Technology, Work, and Strategic Positions in the Oil Industry in Mexico: "Development," 1908-1910

For the last 200 years what has principally defined modern industry as industrial is not its motive force or product, but the timed complexity of its production. Examined externally, purely in production, not sociologically, but industrially, as if by an engineer, a modern industry operates in national or even international articulation with other industries, some of which supply it means of production, others of which take its products, also as means of production, or as finished goods or services; it is an integrated part in an extensive, complex industrial division of labor. Examined internally, again purely in production, as if by an engineer, an industrial plant or system of delivery features an articulation of specialized departments, an integration of synchronic or diachronic or variously both synchronic and diachronic operations, a intensive, complex technical division of labor. In any specific period of industrial development some industries are strategic (more or less strategic), in the sense that on their production depends the production of many others, so that if they stop producing, many others have to stop producing too; continually among the most strategic industries have been fuel (energy) and transportation. Moreover, in most industrial plants or systems, according to their specific technology, certain departments and certain positions at work, certain jobs, have been strategic (more or less so), in the sense that on the work that happens there depends the work in several other departments and at many other jobs, so that if they stop, the entire plant or operation has to shut down. Typical strategic departments have been the power house, or engine room, and the repair shops, or maintenance. But strategic positions have never been only skilled positions; the work there may require no skill.

In short, workers in these strategic positions hold power to disrupt production, technically, in a plant or transporting operation, then maybe industrially as well, across an economy, even between economies, among them. (Of course other workers may because of their work hold different sorts of strategic positions, in the market, or quite apart from production or the market, regardless of work, hold strategic positions in politics, or socially or culturally.)

The first to explain the concept of strategic positions in production, industrially and technically strategic positions, was a great U.S. labor economist, John T. Dunlop (1914-2003). His conscious theoretical sources were evidently Marshall, the Webbs, and John R. Commons. But most influential in the formation of his ideas was his experience as director of research at the U.S. National War Labor Board from 1943 to 1945, when his researchers had to find the positions most strategic to U.S. production, in order to do everything possible to secure them for production, to preserve (or increase) U.S. economic and military strength through World War II. Dunlop first clarified the concept for students of U.S. labor history, in a kind of materialist explanation of early, independent unionization. As he phrased it then, most simply, "unionization….is to be explained in terms of the position of workers both in a market system [not necessarily in the market, but in any industrial economy] and in relation to a technological process. The combined strategic power of groups has varied widely. Some workers have been able to close an entire plant, or to inflict great loss, by possession of a scarce skill, by reason of their location [requiring skills or not] in the flow of operations, or because of their control [skilled or not] over perishable materials or product. Thus loom fixers in weaving, teamsters who deliver materials or finished goods, cutters in clothing, and those who soak hides in the leather trade all occupy extremely advantageous positions simply by virtue of technology. Other workers have strong bargaining power as a consequence of location in a market [or any industrial] structure…at the expense of other factors…or…in the product markets… The bargaining power of wage earners depends upon their strategic position in dealing with the firm, and the strategic position of the firm depends in turn upon its dealings with the rest of the market [or industrial] mechanism."[1]

In other words, abstractly, here is the argument from labor's perspective: Through the study of an economy's productive system, its modern industrial division of labor, strategically

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[1] John T. Dunlop, "The Changing Status of Labor," in Harold F. Williamson, ed., *The Growth of the American Economy: An Introduction to the Economic History of the United States* (New York: Prentice-Hall, 1944), 609-610, 621.

