of steam,” the engineer started mechanical repairs by having the powerhouse shut down. On his orders the several firemen and water tenders became boiler cleaners, killing the fires in the furnaces, taking the ashes away, sweating the boilers, knocking the soot off shells and tubes, draining the water, oiling exposed surfaces, brushing out furnace soot and lint, crawling into the boilers and scarping out scale. While they did these most hated jobs and a [?] cleaned the boiler feed-[?], the engineer inspected the sawmill and repair shops and ordered the annual cleaning and general overhaul of their machinery.

If he followed the wisdom of his trade, he reviewed the diary he had kept of mechanical performances during the harvest. His memories of exasperation refreshed, he made a minute inspection of the factory's motive and manufacturing equipment. On a small and old-fashioned plantation he could go

quickly through the grinding house, the boiling house, the curing house, and the still house, and check respectively a condensing beam engine and a 24-inch mill, a Jamaica train or two and pertinent utensils (paddles, spatulas), an array of racks and receptacles, and a 50-gallon pot still. But in a big modern factory he would need two or three weeks to examine everything carefully and note the faults exactly. With boilers for 1,500 horsepower, San Cristóbal was already archetypical in 1901. In its grinding department the engineer on inspection faced three Corliss engines, a cane carrier, an 800-tons-a-day Krajewski crusher, two 32x60 Whitney mills in tandem, a trash carrier, and a juice pump. In the boiling department he had a multitude of apparatuses to check: 14 700-gallon defecators, 10 clarifiers, eight Wright filters, 10 Taylor filters, a triple-effect with eight-foot pans, two mixers with 12 centrifugals, a molasses tank, and several more pumps. In the drying annex he would look into the stoves and the elevator. And awaiting him in the distillery were a wash-mixer, fermenting vats, a 150-barrel Deroy still and rectifier, receiving tanks, and more pumps. From area to area the specialists or craftsmen in charge, mechanics for the season, made the equipment eventually inspectable, they and their helpers tearing down engines, mills, and pumps, opening journal boxes, dismantling and scrubbing heaters, casings, evaporators, and centrifugals, brushing and swabbing coils, tubes, and vents, stripping the still, disinfecting, hooping, and setting down fermenting and receiving vessels. Surfaces polished bright from use were easiest to inspect, and the dutiful engineer studied long and hard the insides of steam chests—cylinders, valves, pistons, packing, rods—for wear and cracks. He took pains over gearing, journals, and bearings. He double-checked engine governors. And if he went quite by the book, having scanned pulleys, shafts, plates, nuts, pins, bolts, hoops, keys, etc., he tried the supports for the pipes in all the departments.

By then the powerhouse would be clean. The engineer inspected its furnaces and pumps for leaks, the boilers for safety, particularly the safety valves. And on his orders the firemen, firemen again, raised the steam for the saw mill and shops, by then ready for action too. The steam also allowed a test of the factory's pipes, with attention to their exhaust, traps, and valves, and concentration on joints, gauges, and vacuum-pan coils, which if only slightly cracked, would let sugar into the boilers. Seepages noted, the engineer had the pipefitter from the shops disconnect the steam and exhaust pipes and start cleaning and refitting. And the specialists and craftsmen become floor mechanics proceeded with the overhaul, oiling, and reassembly of the equipment in their charge. Actually then most of them became mini-foremen. They

had their helpers take parts to the shop and fetch them. And they did only minimal instruction and supervision on the job, so that a helper oiling an engine or pump would typically, for example, remove a back cylinder head, move the piston forward, overdose the exposed surfaces, but leave the rings, the walls between the piston and the front head, and the rod in the stuffing box dry, and forget to change the frayed and wet packing. But sooner or later the men got the equipment put back together and apparently ready to go. On the whole it was idle for any of them to worry about deficiencies he had hidden. Usually around mid-summer the engineer fixed his mind on the factory's major repairs and new installations, which meant at least his negligence of little points and a fair chance that some recently half-mended apparatuses would be relocated, maybe junked.

These big mid-summer projects often spread confusion. Even small expansions at San Cristóbal, for example, the addition of four centrifugals and three granulators in 1904, the installation of a ??Hersery cubing machine in 1908, were troublesome. However early the engineer had the construction for them finished, he ordinarily received delivery of the new parts and equipment late. In the meantime he could not leave idle the men who would eventually assemble, adjust, and use the equipment, and orders they would pass into the shops, generally assigned to aid the regulars there but generally getting in their way. When awaited shipments arrived, he would in dread of the rain have to have an area inside cleared for them. It would take him days to remuster the men to handle them. And the special orders to the shops then would disrupt work there again.

A complete sawmill was not essential, but most big plantations had a special area for making logs into lumber. Unlike work in the fields or factory, work at the saws went pretty much year round. Depending on the weather, the land that the brush gangs cleared, the number of oxen to bring the logs to the mill, and the place's need for planks, boards, staves, etc., it too seasonally waxed and waned. Since most oxen were available in dead time, more work happened then than at harvest. But some or all of the saws—a drag saw, a head saw, a slabbing gang, a resaw, an edger, a butter—were roaring or screaming and making dust fly most days of almost every week of the year. And except during the annual cleaning and overhaul the foreman and his crew of five to 25 sawyers, yardmen, and helpers were repeating more or less the same operations from week to week, making lumber, stacking it, and taking it as ordered to one or another shop.

Only in the shops, however, did the work happen regularly as in most other industries. It did not exactly reflect the work in other industrial shops. Because of the repairs required for agriculture and transportation as well as manufacturing, this area on a small or large plantation had odd corners. The carpenter's shop on a big new place, for example, included patterns for yokes and room and tools for a plowwright, a wheelwright, a car-man, and a cooper. And the machine shop featured a traveling crane and shearing, punching, and other machines heavy enough to repair locomotives as well as the factory's equipment. Also peculiar to a plantation's shops was the seasonal variation in the parts brought for repair. But like shops elsewhere these were spaces of stationary and steady work, from day to day, from month to month. Repairs in the San Cristóbal shops took around 40 skilled workers and helpers all year every year.

In September the rains ended. In October, glowing green under the sun, morning and afternoon, the cane closed so tall and thick that weeks could not grow or men move in it. It blossomed, field after field, and from above the breezes made the vast gardens of perfect feathery flowers shimmer violent and silver. In their domains below the overseer and the engineer hurried the last preparations of headlands, tracks, the barracks, piping, rollers, and the setting of the mill.

On most plantations *la zafra* commenced in November or December. Out in the fields on old-fashioned and on modern places overseers drove foremen, foremen drove residents and harvest hands, and only the lack of light at night stopped the drive from going round the clock. So operations continued for the duration of the campaign: once a place's harvest began the work proceeded almost every day from the whistle in the dark at 6 a.m. to the whistle in the dark at 6 p.m, through sultry spells and Northers, six or seven days a week, for as long as there was cane to harvest a month or two, or three or four. The amount of work on the place fluctuated. As one *suerte* of cane after another came ripe, there were weeks when several lots were in harvest at the same time, or that the number of workers on the place increased to a peak, held at that level as long as necessary, and toward the end declined. But however many they were the men, women, boys, and girls in the field worked day in day out, as if in battle.

The daily operations to take off a crop were five, three coordinated, two in support. The first was cutting the cane, terribly active and awesomely slow work. The means were cane knives, the old *tencol*, *moruna*, *mojarra*, or *güingaro*, or the new *machete de patente*, the 22-inch Collins. And the movement through a *suerte* was all one way, *a hecho*, as the Cubans said, all a lot's rows cut together on a more or

less even line from one end of the lot to the other. Accordingly the organization was by *cua드릴las* on any lot being cut, a *guardacorte*, a cutting foreman, on horseback, and a gang of *macheteros*, the cutters, men and boys, some residents, mostly migrants. Deployment of the gangs varied from plantation to plantation. On places with narrow lots the foreman assigned one row to each of his *macheteros*, who were each to cut about two tons of cane a day, advancing together maybe a quarter of a mile. On San Cristóbal the lots were wide, and the assignments were by *luchas*, “struggles,” from two to 10 rows counted as one struggle for one cutter. A 100-yard-wide lot with 60 rows of cane, for example, might well bear 12 struggles. By dawn under the foreman’s hard eyes a gang of 12 cutters, on a line one every five rows, shirts closed at the neck, straw hats down tight on their head, would be moving against the cane before them. Through the day the hot air seemed to give no breath, but of dust and insects. In the furrowed ground every step was treacherous. And up close, under the green leaves, the cane was torment. A towering, dense mass, yellows streaked greenish red and tinted purple, or dark violets and reds, or pale greens striped reddish purple, the 10- or 15-foot-long stalks, 12,000-16,000 of them to an acre, each weighing six or eight pounds, curved into each other in the rows and lay down free in thick snake-like tangles as the cutters came to them. Shining in the light as if varnished, they shed a penetrating fuzz that would make an iron man itch. In his assigned struggle, sweat dripping, a cutter groped among the fallen stalks, watching for rats and snakes, lifted a stalk, found its bottom, cut it off hopefully with one clean stroke through its two-inch diameter at ground level, pulled it loose, cut off a foot or two at the top, stripped off the leaves, tossed them to either side, cut the bare, knotty pole into two or three roughly four-foot pieces, threw them behind him, lifted another stalk, cut it off at the bottom, and so on, and minute by minute inched ahead. [I’m confused about the transition here.]

The second operation was the worst in the fields, *alza*, loading the cut cane into carts. Many places old and new abided by the Cuban rule: *Unos cortan y otros alzan*, “some cut, others load.” Under their own mounted foremen the loaders came in gangs of three, five, or seven men, here and there a resident, but most of them, again, migrants on the place only for the season. For a gang of 12 cutters there would probably be a three-man and a five-man gang of loaders, each gang loading a cart. On a place with 75 *macheteros*, this meant another 50 field hands to load. On a big place it meant hundreds more.

At San Cristóbal the cutters themselves loaded. Every 45 or 50 minutes in the 100-yard-wide lot the gang of 12 would stop, turn around to the dust, trash, and heaps of cut cane behind them, and spend 10 or 15 minutes loading, each gathering an armful of cane, maybe 20 pieces, 55-60 pounds, carrying the bundle back a few yards to a cart, lifting it up to the driver, likewise bringing four or five more, and then return together to the torment of the cutting line. If the tops, the first cut off the cane, were to be saved for planting a new lot, a few *pepenadores*, gleaners, boys, would meanwhile gather the sticks into bundles, tie them, carry them back to a cart, and add their bits to the load. By dark the 12 cutters would have cut maybe 6,000 stalks and loaded from 18 to 20 tons of pieces in carts, each cutter having cut and loaded around 1.6 tons in 50 or 60 bundles. Their advance along the 100-yard front would measure from 15 to 20 yards. In a 10-acre lot, the gang would not make it from one end to the other for three or four weeks. In the peak months on San Cristóbal cutting and loading took as many as 500 hands.

The other coordinated operation was *acarreo* or *tiro*, hauling, the work primarily if not only of oxen and *carretoneros*, cart drivers. The carts were two-wheelers on the old Cuban model, the *carro chico* holding about 1.5 tons, the *carro grande* about three tons. In motion these vehicles cracked and creaked like a house falling down. But they were usually the most durable equipment on a plantation. The oxen were typically creole, horn-yoked, two yokes for a little or a big cart. The men as strong as stevedores, were ordinarily migrants. At the corrals by 5:30 a.m. to get assignments from the carting- boss and yoke the teams for the day, soon afterward in the yard to connect the carts and grease their wheels, they were ready at six to give the field gangs rides out to the lots. Along the way, moving a half mile in 20 minutes, they passed the *guardacaminos*, the guards watching for damage to the roads. Arrived at his assignment by first light, passengers out and trudging to the cane, a driver headed the oxen into the lot regardless of the damage to ditches and stubble. Having stopped and settled the beasts, he waited for the loaders to come to him.

[I can't follow the marginal notes on page 16]

...he stood astraddle a wheel, one foot on its hub, the other on the axle, twisting down to grab the bundle from the loader, twisting up to lift it over the side rail, spilling it into the cart. On a bad day he had pieces often spilling, crooked and crazy, which brought him cursing into the cart to put them right. On a rare good

day he had bundle after bundle falling as if hand-packed, lengthwise in the bed, piling evenly first in front, later in the rear. With a loader astraddle the other wheel helping, he finished the piles. Walking around the cart, he checked the load, then to the left of the oxen gave them an *arre!*, or goaded them, or pulled them forward by their nose-ring ropes to start them, turned them slowly around, stood up on the shaft, and rode out onto the headland.

On the road normally he had only to worry that a young ox would buck and throw the load. If he was going to the factory, he faced more troubles: waiting in line behind other carts in the yard, geeing and hawing and maybe having to back up, until, finally at a dumping point and registered by the yard clerk, he could climb down, undo the pole, and let the cart tip backwards and the cane slide out in a heap next to the grinding house. If—the typical case on a new plantation—he was bound for a station on the place's railroad, for transfer of the load to a cane car, he could expect an easier trip. At the station too he would probably have to wait in line, but not deal with a traffic jam. Registered beside the car, he simply drove under the hoist and dumped the load on the sling. In the yard or at a station he then had only to rehitch the cart and drive away, resting on the ride back for another load.

Without a mishap he would by nightfall have handled from three to eight tons of cane. The last load dumped, he returned the cart to the yard and the oxen to the corral. He might not yet be done. Often he also had a six-hour shift at night in the factory, as a helper in the boiling house.

Like the number of cutters and loaders, number of drivers rose and fell. Depending on the amount of cane being cut and distance of the cutting from the factory or the stations, it could vary on the biggest plantations from 100 to 200 men.

On places with railroad, where the tractors for transportation were both the ox and the locomotive, the fields underwent daily invasions by the power, smoke, and sounds of the factory. Loading stations were the oddest junctions of old and new. At many not only the transport to them but the techniques of transfer remained ancient: oxen pulled cane cars onto and off the siding spot, and drew the cable for the hoist; a winchman and his couple of helpers did the slinging and driving, turned the traversing wheel, and undid the slings by hand. At the most newly outfitted stops, a donkey engine lifted the loads, and a derrick operator controlled the movement of the weight. But transport from the stations was as modern as could be. Trains stopped often four times a day, to leave empty cars on the way up and take full carts on the way

back down in the morning, the same again in the afternoon. On some plantations railroads were so extensive that managers appointed a subordinate in effect as a dispatcher and yardmaster. Already in 1901 San Cristóbal had over 10 miles of track, three locomotives, and 75 cars. In 1905 Parasio Novillero had 17.5 miles of track, one 10-ton and three 15-ton engines, a 15-ton crane for derailments, and 120 five-ton cane cars. By 1910, on nearly 20 miles of narrow-gauge and narrower Decauville track, its four engines were rolling almost 200 cars. And there were four train crews, one resident year round, three for the campaign, all the men on duty from 6 a.m. to 6 p.m and taking turns on night shifts in the yard, daily making up empty trains, switching cars off and on at the stations, day and night breaking full trains up in the yard, spotting loaded cars under the crane at the grinding house, parking empty cars for later use.

Both of the essential operations in support were the work of boys. One was the care and feeding of the oxen in the fields, which the ox-boss usually sent resident workers' sons to do. Each team typically had the same *boyerito* in attendance all day. After the driver got the cart into a lot, the boy would go like a *pepenador* among the loaders, gather cane tops no good for plantings, bring them back to the team, and feed them to the oxen. On the trips back and forth from the lot to the factory or station, he watched and listened to the beasts, and in the evening told the ox-boss if the driver had abused them. The other necessary support was bringing food to the workers out in the fields, who would eat there twice a day, customarily at around 8 a.m. and 1 p.m. The boys who brought the food, the *tlacualeros*, were usually harvest hands' sons. For every lot being cut on a particular day, there had better be enough of them at the barracks cooking area in the morning to pick up the *itacatadas*, the provisions of tortillas, beans, and coffee, carry them out to the lot in time for breakfast, take the empty baskets and vessels back down, and return in the afternoon with lunch.

But taking off the crop was not the only work happening in the fields. On most plantations in Veracruz then the cane stubble in 80-90% of the *suertes* cut would yield ratoons for next year's harvest, if soon given a clean chance to grow. And a *suerte* cut was not yet a lot cleaned. It lay littered with *tlazole*, field trash, leaves, rotten stalks, dried tops. If possible, the morning after cutting the last cane there, the cutters would heap trash in the middle of the *suerte*, retreat to the surrounding headlands, set fires to the trash along the lot's edges, and keep the flames unbroken and burning back into the middle, where rats and their predators retreated into a finally blazing doom.

This was also the season for plowing. On a small plantation the overseer himself would detail and supervise such work. On a big plantation a plowing boss was in charge. Six days a week in the morning dark at the corral, he made assignments of plow oxen, plows, and plowmen, typically residents, to the various grounds in need of one or another sort of breaking, and daily he rode the circuit to inspect and see where to make reassignments. Up and down the furrow in a recently burned lot a yoke of usually agreeable oxen pulled an *arado del país*, the primeval wooden share, beam, and handle, which a common plowman steered simply to pulverize the soil between the rows of stubble. The fallow or virgin land to plow might not be much, but it wanted three plowings: *el primer fierro*, “the first iron,” lengthwise; the *cruza*, diagonally across the lot; and the *segunda cruza*, on the other diagonal. In one of these lots a yoke of the plantation’s malevolent oxen drew an old wooden or a new iron plow, a favorite being the light American Avery No. 16, which a good plowman kept as clean and deep as he could, to turn the earth evenly up and over. The land so tilled, to boss studied its rises, slopes, and flats, and sighted and traced a line down the middle of the lot. There followed the furrowing, checked by the boss at least once a day. First down the main line, then as parallel as the land would allow on either side, plodded a yoke of the place’s oldest and most obedient oxen drawing a wooden plow guided by one of the place’s best plowmen, to mark the furrows four, five, or six feet apart. Not far behind plodded a similar but stronger yoke drawing an American plow set 12-14 inches up and guided by another of the best plowmen. And not far behind him plodded a yoke of the strongest and most obedient oxen [?] a weighted double-moldboard plow, e.g., *el zopilote*, “the vulture,” which opened a furrow two feet deep and 18 inches wide, in which, straining to hold the plow steady and true, trod a third excellent plowman. After furrowing, again according to the boss’s directions, the same or an identical trio plowed twice across the head of the low, about every 30 or 40 yards across its length, and once across the bottom, to make trenches for temporary drainage. Whatever the sort of plowing, the beasts, attended like cart oxen by *boyeritos*, plowed only half the day; the men went the whole day. Around noon a plowman unhitched the morning’s yoke, walked it back to the corral, took out a second, hitched it, and plowed on all afternoon.