minded labor leaders can understand which industries are highly, nationally (even internationally) strategic, which are no more than regionally or provincially strategic, and which are only locally so, or not at all. Through the study of an industry's various plants or systems of delivery they can understand which of them offer most strategic opportunities, e.g., those that can best pass increased costs for labor to the purchasers (or recipients) of their products. Through the study of an industrial plant's or system's work, its technical division of labor, or technical (or material) relations of production, they can understand which departments have the strongest strategic positions, and which workers, skilled or not, can interrupt most operations to try to change the social relations of production, only for themselves, or also for their fellows in the same plant (or system), or also for workers elsewhere in the industry, or even for all workers in that economy, or even (conceivably) for the workers of the world. Here is the (abstract) argument vice versa: As soon as an industrial plant's (or system's) operation begins, given its means of production, given therefore its technical division of labor, technological structures of dependence among workers take hold, structures vertical as well as horizontal, structures in which some workers (skilled or not) have many other workers dependent on them. "…work communities [not towns or neighborhoods, but groups of people at work, in particular places or on the move], prior to formal organization, are not simply random aggregates of individual workmen. …informal coagulations exist. ...informal organization."[2] It is the technologically located positions from which some workers can "stop a great number" of others that make the organization. It is the workers strong in this organization, holding technically strategic advantages, who decide whether, when, and how they and their fellow workers make the organization (more or less) a racket or a union, and how they use it to deal or to contend with the officials responsible for the plant (or system). It is the unions in the plants (or systems) strategic to the industry that decide whether, when, and how they and other unions in the industry federate, amalgamate, or unite in an industrial union, and contend with the industry's official association. And it is the federations, amalgamations, or unions in the most strategic industries that decide whether, when, and how they and other federations,

[2] Idem, "The Development of Labor Organization: A Theoretical Framework," in Richard A. Lester and Joseph Shister, eds., *Insights into Labor Issues* (New York: Macmillan, 1948), 178-179; John T. Dunlop, *Industrial Relations Systems* (New York: Holt, 1958), 9-10.

amalgamations, and unions confederate or ally, and contend with the country's capitalists or (once upon a time) socialist authorities. In short, unless we understand industrial work, we misunderstand modern class struggles, for the structure of this work frames the industrial working class's basic organization, therefore also changes it, orients its movement, and gives the material vectors of its strategy.[3]

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The technology of the oil industry in Mexico between 1900 and 1910 came from the industry in other countries. For the first of the industry's then four designated phases, "production," it came almost entirely from the United States, as invented or contrived in Pennsylvania and later adapted in California, Texas, and Oklahoma. For the second then designated phase, "transportation," by land, inland waters, or sea, its source was almost entirely the United States, as Standard Oil had first defined it there; the exception was Águila's 21,000-barrel tanker, the British-built steel single-screw steam schooner, the *San Cristóbal*. And in the third and fourth phases, "manufacturing and marketing," again the source was almost entirely the United States, the only notable exceptions being at S. Pearson & Son/Águila's refinery, German Diesel generators for power and Russian Nobel continuous distillation.

After work on the railroads and at Mexico's principal port, work at the oil industry's technologies was by 1910 the third most strategic collective human exertion in the state of Veracruz. It mattered even worldwide that year for its great discoveries and production. Nationally it was already significant for the fuel it provided the country's main railroads and the profits it promised enormous companies with formidable investments in oil lands, concessions, leases, and installations. Like work on the railroads or at the ports, it therefore seriously concerned the federal government. And as the boom carried from the fields to town, it interested the state government and some newly prominent municipalities. This was what measured and explained its strategic importance: the economic and political disruption that stopping it would cause.

[3] Karl Marx, "Das Kapital: Kritik der politischen Oekonomie [1867, 4th ed., 1890]," in Karl Marx and Friedrich Engels, *Werke*, 43 vols. (Berlin: Dietz, 1957-90), XXIII, 790-791.

Since the industry already embraced “production, transportation, manufacture and marketing,” it involved (like, e.g., sugar) several quite different processes. In the few departments that the oil companies had as yet organized, “exploration,” “fields,” “engineering,” “sales,” the chiefs and superintendents each managed some similar but many different tasks and operations. Technically then the work happened through at least a dozen different divisions of labor. Production, for instance, which consisted of “exploration” and some of the “fields” and “engineering” work, included at least six divisions, four of them in different sorts of construction, building drilling rigs, roads, railroads, and pipelines. The subdivisions numbered in the scores.