And once a lot was plowed, the overseer had yet another necessary order. In compliance a foreman promptly brought a gang of laborers away from other work, and they covered the rows of stubble or planted tops in the new furrows and covered them.

Besides, on plantations with corn and bean plots, foremen sent resident old men to them for some days every month. The elders would pick the *temporal* corn and rainy-season beans in January, weed the corn again in February, weed it yet again and clear land for new plots in March, fold the corn stalks down in April, and burn the trash in the newly cleared lots in May.

The campaign in the factory was different, a drive indoors always at the same points to sustain and control high pressure and heat. From the first day of production to the last, the factory's chimney poured black smoke into the sky. Its whistles screamed signals not only for starting and stopping work, but also for accelerations, reductions, and emergencies. From 6 a.m. to 6 p.m. at least six days a week, barring breakdown, the houses sounded as if they would suddenly go into locomotion, or explode. On a big place in its heaviest weeks they would stay at full blast from 6 p.m. to 6 a.m. At night and from a distance the factory seemed even more powerful, its smoke in the starry sky a long black cloud rising east, its whistle silent except at midnight, but its scores of lights beaming through the night like an ocean liner's lamps in celebration or distress. Inside, the throbbing of the engines might well continue for 10 to 15 days and nights on end, until the manager ordered a halt to take stock. [Taking stock. Deerr, 562, AJWT, 25-27, and others.]

On these runs, to rotate mere human powers, supervision happened in watches and work in shifts of six hours. But a man's standard duty was three stints in succession, 18 hours in 24. With enough men from the fields taking turns on the shifts at night, the men regularly in the factory could by turns get a 12- instead of an 18-hour stretch as often as one day in four. There was, however, no day or night of rest for all. When every week or two the houses went silent for maybe a day and night, only machines stood idle and vessels empty; the men and boys in rotation for the shifts then worked them on maintenance, cleaning and putting things right to start again tomorrow.

The force for the work inside, skilled and unskilled, was mainly of residents. It comprised foremost the very men and boys who overhauled the equipment in dead time, secondarily as many resident and migrant peons as necessary for helpers and common labor. On a small plantation with an old-fashioned factory, all these men and boys might number no more than 25. And ordinarily all of them who were able would work six days in seven, taking turn to clean on Sunday. At San Cristóbal the regular force

was around 360, of whom, in rotations of around 90 from shift to shift during the peak of the season, around 270 were at work on every shift.

The several stages of manufacturing connected technically as the grinding, boiling, and distilling departments. To supervise them, the manager had three deputies, the engineer, a sugarmaster, and a stillman, each with an assistant. And like work in most other industries, cooperation within and between departments was largely a sequence of routines. But it was remarkably problematic where it involved concurrent responsibilities, where practical physics intersected with practical chemistry. The engineer watched wherever there were machines and pipes, so that his orders carried beyond his department into the sugarmaster's and the stillman's, which caused continual complications and confusion and frequent messes. Routinely organized or problematic, this work was hardest to direct and to do during the long runs of many days and nights, when through any 24 hours six supervisors might come and go, without a single trio staying together and keeping orders straight for more than one watch, while on any shift the quarter of the workers on their first six hours would be straining to wake up, some who had worked their first shift or two in one department would be working their second or third in another, and the quarter of the workers on their last stint, including the men who had spent 12 hours earlier in the field, would be falling asleep on their feet.

[Gay G. Luce, *Body Time*, (NY, 1971)]

The engineer (or his assistant) supervised most of the men and boys in the factory. At San Cristóbal in heavy weeks, day and night, 80 of the men in the grinding department (most if not all of them migrants) would be around the south entrance to the millhouse, carrying armfuls of cane from the shed to the mill-dock, fixing slings for a crane to lift loads from the cars to the dock, cleaning trash out of the cars, throwing cane, 30-35 tons an hour, from the dock onto the endless mechanical carrier. Back in the house another 40 workers, including boys, tended to the milling equipment. Alongside the clanking carrier from the open front of the house back to the carrier's upward slope several men and boys labored to spread and keep on board the slowly passing piles of cane. Toward the top of the carrier, in deafening noise, a man stepped on and off the slats in last efforts to even the feed. Below on the right and in a line back toward the north end of the house stood the three big, throbbing engines, rods plunging back and forth, flywheels cycling, spur wheels revolving in gear, pulleys spinning, belts whipping, and slapping. Beside each engine

on the right was an engineman, concentrating on gauges, valves, rhythms, and lubrication. From the carrier the cane slid back down a chute into the monstrous Krajewski crusher, whose two 26-inch, zigzag-toothed, slowly meshing rollers, powered by the first engine, took between them maybe 1,100 pounds of cane a minute, chewed the pieces into six-inch sticks, mashed them into a thick, juicy mat, and expelled it continuously back down another carrier. The crusher's operator could not worry then about its bedplate, headstock bolts, hoops, and keys. In the pounding, rumbling din he needed all his wits just to study the feed into the rollers, remember to oil the gudgeons, and not let oil into the carrier. A few feet straight behind the crusher stood the first mill, whose three 32-inch, slowly revolving rollers, powered by the second engine, took the juicy mat between them, squeezed it under 250 tons of pressure, and sent it flat but still wet backward up another carrier. Several yards to the rear stood the second mill, whose rollers, powered by the third engine, took the mat, squeezed it under 320 tons of pressure, and sent the moist bagasse backward up into the endless trash carrier. Engines pounding, mills moaning, the two millmen watched feed and rollers, listened to turnplate wails, smelled for heat in journals, oiled them again and again, and if they remembered, wiped away oil overflows. Underneath the mills raw, grayish-green juice, *guarapo*, streamed splashing and frothy into pans, as much as 5,600 gallons an hour, down through strainers, and into the subfloor tank open on the left side of the carrier between the machines. Spattered with juice and shreds of cane and pulp, stinking as sour as the air under the pans, a boy or two at each mill now and then scraped the coarse strainer and threw the scrapings back into the [?]. The trash carrier passed the bagasse back up to the horizontal conveyor, 20 feet above the floor and abutting on the right the feeding side of the big brick furnaces. On the conveyor's platform a couple of men with rakes saw that the openings of the chutes from the conveyor into the furnaces stayed open and that the bagasse slid evenly down them.

If anything stopped, therefore, everything else had to stop too. And the longer the run, the more intense the dread of a breakdown. Sometimes, if not for taking stock, the department would grind to a halt for reasons of planning, on deliberate orders and in calm. This happened, for instance, when the overseer advised the engineer to expect considerably more or less cane for a while: the men were ready when the engineer told them to idle engines and mills and clean them while he adjusted governors, shifted gears, and reset rollers. But more often a little thing went wrong without warning, there was a sickening noise, and

suddenly all hell broke loose. The man on the cane carrier fell through the slats. A tooth in a gear snapped. A carrier bolt lost in the cane lodged in the crusher. A turnplate, its wail wavering into a howl, splintered. Too much feed choked a mill, which if it did not crack a shaft or twist a crown wheel off, began screeching and pulling the engine up. A fine strainer clogged, the drain filled, and juice flooded out over the floor. The engineer then could only sound the alarm to quit power, try to contain his rage, and, mindful of the cane deteriorating in front and the furnaces cooling in back, get the repairs done as soon as possible. Replacing a carrier slat was a matter of minutes. But clearing a choked mill and engine could take hours. On old engines the engine-man would lift the eccentric rod out of gear and lever the slide valve through the few necessary revolutions in reverse. But on the new ones he and the millman had to pinch the actions back by hand.

In the same department, at the building's rear and off to the right, was the powerhouse. There the furnaces and boilers absorbed the energies of firemen, water tenders, ashmen, oilers, and helpers. And the generator and switchboard for the electric lights held the attention of an electrician. Throughout the building the cables and wiring gave worry to a lineman and his helpers.

Also the engineer's responsibility were the pumps and pumpmen everywhere on the plantation. Most notable was the juice pump. As fast as the *guarapo* streamed into the tank, where it would quickly ferment, it needed piping to the boiling department. In huge gulps the pump would take 90-95 gallons a minute, but it took constant care as well, frequent lubrication with just enough of the best oil, repeated adjustments of the plunger, continual tightening or loosening of the stuffing box. And even if maintained to a T, it sooner or later choked, which always caused an uproar. [I can't figure out the transitions in these next couple of sentences.]