The work also happened in many different kinds of places. The two “oil regions” where the companies had the grandest properties and privileges were expanses so vast that they “can only be estimated roughly....” The Tampico region, “the coastal plain between the Rio Soto La Marina and the vicinity of Jalapa....bounded on the East by the Gulf of Mexico and on the South-west and North-east [sic, for North -west] by the front of the great central plateau....comprises, roughly, an area of about 1,700 square miles.” The Isthmus, “the basin of the San Juan, Coatzacoalcos, and Tancochapa Rivers,” amounted to some 6,000 square miles. Neither region contained many towns or villages. Both were largely wild country, savannah, swamp, jungle, famously but erratically marked by “numerous exudations of petroleum...from small seepages a few inches in diameter to asphalt lakes....” Exploration occurred in erratic movements through these wilds and in indefinite tasks at locations in unpredictable places in them. The “oil fields,” where exploration had succeeded and the work was “development,” i.e., construction and indefinite extraction, were places only a few square miles in extent, far from any town, reachable only by wagon roads or company railroads, and as different from one another as battlefields. Transportation of oil occurred variously inside and outside the regions, at pumping stations for the pipelines from the fields to terminals near the coast, along right of ways between fields, pumping stations, and terminals, on launches and barges back and forth along rivers and across lagoons between the fields and towns and terminals, and on tank steamers and barges back and forth across the open sea of the Gulf. Manufacturing in Veracruz took place at two quite differently established refineries on the outskirts of two quite different towns, the port of Veracruz and the Coatzacoalcos River town of

Minatitlán. The agencies for distribution in the state were in four other very different towns, near the coast 50-odd miles north of Veracruz in Gutiérrez Zamora and upcountry in Jalapa, Córdoba, and Orizaba.

In none of these places, except on wagon roads in the summer, did work vary by season. Through the rainy and the dry months, it continued as constantly as the surface of the earth indicated deposits of oil below, good luck led to discoveries, and workers could capture oil, render it useful, and deliver it. The days of work were ordinarily therefore six or seven a week; the hours, all the hours possible.

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Depending on the structure and pressure of the oil market the strategic importance of different operations in the industry varied. In the United States then, typically, the fragmentation of the power (property, leases, courts, police) to produce crude oil and the tremendous concentration of control over transportation, refining, and distributing finished products combined to make the work of "exploration" and "development"--the shift from exploratory success into full production--technically most open to disruption, and left the work of transportation and refining technically least open to it. Once exploration reached the stage of drilling a lease, the work proceeded as fast and almost as secretly as possible, which is why U.S. oil trade journals called these holes "mysteries," because the businessmen behind the mysteries, who whispered them to the press, wanted to hide their substance as long as they could. If the drilling gave dry holes, but nobody else knew, the businessmen behind it might still get good money for their local leases from yet wilder speculators. If it gave an oil well, and a rival scout or the neighbors found out, the businessmen backing it would lose their chance to monopolize local leases on the cheap, instead have to pay higher royalties, and face immediate, fierce competition from other businessmen racing to drill maybe only 50 yards away. Once a boom started, it was dog-eat-dog in every patch in the field. Consequently the most effective unions in the U.S. oil industry then were of drilling-rig carpenters, who could make or break a mystery, but typically only a local business. On the other hand, since in the industrial United States one company ruled pipelines, refineries, barges, tankers, courts, and police, the work that was industrially of terrific strategic importance was technically (and politically) the hardest to stop, and no union of these workers was effective until after World War II.

In Mexico, in contrast, the concentration of the power to produce crude was greater by 1910 than the concentration of control over transportation, refining, and distribution. Only three sets of interests there were producing crude then, Edward L. Doheny's Mexican Petroleum and Pennsylvania Oil companies, Weetman Dickinson Pearson's S. Pearson & Son and El Águila, S.A., and Percy N. Furber's Oil Fields of Mexico Company; and the second set took all the third's production. Since 1900 Doheny's companies had come to hold vast, continuously extensive tracts of land in private property and hundreds of mostly contiguous leases on other properties; so had Pearson's companies, which also held vast tracts in federal concessions (as well as the contract on Oil Fields of Mexico's crude). From 1900 to 1908 the main battles between the Doheny- and the Pearson-led interests had been political and legal, over concessions (tax exemptions, drilling rights, etc.) and public and private contracts. For the oil industry in Mexico in those years the most strategic positions were therefore in the federal government, particularly in the Ministry of Hacienda and in Congress. In a brutal, but still cautious rivalry between two big, mutually exclusive, geographically distant sets of interests, the mystery of exploration was much easier to maintain, and no manager had reason to fear his rig-building crews. Greater than either the Doheny or the Pearson interests, however, greater than both together, the greatest power in the industry worldwide, was Standard Oil, not producing crude in Mexico, but transporting its own from New Jersey and (since 1905) Mexican Petroleum's from Tampico to an old subsidiary, the Waters-Pierce Oil Company, whose refineries in Mexico City and Veracruz refined and distributed its products in Mexico, including fuel for the biggest transport company in the country, the Standard-backed, Pierce-owned Mexican Central Railroad. This situation changed in 1908, when Hacienda Minister José Limantour merged the Mexican Central into the new Ferrocarriles Nacionales, S.A., most of the stock of which the Mexican government owned. Fierce conflict began then between Standard-Pierce-Doheny and Pearson/Águila to monopolize Mexico's oil market, particularly the supply of fuel to railroads across the country. The more contentious the conflict turned in 1909-1910, “the most spectacular oil war in the history of the world [provincial hubris],” the more strategic was the work necessary for establishing the supply, “development.”

The development of an oil field began with the construction of a pipeline to carry the crude oil off to use. Like logistics in (real) war or building railroads, this happened on order, out in the open, over long distances, and all in broad daylight. It was episodic, multifarious, coordinated, and dangerous work, largely by gangs and crews of laborers. Moreover, since it proceeded to make connections between distinctly different places, its sites continually changed along the chosen way. In particular, building a pipeline meant arranging an entire “spread,” mobilizing a force of 200-500 men, and constructing a system not only of roads but also of telegraph or telephone lines, gathering lines, field storage tanks, pumping stations, and terminal storage tanks as well as one trunk or main line. Most peculiarly, it was both unpredictable and urgent: any newly discovered field then wanted a pipeline as soon as possible. Speed of construction depended on terrain, weather, supplies, experience, but mainly on the size of the force at work. The general measure of progress was lengthwise, the number of joints or feet of pipe laid per “laying gang” per day, excellent progress being 250 joints of eight-inch pipe, a mile a day, fair being half that. The industry’s latest record was for the Gulf Pipe Line Co., between Watkins Station, Oklahoma, and Sour Lake, Texas. Beginning in February, 1907, a force that would grow to 1,500 men, including at one time nine laying gangs, had ready to run by August that year, in only six months, six stations, 56 tanks, and the complete eight-inch trunk line 419 miles long.

The three crude-oil pipelines in Mexico by 1910, all in Veracruz, were much smaller and (although no less urgently needed) for various reasons more slowly constructed. Built before the “oil war” began, the first and smallest was Pearson’s in the Isthmus, for 10,000 barrels a day from its San Cristóbal field to its experimental refinery in Minatitlán. A force of some 120 men took from March to November, 1906, to make a 2-1/2-mile standard-gauge railroad from a landing on the nearest navigable river to San Cristóbal, a parallel water system, telephone lines along the same way and from San Cristóbal to Minatitlán, field tanks, gathering lines, a mahogany pumping station with a 350-h.p. boiler, a Worthington 16x25x7x24 pump, and 42,000-barrel steel working tanks, one 42,000-barrel storage tank at the refinery, and the six-inch main line 14-1/2 miles long.

The second and most difficult construction was Pearson's for Oil Fields of Mexico, to connect the Furbero field, in the hills west of Papantla, with a point on the coast. Imagined in December, 1907, to go southeast to a terminal at Tecolutla or Nautla, it became a definite project in March, 1908, for 14,000 barrels a day to go northeast to the right bank of the Tuxpan River, across from Tuxpan town. And in June, 1908, in the rain, gangs at the Cobos terminal began working on a 56-mile narrow-gauge railroad and six-inch pipeline planned for completion by March, 1909. Eventually imported into the force were some "300 labourers from Cuba." In the heat of the "oil war" the work neared completion that summer. Then it went to ruin in the hurricane of August 26, 1909. The reconstruction, begun in September and complete by January 1910, included the railroad and telephone lines, three bridges, field tanks, gathering lines, an initial pumping station with two 200-h.p. boilers, two Worthington 16x25x18 pumps, and 42,000-barrel working tanks, an identical station and tanks about midway, and the main line, except that its terminal was no longer at Cobos. The pipe went another 7-1/2 miles under the river, "nearly as broad here as the Hudson," and down to Tuxpan Bar. In new construction there were another powerful station, two 55,000-barrel storage tanks, and most remarkably, more than a mile out into the Gulf, a six-inch submarine line, projected to end some 30 feet under water in a universal joint and a flexible tube, this to be chained to a buoy on the surface, where it could be hauled up for leading anchored tankers. Then in a Norther the submarine line disappeared. Reconstruction resulted by March, 1910, in two six-inch lines, one 3,608 feet and the other 3,150 feet long some 40 feet below high water, each jointed to a 120-foot armored hose chained to a buoy.