In the boiling department at San Cristóbal in heavy weeks the sugarmaster supervised altogether around 50 men and boys. As in brewing, most of the operations were technically intermittent, continuous not in a steady flow, but by regular subtraction, completion, and reintegration of batches, which in working at capacity had to be very regular. At least the procedures were repetitious. At San Cristóbal the master's orders were almost always the same, to produce *azúcar centrifuga*, "centrifugal sugar," the kind called "96° test" in New York, "refining crystals" in London. At other modern sugar factories in the state, the orders

often changed from harvest to harvest, even during the season, to produce “white” or “[?]” or “[?],” which caused changes at every stage of the boiling process.

The first operation was defecation. In hot, sweet air up on a platform above and to the right of the mills sat 14 *defecadoras*, double-bottomed, iron-jacketed, 500- and 600-gallon copper vats, each fitted with steam inlet and outlet valves, feed pipe and valve, a plug pipe, and a two-way discharge valve. The 90-95 gallons of *guarapo* a minute that the pump below would send them would keep them all in use. And up there tending them would be several *defecadores*, men and the boys helping them. A defecation took about two hours: 15 minutes to fill the vat, add the milk of lime that the boys brought in buckets, stir the contents, and start the heat; another 30 minutes for the neutralized juice to heat almost to a boil and for the *cachaza*, the scum, to form on the surface and crack; 60-90 minutes for more scum to form and the *turbios*, the sediment or silt to settle to the bottom; and 15-30 minutes to drain the mud on way, drain the clear, olive-green juice another, shut the valve, pull the plug pipe, and wash the vat [“...great skill and care are necessary in this process,” and]. Two vats were usually plenty for one man. With only two to tend, he would ordinarily in the course of his first two hours on duty turn the right valves at the right moments for two fillings, two heatings, two shutoffs of heat, two discharges of mud, two of clear juice, and two washings, while he remembered to have lime ready, added the right amount, stirred the vats on heat, and with a copper sieve, a *cachacera*, skimmed the scum into its gutter—and go on more or less correctly through eight more courses of the same. But even so a sleepy man could easily turn the discharge valve the wrong way and let a long shot of mud down the pipe for clear juice.

This pipe led nearby on the platform to 10 *clarificadoras*, clarifying tanks. Iron rectangles of various proportions, with interior copper heating tubes, the tanks had inlet, outlet, feed, decanting, mud, and wash valves. At capacity, all 10 in use, they were tended by five men. The [warm] juice from defecation steadily filled one tank after another. A clarification took about 90 minutes. Continually through the day and night the man at a tank being filled, having turned its heat high, was watching for when to turn the juice off, the man at the tank last filled was stirring its juice, watching for it to boil, waiting to turn its heat down, another man was skimming one of the six tanks of hot juice at rest, another was [?] clarified juice or letting mud out of a tank, and the man at the tank next in line was washing it and watching for when to stop the water, close the drain, and turn the juice on.

At 90 gallons a minute or more the clarified juice ran down a pipe to feed the 10 Taylor filters on an intermediate platform below. Since the feed into the casings and the filtered discharge from them were continuous, the few men in attendance there regarded the valves only to make sure that they were duly open and not leaking. They worried mainly about the filter bags, how fast the residue still in the juice was clogging them. They could handle a change of bags every hour or so: close the dirty casing's valves, open its door, step into the dark, sour heat, detach from the nozzle plate and remove one by one 49 five-foot-long, hot, heavy, slimy bags, hang as many clean bags from the plate, close the door, and reopen the valves. If the clogging happened much faster, they could only call for helpers, send word to the master, and hope he vented his wrath upstairs.

The scum, sediment, and wash from defecation and clarification ran down their pipes into a hot tank on the ground floor. A man at the tank kept its contents stirred and periodically limed. Through a pipe from the tank a pump more or less steadily pulled the sludge and fed it to the eight Wright filters nearby on the floor. Each filter had an operator, who owed the apparatus "great attention." Starting, the man cranked the press shut, checked that the clean juice taps were all open, and opened the valve for the sludge to enter the chambers under around six tons of pressure. He watched the light brown juice pour from the taps into its gutter and away into a tank to be pumped back up into defecation. Soon, as the dirt caked in the chambers, the flow slowed. The man closed the sludge valve and the clean juice taps, opened the dirty juice taps, let a shot of steam into the chambers, stopped the steam, opened the water valve to maybe 18 tons of pressure, and watched the dark brown juice pour into its gutter and away into barrels. Shortly he reset the valves for more filtering. He might do one or two more flushings, but usually by about an hour and a half after starting, the cakes of dirt had so thickened that he increased the flow of the sludge and the pressure in the chambers to around 12 tons to make a fair flow of filtered juice. Finally, in maybe another half hour, when the cakes were an inch thick and the taps only trickled, he closed the sludge valve, cranked the press open, scraped the cakes off the plate cloths into a subfloor dump, reclosed the press, flushed it empty, reopened it, checked the cloths and replaced useless ones, and reset the taps to go again.

Whatever the attention due and paid, in defecation, clarification, or filtering, none of the men at these purifying routines reasonably bothered about the later consequences of his work. Only from an entire

shift of improper defecations, for example, would the master know for sure whom to cuss, and then not for several hours after the fact, when the results tormented workers elsewhere in the department.

On a platform 20 feet above and across the room from the filters stood the three enormous wood-cased vessels of the *triple efecto*, the triple-effect evaporator. The *guarapo* from the Taylor filters ran continuously down into a supply tank at the back of the room, from which it was pumped continuously up into the evaporator, where through the three connected cookers, vacuumized at three, 14, and 26 inches, it boiled continuously into *miel*, syrup. From [clear], warm, supposedly purified juice entering the first effect at 90 gallons a minute or more, dark, hot, supposedly purified syrup was pumped out of the third effect at 27 gallons a minute into a syrup tank below. On the platform around the vessels moved the *triplero*, the evaporator man. Ordinarily it was quiet up there, except for the faint sound of splashing and occasional vibrations from bad circulation in the heating tubes, especially in the third effect. The men went continually from vessel to vessel, peering through the peepholes to see if the splashing inside was too high, checking the steam gauge in the first vessel and the vacuum gauges in the second and third, gradually adjusting all juice and air valves if the liquid in any vessel boiled too high or low, now and then drawing a sample of the syrup from the third vessel's discharge for the master to read, reducing steam in the first vessel if the result proved too sweet, watching for leaks in any of the apparatus's 18 connections, and always in the back of his mind dreading a breakdown elsewhere or the rest every 10 or 15 days.

This was dreadful because it entailed boiling off the effect and cleaning them, which was more complicated than keeping them going. Ordered by the master to stop evaporation, the *triplero* let the pump empty the supply tank and the liquid boil down very low in all three vessels, then shut off the steam into the first, let steam into the second, opened wide the juice pipe between the first and second, closed the first vapor valve, and opened the first effect's air valve, which broke its vacuum and drew the juice from it into the second. While the first vessel emptied, he went down to the tank and filled it with water and sulphuric acid. As soon as the juice was out of the first effect, he closed the connection between it and the second, shut the first's air valve, turned the first vapor valve half-way in, and reopened the connection with the tank, to fill the first effect with the cleaning solution. The liquid in the second and third vessels having boiled very low again, he shut off steam into the second, opened wide the juice pipe between it and the third, turned the first vapor valve right in, and opened the second effect's air valve, drawing its juice into

the third. With the remaining liquid all in the third vessel and boiling, he closed the connection between it and the second, shut the second's air valve, and turned the first vapor valve out again, drawing cleaning fluid into the second effect. Before long the syrup in the third effect ceased boiling, whereupon the man let it be pumped out into the sugar tank below, shut the discharge valve, and reopened the connection with the second effected, to draw cleaning fluid into the third. With enough fluid in all three vessels, he left them to soak and went down and drained and cleaned the supply tank. After six or eight hours, he or the next man on duty drained the effects, opened their manholes, crawled inside the third, brushed its tubes, wiped them, refastened the door, and closed all connections, and so on with the second and the first.

Sooner or later he had to restart the apparatus, which was also complicated. When the supply tank began to refill with juice, he turned the first, third, fourth, sixth, and seventh juice valves wide open. Once the first vessel had its proper level of juice, he opened the steam valve and adjusted the first vapor valve to hold the first effect's level while the second received its juice, and once the second had its proper level, he adjusted the first and second vapor valves to hold the first and second levels while the third effect received its juice. The third level reached, he opened the connection to the pump enough to hold that level, closed the second juice valve, and used as much steam as possible without letting the first two effects boil or losing the necessary vacuum, until the syrup in the third was sufficiently sweet for the continuous flow and regular discharge below.

On the floor under the platform sat a syrup pump and three vacuum pumps. The first was among the most difficult in the house. The slightest thing wrong would defeat it: a tiny leak in the suction, air in the pipe, bits of scale in the valves. The three vacuum pumps, one for the triple effect, the others for the pans, rarely weakened, but when they did, the silence above broke into amazing curses and cries.