The longest, most urgently needed, and fastest-constructed pipeline was Standard-Doheny's Huasteca Petroleum line, to move 30,000 barrels a day from its Juan Casiano field north to the right bank of the Pánuco River across from Tampico. In October, 1909, while Juan Casiano's first wells flowed into ground tanks in the field, gangs at the projected terminal (three miles south of the Pánuco) began work behind the west bank of the new Chijol Canal and along the west shore of Tamiahua Lagoon for a 65-mile eight-inch line. Without roads along the canal or the lagoon, supplied from Tampico by barges, a force of hundreds had built by February, 1910, a 55,000-barrel storage tank in the field, two 40,000-barrel storage tanks at the newly named

Terminal, and the line about 40 miles southward. Problems in securing right of way through 7-1/2 miles farther south along the lagoon stopped the line's direct extension. Instead gangs and crews of altogether some 1,200 men concentrated on gathering lines, pumping stations, another 55,000-barrel storage in the field, and a road and the main line's farthest 12-1/2 miles, from the lagoon south into the field. On July 26, 1910, Mexico's biggest well since Dos Bocas, Juan Casiano No. 6, came in flowing 8,000 barrels a day. The initially denied right of way promptly secured, as many as 2,000 men worked there and elsewhere on the spread "with all possible speed." On September 11 Juan Casiano No. 7 blew in flowing 60-70,000 barrels. The next day the company declared the project finished, including telephone lines from Terminal to the field, a water system, five almost equidistant pumping stations, each with three 200-h.p. gas- and oil-fired boilers, a Wilson-Snyder crank-and-fly-wheel 28x54x8-1/2x36 pump, and a Wilson-Snyder direct-acting 25x42x9-1/2x36, and the main line from the field all the way to Terminal and its tanks. But as the oil accumulated daily, some gangs and crews continued building. By December, 1910, they had made nine 55,000-barrel storage tanks at Terminal, and begun work on a 1,250,000-barrel concrete reservoir there and another tank farm 2-1/2 miles south.

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Such work happened in complicated sequences and patterns. On any spread, however small or large the force at any time, at least 15 and maybe 20 different sorts of working groups would have come and gone by the end. In more or less overlapping successions, based together in a spread camp while their stints coincided, generally at the disposal of the spread foreman, but under a specific boss's command for their daily parts, from sunup to sundown six days a week, some when done gone for good, others to return, they would form from stage to stage several quite different combinations. Some of these groups were like those on other major construction projects. There would come and go surveying parties, to map and stake the building sites and the right of way 16-20 feet wide (a stake every 200 feet) from the field down to the terminal; a pioneer gang, to prepare the camp for the men to follow; right-of-way clearing gangs; road-building gangs; hauling outfits, to bring supplies and equipment inland and string telephone poles and pipe along the way; grading outfits; maybe, as from Cobos to Furbero, gangs and crews to build a railroad; a telephone-pole gang; a telephone-line crew; a water-line laying gang; crews of masons, crane men, and structural-steel workers, for the foundations, installation of boilers, chimneys, engines, and framing of a water plant and pumping stations; crews of carpenters, roofers, glaziers, and electricians, to close and wire the buildings; machinist crew to install the pumps; a connection gang to tie everything from the field to the terminal together; and an inspection team to test the system and declare it set to carry. But besides there would be other sorts of groups especially for the peculiarities of constructing a pipeline.