Forward on the platform, "like a ship's officer on the flying bridge," the sugarmaster (or his assistant) usually stood most of his watch. Up there he could see the men at the department's essential operations, hear reports of trouble, order general alterations to keep the several treatments of the material in balance and synchronized, and, facing around to the two *tachos al vacío*, the vacuum pans beside him on the platform, study the actual transformation of the syrup into sugar. No better than the brewmaster could explain the mysteries of the kettle, could this master explain the mysteries of the pan. But neither did he need to. He carried a saccharometer for reading densities, and from his "practical education" he knew the

art of granulation, the discipline of cultivating crystals, the moves to dissolve false grain, the tests for telling the *punto* or degree of the sugar, and the precise moment to *botar la templa*, “drop the strike.” Ordinarily he did not even do the work, only supervised it. Each pan had its own operator, the *tachero*, a skilled sugar boiler (who every 72 hours stood as the assistant for a six-hour watch).

Like the effects, the pans were enormous, wood-cased, cast-iron cookers. The dome of the one 12 feet in diameter towered nearly 20 feet above the platform. With steam inlets, valves, and outlets, both pans presented thermometers, steam-pressure and vacuum gages, thickly glassed windows, proofsticks, manholes, and valves for charging, discharging, breaking vacuum, and steaming and washing out, all of which promised only more evaporation. But the two vessels functioned separately, each with its own condenser and air pump slowly puffing below.

Work at the *tachos* was therefore cooking again, but intermittently, in batches. It had aspects of routine. The material to be cooked, the hot *miel* in the syrup tank, was by necessary if grudging presumption always of the proper purity. At both the 12-foot and eight-foot pans, unless orders changed, the aim was always the same: the boil the syrup *in vacuo* from its solution of half sweetness and half water into *masa cocia*, a magma of crystallised sugar and molasses. The practice was the same too: fine granulation, boiling molasses from previous batches into the one in the pan, and six hours to strike and clean. But every batch was inevitably different in some way, therefore a trial of the boiler’s craft. And in heavy weeks the boilers at both pans went on trial every six hours.

At the 12-foot pan, for example, having just cleaned and sealed the thing, the *tachero* would start a new batch by opening the connection with the condenser, having the pressure pumped down to prime, and turning the valve the draw the first, full charge of hot and supposedly purified *miel* from the syrup tank into the vessel. Son, through the low window, he saw the syrup cover the bottom coil. He let live steam into the coil, then admitted enough cold water into the condenser to hold a vigorous boil in a vacuum of say 26 inches. As the surface of the syrup rose and covered the second, third, fourth, fifth, and sixth coils, he let steam into them. In maybe 15 minutes he had the pan filled high, as much as 6,000 gallons of syrup boiling briskly at around 155°. He turned the charging valve off. With glances at the thermometer and gauges, he stood up to peer through the high window. For an hour or so he watched the syrup’s bubbling and splashing surface slowly sink. As the sixth, fifth, and fourth coils became visible under the surface, he

stopped their steam. The syrup boiled below the middle window. The man studied the drops spattering on the glass, how runny they were. After an hour and a half or more of boiling, he pulled the proofstick and felt the clear, auburn stickiness between his fingertips, not yet sticky enough. He licked his fingers, relocked the stick, and waited. In another few minutes he pulled the stick again, dabbed a forefinger and thumb, and saw the soft string between them break at about an inch long, nearer his forefinger than his thumb, and curl weakly up toward his finger. The syrup was still *bajo*, too thin to crystallize. In another few minutes he tested another sample, thicker, but still *bajo*. If this happened once or twice again, he would prepare himself for humiliation, call the master, blame bad defecation for the mess in the pan, swear that no trick could save such gummy crap from the molasses tank, and endure a masterly cussing for incompetence. But ordinarily on the next try, after maybe two hours of boiling, he got a string for a couple of inches, breaking nearing his thumb than his finger, and curling strongly back toward his finger, hanging like a little tough hook. This meant *de punto*, grain. For several minutes more he kept the ever more viscid syrup boiling and graining. Then from another sample he took a pinch and put it in the roof of his mouth. With his tongue he felt the crystals as tiny and numerous as usual. It was time to grow them.

Praying for good circulation in the pan, preparing himself again for humiliation, the boiler turned the valve for the second charge of syrup, nearly 1,500 gallons. As the boiling surface slowly recovered the fourth coil, he reopened the steam into it. Shortly he pulled the proofstick again and studied the look of the sample in the light: still clear, which meant that sugar was growing on the first charge's crystals. (If the sample had been murky, and another one or two the same, a boiler's dread, the sweetness in the pan would be making a second, false grain, which he could either dissolve, increasing the current in the condenser and turning the steam very high, or drawing an extra dose of syrup or even juice into the batch, either way slipping far behind schedule, or leave to foul the work of a man at the next stage—a choice between masterly cussing sooner or later.) Relieved for the moment, the man kept the charge slowly coming, meanwhile tested again and again for false grain, at the right level turned the charging off, watched for the coil to reappear, and stopped its steam again. He let the growth continue and close for maybe 40 minutes, until yet another sample showed him enough strength in its string and curl.

Then, as tensely as before, he turned the valve for the third charge, the last, 1,000 gallons of diluted molasses. Into the again recovered [fourth] coil he again reopened the steam. Again he tested for

false grain. Again relieved, he waited for the full batch to rise to its right level, turned off the charge, and let this growth continue and close. In maybe 10 minutes he got another strong string and curl. It was time to tighten the grain in the final concentration.

The man increased the [?] in the condenser, to [...]. For an hour and 15 or 20 minutes he watched and waited for the batch to boil down to usual finishing level, 4,000-4,100 gallons. From a sample of the magma toward the end he tried his penultimate test, *al agua*, throwing a wad into a bucket of water, picking it out, seeing if it would roll into a little smooth ball. Finally, if only to perfect his skill, he tested a ball *al diente*, between his teeth. He felt it firm, which meant a strike was ready. The master checked a sample in the saccharometer, “93° Brix.”

The boiler shut all the steam, turned off the water in the condenser, had the pump stopped, broke the pan’s vacuum, and wheeled open the big valve underneath for the clear, brown mass to ooze out below. At more than 12.5 pounds a gallon, the strike weighed around 25-26 tons. Discharge took maybe an hour and a half. As sugar crystals appeared on top and tried, the man bucketed the molasses through the manhole to keep the ooze going. Afterward he had only a few minutes to shoot steam into the vessel and wash it, before he was due to start again.

When both pans were in continual use, their boilers ordinarily had them on staggered schedules. The 12-foot pan would go empty, for instance, about the time the eight-foot pan began a final concentration. For an hour and a half every three hours then, after a strike of 25 tons or the smaller pan’s strike of maybe nine tons, a more or less gigantic load of hot, clear brown *masa cocida* would be sinking below the platform into one of a big, long, covered trough, the *mezclador*, a mixer.

From under the pans the mixer extended forward some 16 feet through a steel frame on a lower platform, where responsibility was the engineer’s. Before the additions in 1904, the frame held a battery of six, individually belt-driven, wrought-iron and steel *centrifugas*, each centrifugal’s basket 30 inches wide, 18 inches deep. These “curing” machines in operation clattered as if they would fly to pieces. (They would if rusted, under a running pressure of 120 lbs. an inch.) Backed against their back, facing the east wall, stood an identical frame, its mixer open to the first’s over a bucket elevator, its centrifugals also 30x18. When the master changed the boiling process to make “white sugar” or “muscovado,” the second battery served as “afterrunners” in the new technique (from Cuba) of “doublecuring.” But while the order

remained from “96° test,” it stood simply as a set of spares for any in the first battery idled for cleaning or repair, which happened frequently.

The *masa* in the mixer properly pure, finely but truly grained, hot, and wet, and all the first battery’s centrifugals in working condition, there would be three *centrifugeros*, each man to operate two adjacent machines. This was as much as anyone could handle. One cure typically took from eight to 10 minutes, several smooth maneuvers, and serious attention. A man doing two cures was forever back and forth from one machine to the other. Turning from the one clattering on the right at full speed (1200 rpm), he would start the one on the left up to quarter speed in about 30 seconds, then reach over it, lever open its mixer gate, watch for a couple of minutes as magma oozed into the clockwise-spinning basket’s fine copper screen for a full charge of 22-23 gallons, then shut the gate, run the machine up to third speed, brake the machine on the right to stop in about 30 second, accelerate the left one to half speed, raise the right one’s brass bell to discharge 125-130 pounds of warm, damp, fine, beige “raw sugar” onto the conveyor below, run the left one up to two-thirds speed, spend a minute scraping and brushing the few pounds of remaining sugar from the right one’s screen, accelerate the left one again, listen intently to it, rev it up to full speed, pray it held together, finish cleaning the right one, start it, and charge it, then stop the left one and discharge its 125-130 pounds, turning to run the right one up to third, half, two-thirds speed, then clean the leavings from the left one, but turn again to run the right one faster yet and again to full speed, as he finished cleaning the left one for its next start. In an hour, on the average at both centrifugals, he would have drawn 300 gallons of *masa* and produced 1,736 pounds of 96° test sugar. Constantly meanwhile the *mieles* or molasses expelled from the baskets, at all six machines almost 500 gallons an hour, drained into a gutter under the battery and through a pipe to the molasses tank against the north wall.

One bad strike, however, could make the most dutifully maintained centrifugals run for hours as if they were lead. At ordinary accelerations, false grain would choke the copper screen, sugar would pack around the sides, and the charge would only spin faster and faster, the *mieles* blocked from expulsion. The engineer, the master, and the *centrifugeros* damned boilers in general, maybe one or two in particular. The only way to save the crystals from the molasses was to cure the mess slow, at half speed, using all the machines if possible, or even at third speed, which if necessary for some hours would slow operations throughout the factory. In the peak of the season such a remedy would for some hours halt the entire line

of production. Too practical for that much waste, regardless of the master's objections, the engineer would have his men wash the mess straight from the mixer into the molasses gutter.

Endlessly the conveyor below the centrifugals carried the successive heaps of sugar around to the boiling room's east wall, and spilled them into a hopper. From the hopper rose an encased bucket elevator, which on heavy days lifted some 5,200 pounds an hour up through the wall into the quiet heat of the drying annex on the other side. Sugar made "white" after the additions of 1904 was dried in the annex's three belt-driven *granuladoras*, a misnomer for the big, long, inclined, slowly revolving, hot-air drums. When in 1909 "white" sugar was "cubed," the treatment was still more elaborate, including operation of the new Hersey machine. But 96° test passed through the room swiftly and simply. The buckets at their high swing down into the annex spilled the sugar into the top of a tall, baffled bin. Around its bottom moved several men. One was the foreman. Another, the filler, about every two and a half minutes raised the lever to open the bin's brass hopper and let barely dried and cooled, fine, beige sugar rush into a 40"x20" 100-kilo jute sack. A third man would take an empty sack from his helper, rest its sewn end on the filling platform, and hold it open under the hopper. Four more took turns in pairs pulling the 220-lb. sacks off the platform and standing them on a low wagon. Another man waited to pull the loaded wagon aside, roll an empty one into position, and haul the full sacks away to the annex's east door. There were a couple more men, one, the sewer, stitching with quick butt-seams a wagon of bags shut, the other waiting to haul them through the door into the sugar warehouse.

This two was a quiet room. There were no machines. The air was thin and warmer than outside; the master had the windows, high on the outer walls, opened for ventilation only during the dry hot winds before a Norther. The sacks of sugar lay in several 20-foot-square piles built apart from the walls and separated by aisles wide enough for the wagons to go by. As the room's foreman directed, depending on how many previous days' production remained, the newest piles were banked up maybe 10 or 15 rows high in the middle, each row laid perpendicular to that beneath. In heavy weeks day and night the men with the wagons brought 20-25 sacks an hour to stack. Daily the master checked the stock for the record, and looked at the older piles for hard sacks trickling the sweet brown drops that were the sign of deterioration and reason for more cussings. On and around the piles several men worked in pairs, some moving sacks

from a wagon to build a new pile, the other taking the oldest pile down, laying its sacks on a wagon, hauling them to the door outside. There a man stenciled San Cristóbal on each sack.

Unlike the sugar, the *mieles* were not a final product. The tank where they flowed, against the boiling department's north wall, was actually two holding tanks, in which an attendant treated them as raw material. Into one tank, the smaller, stronger, and higher, the pipe from the centrifugals issued. There also was a water inlet. The attendant kept the contents diluted to the right ooze. When both vacuum pans were in continual use, the level in the tank sank every three hours as the boilers had *mieles* pumped back up to [feed] and close the grain. From the small tank molasses overflowed into the big tank, where moreover laborers brought the barrels of muck cleaned from the Taylor filters and the dark brown juice flushed from the Wright filter, and dumped them. There from another water inlet the attendant kept the contents thin enough to run easily down a pipe through the wall. Sometimes the big tank filled high with the [pungent], sweet muck, and the master had the attendant drain the excess into barrels for feed for the oxen or shipment to distillers. But mainly these *mieles* were for distillation in San Cristóbal's own plant.

The distillery stood just beyond the north wall. Connected back to the powerhouse and the boiling department, it was otherwise practically a separate factory. Like a small brewery, three of its four rooms had vaulted ceilings, pipes and gutters back and forth, thick, white-washed walls, slightly slanted, tiled floors, and daily bright light streaming through high, narrow windows. One of these rooms featured machinery; the other two, big, wooden vessels. The *alcoholero*, a stillman, directed operations. Under him were 10-12 men.

Neither at San Cristóbal nor at any of the other modern plantations in Veracruz in the 1900's did the making of *mieles* into *aguardiente* involve distinctions of quality. The only questions were quantity and strength. Managers did not have orders for aroma or smoothness, and *alcoholeros* did not have the materials or the skill to render industrial volumes of superior rum, a Bacardi, a Jamaica, or a Martinique. Told to convert a certain amount of the daily (and nightly) available molasses into spirit of a certain degree, a stillman (or his assistant) put the distillery's capacities to the indicated use and looked to keep that flow going until further notice. Throughout the state during the campaign of 1906-7, again in 1909-10, the word on quantity was for as much as possible. San Cristóbal's 24-hour capacity was 150 barrels of 18-1/2 gallons at 30° Cartier, about 78% alcohol. In the heavy weeks this was actually the production.

The first room was the *casa de alambique*, the stillhouse, a three-story tower. It aired reeked of a stench like stinking feet. Sixteen times every 24 hours there, once every hour and a half, a man prepared a batch of *mieles* for the second room. From the central hot- and cold-water tanks he would run some 2,000 gallons of water into the nearly five-foot-high, 10-foot-in-diameter, cast-iron mechanical mixer on the ground floor. Then from the molasses tank he would pipe some 360 gallons of molasses into the mixer, mount its ladder, bucket two or three gallons of sulphuric acid over the top, add 20-25 pounds of sulphate of ammonia, climb down, and shift the belt for the machine to stir. Soon he would have a passable *mozto*, must or wort. He would then check through the north door, see a man signaling at an empty vat, go back and stop the mixer, turn on the pump beside it, and send the *mozto* up into a gutter and on its way. While the pump puffed, he would get acid and ammonia for the next batch. When the wort was gone, he would turn the pump off, rinse out the mixer, and clean and dry around it, until the time to mix again.

The second room was the *casa de fermentación*, the [?]house, a long, one-story extension north. It contained in three parallel rows, up to two-foot supports, 40-odd 3000-gallon oak vats, all but three or four of them covered, four-fifths of *mozto* fermenting into *mozto vivo* or *caldo*, literally “soup,” technically wine or wash. The air was sour. Around the bottom of the vats it was often too thick and putrid to breathe. Usually there were two men at work, vat tenders. About noon they would open the side windows for a brief ventilation. Diligently or not, they spent as much time as they could back and forth on the long ramps between the vats; when one went below, the other watched for him, to rescue him if he fainted. Every hour and a half, when the mixer had a batch of wort ready, one or the other man would climb down below a clean empty vat, shut its drain and outlet, scramble back on the ramp, clear and gutter out to the vat, signal ready to the man at the door, and witness that the batch ran into the vat. He would then tend to other vats, but, hearing the pump stop, come back and shut the newly filled vat’s lid. The proper fermentation was ordinarily complete in about 48 hours, from the initial swelling of the wort, through its increasing turbulence, bubbling, foaming, and heat, to subsidence, quietude, the fall of the foamy cap, cooling, and the sudden, amber transparency of the wash, typically 6-7% alcohol. In the morning and evening one man would hose the floor, the other with a bucket of soapy water, made the rounds of all the covered vats, peeking under the lids, feeling the heat in his face, looking for worrisomely high or violent ferment, into which he would dump some suds. More frequently, every two or three hours, both men would check the

vats full for 40 hours or more, sniffing the strength of the alcohol. A wash might fall early, or maybe 12 hours late. Wherever it fell, it wanted quick attention. Left in the vat, it rapidly fermented into vinegar, “the most to be avoided of all the accidents of fermentation.” Not so regularly therefore as they had to fill a vat, but usually from 12 to 20 times a day (and night), one or the other man would have a vat to empty. He would open its lid, climb down and open its outlet into the gutter to the wash well, scramble back on the ramp, and for a minute gaze at the slowly lowering surface before going off to another duty. The vat empty, he or his fellow would sooner or later return to it, open its drain, flush out the dregs, scrub the insides with him, and rinse the thing clean for the next filling. (Never mind the shameful trouble of cleaning a vat that had sat full of vinegar and putrefied for several hours.)

Back in the stillhouse another pump was puffing 24 hours a day, drawing *caldo* continuously from the wash well, 24 gallons a minute, up into a supply tank in the tower’s loft. Below the tank, in part on the ground floor, in part on a second-story platform stood the Dero *alambique y rectificador*, actually a Derosne continuous still adapted by Dero for rectification, with standard steam and cold-water connections. The room’s stink came from this apparatus, constantly accumulating the *colas* or tails of rectification, the essence of fetid. On the ground floor under the left side of the platform, as the stillman faced it, was the boiler, seven feet in diameter, eight feet high. From the center of its head the distilling and rectifying columns rose almost 15 feet higher, through the platform, and connected upward through wash and vapor pipes to the hot end of the horizontal condenser and wash heater. On the right side of the platform, to the right of the stairs up to it, stood the 10-foot-high cooler, connected upward through wash and vapor pipes to the cold end of the condenser. A pipe protruded from the cooler’s bottom forward over the edge of the platform beside the stairs. It ended in a proof glass, a big test tube holding a Cartier alcoholometer. Through the glass and the valve below it flowed nearly two gallons of *aguardiente* a minute, away through another pipe to the third room.