One would be tank-building crews, "the meanest men in the oil fields," to hear them tell it. These crews were each to build tanks complete, one tank after another, as many as ordered as fast as they could. Generally a crew comprised a foreman, called the "tank setter," his assistant, or "second guy," and their "tankies," more or less skilled in rigging, cooperage, boiler-making, and structural-steel work, most if not all tobacco-chewing U.S. Americans, exceptions being Mexican. Different kinds of tank, however, determined differences in numbers, tools, and the time on site. Field tanks likely to be temporary were small and made of hooped wood staves. The biggest of the common tapered wood tanks, to hold 1,600 barrels of oil, measured 16 feet high, 23 feet across its bottom diameter, 25 feet across the top. To build a battery of several such tanks would take a crew of five or six men with braces and mauls maybe two weeks. But field tanks projected as permanent and all working tanks and terminal storage tanks were large and made of riveted steel plates. The biggest steel tanks, the "55"'s (for 55,000 barrels), would stand 30 feet high and 114-1/2 feet in diameter, bottom and top. All were "hickory jobs," the riveting by hand. The tools were wrenches, tongs, drifts, hickory-handled hammers. To build one 55,000-barrel tank would take a crew of 25 men through six tasks from start to finish a good two months.

The first task for any tank was grading the foundation. On a site the spread foreman had selected for its solidity and near which he had teamsters (Mexican) deliver supplies and equipment, the crew foremen on a "55" would form the tankies into a bull gang and have them clear and level a circle 125 feet across, done in two or three days.

The second stage was making the "tub," assembling the tank's bottom and the first course of its shell, like making a round barge. Since the assembly had to be on supports, to allow the riveting, the supplies would include scores of barrels, boxes, and "pig boards," or special saw horses, three feet high, 18 feet long. Two horses, to commence, a few tankies would carry over the grade and put parallel three feet on either side of the circle's center stake, ends even. After them 10 or 12 fellows would carry over the grade the first steel plate, 5x15 feet from center to center of the pre-punched rivet holes, 3/16-inch thick, about 650 lbs., lay it across the horses, and as the foremen directed center it exactly. Parallel and even with the first two horses, perpendicular to the length of the plate, and every six feet across that middle line of the circle out to both edges, the tankies would array 18 more horses. Taking turns, they would carry the other six rectangular plates one by one for the middle row, lay each across its horses, lap its inner end over the outer end of the plate just laid, match the holes, one every 1-1/2 inch, 41 in all, and fasten the lap tight with a few bolts. At both ends of the row they would bolt specifically cut and marked sketch plates, almost five feet long, 7/32-inch thick, the outside edges slightly arced for the circumference. Likewise they would carry, lay across the horses, lap, match holes, 121 in each length, and bolt six more rectangular plates in bond along one side of the middle row, six more in bond along the other side, and longer sketch plates at their ends. Across second and third cross-rows of horses aligned on either side with the first, they would bolt eight more rows of plates, four rows on either side, each ever shorter, to round the circumference. So across more horses on either side they would both 12 more ever shorter rows, the last on either side of three sketch plates only, to complete the circle, 360 feet around. On maybe 100 horses there would be 165 plates, over 46 tons of steel, the dark, low aisles beneath them like tunnels. All this too would take but two or three days.