At the still during a heavy run the *alcoholero* ordinarily did not have much to do. For many hours at a stretch in the first several days the apparatus functioned automatically by a balance of gravity, conduction, and convection. With enough steam in the boiler’s coil and enough cold water coursing through the condenser and cooler, wash pouring continuous from the supply tank into the cooler would there gain a few degrees of heat, rise into the condenser, there gain more heat, stream down into the

column, spill down much stronger and hotter at each level through the plates into the *vinaza*, the alcoholic slop seething in the boiler, and alcoholic vapor would continuously swirl every stronger up through the column's plates, rush into the condenser's coil, there lose much heat and weak mist in condensation (which ran through the return pipe's first valve back into the column), carry its strong fumes down into the cooler's worm, there condense into rum, and stream down cold, limpid, and at the ordered strength of 30° Cartier through the proof glass and away. The stillman then would only watch for leaks and check the glass hourly, if it felt cold, the current through it looked as clear as water, and the alcoholometric bubble inside read 20, all expected, confirmed, and demonstrating how little he could usefully do. Not until scale collected on the condenser's coil, which lessened the heat from it, which brought more condensation in it, which diminished the flow through the worm and glass and there lowered the bubble, which as it went down showed a correspondingly higher degree of alcohol, did the man have reason to check the glass more often or adjustments to make. Seeing the bubble down to maybe 18, assuming the steady supply of wash, he would gradually let more steam into the boiler. Before long he would see the flow full again and the bubble back to 20. Soon, with too much heat for the condenser, he would find the glass warm, even steamy, the current tinted yellow, the bubble up to 21 or 22, and he would gradually reduce the steam. The adjustments would be necessary more and more often, but never continually and anyway within a narrow range.

The hard and ugly work happened between runs. Four days after the other departments suspended operations for maybe a day, three days after that run's last batches of wort went into the vats, two days after the men in the sweathouse began their periodic housecleaning, the day after the new run's first wort went into a vat, the wash well would go dry, and the stillman had a day to stop and clean the still. Seeing the well nearly dry, he opened the room's windows and took a deep breath. Every time the work was the same, and he did it as fast as he could, to rest a few hours in fresh air before starting again, but also carefully, not to cause damage or leave filth that would plague him on the next run. He stopped the wash pump, closed the pipe from the condenser to the column, turned off the steam in the boiler, opened its waste valve, and hosed the draining slop into the sewer. The boiler empty, he let the condenser's wash down into it, rigged a pipe from the cooler, and let its wash into the boiler too. The condenser and cooler empty, he reclosed their pipes to the column and boiler, rigged waste pipes on them, let cold water into the supply tank, and

gradually turned the steam back on in the boiler. In a couple of hours, the level of slop in the boiler and the degree of alcohol in the rum both sinking low, he increased the cold water through the cooler and condenser and opened the return pipe's second valve to keep as much strength as possible in the rum. Soon the bubble in the glass read 30, its maximum, i.e., rum only 50% alcohol. The stillman turned off the steam, let out the slop, removed the temporary waste pipes, reopened the condenser's pipe to the column, and let its hot water stream down over the plates, flushing most of the oils of rectification into the boiler and out into the sewer. Dizzy at the stench, he reclosed the condenser's pipe to the column, let the cooler's water into the boiler, reclosed that connection, and turned the steam on again, so that the steam from the water in the boiler carried the remaining oils out through the worm. This odor being unbearable, except by weeping, vomiting, and seeing double, he waited in one of the other rooms for it to pass. When he could come back, in maybe half an hour, he turned off the steam and left the apparatus to cool. Back again, he let the remaining water out of the boiler, removed the temporary connection from the cooler, removed the condenser's and cooler's covers, and scrubbed the scale off the coils. Finally he rinsed out the condenser and cooler and put their covers back on them, leaving the apparatus ready for tomorrow.

The next morning he restarted the still, a balancing trick more difficult than restarting the triple effect. He closed the waste valves, said a prayer against leaks, which could end in a "truly terrific" explosion, and turned on the pump for *caldo* to fill again the cooler and condenser and spill down the column. The boiler about three-quarters full, he stopped the flow from the supply tank, opened both return-pipe valves, and gradually turned on the steam. He soon heard the banging in the column as the wash's vapor rose, and soon after he smelled the coppery, resinous *cabezas* or heads circulating from the condenser back into the column. Thirty or 45 minutes later he closed the second return valve. Already he smelled the fetid tails. Maybe two hours later, when the hot side of the condenser was too hot for him to feel, he looked for the first flow of *aguardiente* through the glass. This might prove a disappointment. Too much steam for the wash in the boiler made the still prime, sending boiling wash and vapor along with the rum. Then the man would have to turn the steam down, gradually, wait and look for the change in the glass, maybe turn the steam up again, gradually, and so on, until the current was cold and clear and the bubble at 20. The rum flowing right, he reopened the supply tank and went back to the glass. If he soon saw priming again, he faced the maddening probability of a faulty pump and an indefinite delay in the

sufficient and steady supply of wash. If the bubble drifted up, he faced four other possibilities, one of them of the “terrific” kind: scale left on the coils, not enough steam, too much wash, or a hidden leak. He checked all visible joints in the apparatus. Finding no leak, which was no guarantee of none, he opened the boiler’s air valve a crack and lit a match under it. The air around it flamed: too much wash, easy to correct. The man closed the boiler tight. In another hour or two he had the pump, the supply tank, and the valve adjusted for the run’s production of the “powerful intoxicant which makes devils of men...”

The third room, where the pipe from the proof glass brought the rum, was next-door east. There in two rows up on supports in quiet, faintly fetid air sat six, 700-gallon, oak receiving tanks, their lids and outlet valves padlocked, although the locks usually hung unfastened. The stillman had the keys, and the sense to figure that if he did not bother to fasten the locks, he would not have the bother of unfastening them; he usually came only once a day, to collect the daily record of production. Around and between the tanks and their inlet and outlet pipes, watching always for leaks, worked the tank tender. Every six hours day and night during a heavy run he opened the inlet into an empty tank and closed the inlet into a full one. The pipes from the outlets joined a main pipe between the rows, which carried the rum from one full tank or another to the rows’ outer end, through a racking faucet, and into a hose. When every six hours a tank went empty, the tender lifted its lid, opened its drain, scrubbed, rinsed, and dried its insides, and reclosed the outlet and drain for the next filling. At the faucet and hose worked another man, continually filling the 18-1/2-gallon oak barrels, one every nine or 10 minutes, and keeping a count of how many he filled. He had three helpers, one who brought clean barrels from the yard, one who cleaned the barrels in the yard, and one who took the full barrels, bunged them, and rolled them away east to the fourth room.

This was the rum warehouse. Like the sugar warehouse, it was quiet, but with more ventilation through lower windows. The barrels stood on end in 25 or 30 short parallel rows from the inner toward the outer wall. It took two men to handle the barrels, each about 150 pounds. At an average of 150 barrels a day (and night) put in rows and 150 barrels a day (and night) moved from their rows to the door outside, the four men who did stints in the room through any 24 hours handled altogether around 45,000 pounds of rum and oak.

Shipping the sugar and rum happened separately from the factory, under the dispatcher-yardmaster’s direction. During *la zafra* Veracruz Railroad steamboats stopped by San Cristóbal’s pier

usually twice a day, one on the way up to Chacaltianguis, another on the way down to Alvarado. Daily a boss and his gang of 10 or 12 *cargadores* met an upriver boat, unloaded its deliveries of tools, parts and supplies onto a train, rode it up to the yard, unloaded its freight for storage later, loaded the train with 220-lb. sacks and 150-lb. barrels from the warehouses, rode back down to the pier, and unloaded the shipment onto the downriver boat. In peak weeks this movement averaged 85 tons a day.

[The next section supposedly goes as insert on pg. 26...where exactly?]

All plantations in *zafra* daily required one more tremendously detailed, continual, manual operation, cooking. This too was odd about the sugar industry: whereas most other industrial workers, in production the year round, usually ate food that family cooks prepared, most workers in the sugar harvest, migrants concentrated for the campaign in the largest isolated congregations in the state, the smallest such group being larger than any garrison, prison, or school (or full hotel), ate rations that mess or camp cooks put out in commissary volume. The tens of skilled men on a place for only the harvest took their meals in a hall where the manager's *cocinero*, the kitchen steward, had a few cooks at stoves and serving day and night. But the scores or hundreds of the unskilled, coming from afar and in gangs, depended on separate, diverse, altogether regiment-sized arrangements. [There's a note in the margin here as well.] Some gangs dealt with resident families able to commit a member entirely to cooking for them every day for three or four months. Most brought their own cooking equipment and cooks, members of their families committed to feeding kith as well as kin.

The rations for migrant laborers including no surprises for the cooks. From a weekly market outside the plantation, from the plantation's general store, or directly from its storage bins, the staples were the basics everywhere in Mexico, corn, beans, chile, salt, sugar, and coffee, occasionally rice, maybe once a week beef. The cooking area was not one but many kitchens, typically located in front of the migrant barracks and typically *de humo*, "made of smoke," barely more than brush [arbors]. In such a kitchen the equipment consisted of the sort of implements and utensils used in central and southern Mexico since long before the Conquest, most still called by Nahuatl names. There was no stove, only three *tenamastes*, stones, whose triangle made one *tlecuil*, a hearth, in which not charcoal but wood burned. The pots were four *ollas*, molded, earthenware jars, the biggest of them the *nixcomil*, for cooking and soaking the *nixtamal*, corn kernels in milk of lime, two others for cooking beans, and one for coffee. Of molded clay

like them were two other jars, a big one, the *tinaja*, for water, a little one for *tenejales*, lime, and a *cedazo*, a colander. On the ground beside the *tlecuil* stood a *metate*, the three-legged, andesite grinding stone, about 15 inches long, 10 or 12 inches wide, with its *metlapil* or *mano*, the four-sided andesite rubbing stone, for grinding the *nixtamal* into *masa*, the dough for tortillas. On the ground by the *metate* sat the *batea*, a low wooden tray, and the *apaste*, a low, round, clay bowl, for the *machigiüs*, the water to wet the dough. If on the hearth there was no pot, there was the *comal*, the circular earthenware griddle, 18 inches in diameter, on which the tortillas toasted. Nearby stood the three-legged *molcajete*, the andesite mortar, with its *tejolote*, or pestle, for grinding chile into *salsa*. Also at hand were a few *jícaras*, round gourd bowls for salt and sugar, a clay spoon or two, some *tecomates*, gourd scoops and drinking cups, and the *tezcales*, *chiquihuites*, and *tOMPIATES*, the baskets for storing the food and carrying the *itacatadas* away to gangs.

Residents or migrants, in the mess hall or the camps, all the cooks were women. The men who received the *itacatadas* might make little fires and reheat the tortillas and beans. But only women could produce the food. As workers they bore no special name *de oficio*, not *cocinera*, not even *tezqui* (miller) or *tortillera*. They were simply *las mujeres*, “the women.” At home this meant skill in cooking and in several other arts and crafts, all of which a reputable woman could practice as satisfactorily as a reputable craftsman would practice his one trade. In harvest, however, the cooks worked only at cooking. And at that they forgot about artful elaborations. Trained by their mothers from the age of eight or nine, as soon as they had lost the fear of lifting a hot *comal*, they knew mysteries from *atoles* to *moles* to *zoallis*. But their duties on campaign were few and crude, mainly, every day, to grind *nixtamal* into *masa* and make tortillas as fast as they could.

To feed San Cristóbal’s concentration of some 900 migrant hands, for example, there were some 90 cooks. The amounts they daily prepared for the men and boys in the gangs, for themselves, and for the children with them, were individually short but collectively a carload: about 1,000 pounds of shelled corn, 500 pounds of dry black beans, 60 pounds of chile, 20 pounds of coffee beans, 12 pounds of salt, 15 pounds of lime, and 50 pounds of sugar (not counting the occasional rice or the exceptional meat). These ingredients the women worked around 18 hours a day, with firewood the children brought and altogether maybe 900 gallons of water for cooking and washing, to make into a thousand *desayunos*, *almuerzos*, and *cenás*, breakfasts, lunches, and suppers.

They all followed practically the same schedule. Typically a cook started the day at three in the morning, when she awoke, lifted the big, heavy pot of *nixtamal* off the dead hearth, and kindled a fire. As the flame flickered and acrid smoke drifted into the night, she dumped a gourd of clean beans, a couple of pounds, into their pot, poured a gallon and a half of water over them, partly covered the pot, and put it on the fire for *frijoles parados*, no lard, no spice. Then she took a scoop of coffee beans from their sack, knelt behind the *metate*, ground three or four ounces, put the grind in the coffee pot, set it aside, and rinsed the *metate*. Returning to the *nixtamal*, she reached down into the big pot, squeezed the hulls off pound after pound of the soft, swollen kernels, took up heaping, double-handfuls of the skinned, soaked seed, let the *nexayote*, the mother liquor, run through her fingers back into the pot, and dumped the heaps into the colander. When she felt enough *nixtamal* in the colander, about six and a half pounds, she poured water over it once or twice, to wash away the lye, and set the [*bates*] in front of the *metate* and the colander and the bowl of *machigüis*, about a pint, beside it. From around 4 a.m., on her knees behind the stone, she milled with the *metlapil* as steadily as she could to around 6 a.m. (Once, at around 5:30, she got up to throw a spoonful of salt into the beans.) Handful after handful of the *nixtamal* from the colander she put onto the stone and ground into *masa martajada*, rough dough, which she piled on one end of the tray in front. When she had emptied the colander, she took handfuls of the rough dough onto the stone, sprinkled *machigüis* on them, and ground them into *masa repasada*, smooth dough, which she piled on the other end of the tray. Having ground most of the smooth dough by around 6, she stopped to pour five or six pints of water into the coffee pot, drop eight or 10 ounces of sugar into it, remove the pot of by then done beans from the fire, and put the coffee pot on. Back at the *metate*, she had the whole pile of *masa* finished before 6:30, about seven and a half pounds. Then she rinsed the *metate* and *metlapil* with *machigüis*, took coffee of the fire, made sure the hearth's hottest coals were in the center, balanced the *comal* over them, sprinkled *nexayote* on it, let the griddle heat and dry, and knelt down by it to *echar* or "throw" the tortillas. From the pile of whitish, soft, damp *masa* on the tray beside her she took a wad (about 50 grams), rolled it in her hands into a *testal*, a little ball, flattened it between her palms, patted it back and forth in her hands into a thin cake about five or six inches in diameter, laid it flat toward the edge of the griddle, took another wad, rolled it into a *testal*, and so on for the second cake. When the first tortilla had been sizzling on the griddle around 30 seconds, sending the smell of parched corn into the air, she took it by an edge and flipped it *al*

revés, face down on the shimmering heat toward the griddle's center. Then she gave the second cake its last pats, and laid it toward the edge. When it had been on the griddle about 30 seconds, she flipped it *al revés* toward the center, gave the third its last pats, and laid it toward the edge. A few seconds after she flipped the third toward the center, about when she had the fourth cake ready, 80 or 85 seconds after the first had gone face down, she saw its top side begin to swell and blister and its edges lightly curl, and she slipped it *al derecho*, face up again, and saw that it had cooked as it should have to a yellowish buff. She added the fourth cake toward the edge. About 30 seconds later, flipping the fourth *al revés*, she saw the first rising slightly on the griddle like a soft, five- or six-inch corn lense. She picked it off, laid it in a cloth-lined *tazcal*, covered it, rolled a ball for its replacement on the griddle, and looked to flip the second *al derecho*. So with good *masa*, hot, centered coals, a *comal* that did not stick, and no interruptions, she had 65 or 70 tortillas warmly wrapped in stacks in their baskets by 7:30. In a few minutes then she put the bean pot, the coffee pot, and 60 tortillas securely in a big basket, to make the *itacatada* that a *tlacualero* was waiting to carry away. Breakfast for the men and boys done, she had less than an hour to wash the dirty implements, eat her breakfast, maybe feed a child, and sift beans from the sack, from hand to hand, clean into the gourd for the next meal.

By 8:30 she had the second pot of beans for *frijoles parados* on the fire. Then at the *molcajete* she ground five or six ounces of chile in a couple of cups of water for *salsa*. By 9 she returned again to the *nixtamal*. Another six and a half pounds she skinned and heaped into the colander, washed, and for two hours ground into rough, smooth, and soft dough. By 11:30 she had the beans done and another seven and a half pounds of *masa* finished, which by 12:30 she had rolled, patted, flipped, and cooked into 65 or 70 tortillas, to make the second *itacatada* for the *tlacualero* to carry away. Lunch for the men and boys done, she had again less than an hour to wash, eat her lunch, and maybe feed a child. This left her an hour to go for supplies, a sack of corn or beans, a jar of water, and borrow another bean pot if the *tlacualero* had not brought the first one back. By 2:30 she was sifting the beans again for the next meal.

By 3 in the afternoon she had the day's third pot of *frijoles parados* on the fire. After grinding another bowl of *salsa* and washing the last six and a half pounds of *nixtamal*, she ground *masa* again from 4 to 6, took off the beans, and made another 65 or 70 tortillas for supper, which she served at the kitchen while she ate between 7 and 8 p.m.

Then she washed the *ollas*, rinsed the *metate*, threw out the *machigüis*, fed the fire, and prepared the *nixtamal* for tomorrow. From the sack of corn she scooped into the big clay pot the amount she knew from experience she would need, about eleven pounds and a bit. Over the corn she poured enough water to weigh twice that much (about 2.7 gallons), and from the jar of *tenejales* she added a fistful of lime (2.5-3 ounces). She checked the fire: if the corn cooked too fast, the dough tomorrow would be *arreatada*, scorched; if it boiled, worse, the dough would be *chiclosa*, gummy, sticking to her fingers and the griddle; and if it cooked at heat too low, just as bad, a dough that had no *correa*, malleability, cohesion, endurance. The fire right, she stirred the mixture and set the heavy pot on the stones. She sifted the beans for the morning. After the corn had cooked maybe half an hour, she killed the fire, and lay down to sleep.