Then the setter would organize the tankies for the riveting. Three to be roustabouts would bring the tools, 80-lb. sacks of 7/16-inch "soft flat-head tank rivets" (3/4-inch long), and buckets of drinking water. Eight to be riveters would get 2-lb. cross-peen riveting hammers. Eight for holder-ups would each get a 10-lb. heavy hammer and a sack of rivets. The other four, the calkers, would get closing hammers. The foremen, who needed to keep their hearing, would get some distance away. And the riveting would begin, the riveters and calkers in the open air on top of the bottom, the holder-ups underneath. From the bottom's center outward along the middle row four riveters on their knees above and four holder-ups on their knees below would rivet in one direction, each riveter paired with a holder-up, and the other four riveters and other four holder-ups would rivet in the other direction. The hammering made noise even on top 1,000 times that in a factory, deafening and ceaseless, but no one in the din needed to hear to work. Plate by plate in either direction the four riveters moved as the holder-ups under them moved, two riveters along each plate's 15-foot seam with the next row on one side, two riveters along the seam on the other side, the outer riveter and holder-up along each successive seam driving a rivet in its outer corner, the inner riveter and holder-up driving a rivet in the middle, each pair filling the gap from the corner to the middle, removing bolts as they came to them; periodically, along each 5-foot cross-seam with the next plate out, a pair from both sides would fill the gap. Hammering the rivets was work of intense visual concentration and fast, very repetitive action. As soon as the rivet's end was up in the hole and still, the riveter would hit it lightly and straight down to plug the hole. Steadily then but ever harder he would beat it down. After maybe 40 blows in maybe a minute he would have the rivet tight and its end made up flat, shift his chaw, spit, and be looking for the next end. So, each averaging about 50 rivets an hour, the two riveters on a long seam, 120 rivets, would flatten them in about an hour and 10 or 15 minutes; a cross-seam, 40 rivets, 25 minutes. Following a plate behind the riveting along each seam, a calker would go on his knees at about the same speed, inch after inch about 12-1/2 feet an hour in extreme repetition, pounding the overlap into the seam to seal it. The work underneath was much worse. There, in noise 10,000 times that in a factory, at the threshold of pain, kneeling low under the trembling steel in a gloomy forest of supports, the shafts of light along the seam showing the holes yet to do, a holder-up under a hammering riveter would hold up the heavy hammer against the driven rivet's head. When the riveter stopped (a last tap), the holder-up would lay down the heavy hammer, reach into the sack beside him, pick out another rivet (maybe wait for the riveter to drive a drift pin into the next hole and pull it out), poke the rivet up into the hole, and press on its head with the heavy hammer. Then taking a blow every second and a half for a minute, he would strain 40 times during the minute not to be jarred off, until he could lay the weight down again, and reach for the next rivet. So altogether in about five hours and 20-30 minutes riveters and holder-ups would finish the middle row, go back to the starting line across the center, and start on the next two seams out, as before in either direction along each seam two riveters and two holder-ups, followed by a calker. Occasionally the foremen would climb onto the bottom and test the rivets, sounding them with a hammer, listening for the dull click of the loose ones, doctoring these with a cold chisel, or dutifully ordering them cut out and replaced. In maybe 5-1/2 or six days of work, having driven some 2,000 rivets and calked over half a mile of seams, the crew would hopefully have the bottom tight.

Then it began the shell. Hammers aside, the tankies would bolt 16 22-1/2-foot-long curved 4”x4”x1/2” steel angles (and shoes) to the bottom’s circumference, lay skids on the ground to slide the curved rectangular shell plates each to its arc of the circle, bring a tripod or two to move around the rim, slide the first course’s 24 specially marked and pre-punched plates into position, hoist, hang, and bolt them horizontally to the angles below and vertically to each other, and build chicken ladders to climb into and out of the tub. (One plate had three big pre-cut holes, the biggest a 20-inch manhole, used instead of a ladder only in emergencies.) The plates were also 5x15 feet from center to center of rivet lap, but they were 1/2-inch thick, each weighing about 1,700 lbs. Their holes lengthwise, horizontally, were every 2-1/4 inches, but on the sides, vertically, they were every three inches and in three rows, for a triple-rivet lap. For 1/2-inch plate and these holes the rivets were 3/4-inch cone heads, 2-1/4-inches long, driven hot. As the setter reorganized the tankies for this riveting, 23 men would work as two heaters, four “hot gangs” (each for a quarter of the course) each comprising a catcher, a holder-up, and two riveters, after them four calkers, and in constant demand on all sides a water boy.

The heaters tended two portable rivet forges hoisted inside the tub and kept near the shell on opposite sides. They would fire the rivets red hot, several in the forge at a time, and each supply the two gangs on his side. The gangs first riveted the angles to the bottom, then the plates to the angles. In the deepening clamor inside the shell about every minute and a half a gang’s catcher would hurry to his side’s forge with a rivet tongs, pick out a bright red rivet, and hurry back to the gang’s holder-up, crouched down at the angle being riveted. In a few seconds the gang’s two riveters, outside on the ground, would stop hammering (except maybe to drive a drift).

The holder-up would down the heavy hammer, grab the short tongs lying beside him, take the glowing rivet, poke its end into the next hole, and put the heavy hammer against the head. Outside, the two riveters would resume hammering, taking turns beating the end. In maybe a minute and a half they had the rivet down and probably tight, its end made up, still dull red, hot enough to cook a squirt of tobacco juice into instant cement. By then the catcher would have returned with another rivet. So the gangs would go slowly around their arc, pausing only to remove bolts and swig water. And trailing the holder-ups around the inside, the calkers would go hammering to seal the angles, first against the bottom, then against the plates. The horizontal riveting done, the ringing of steel on steel would stop for a few hours while the tankies rigged scaffolding around the outside of the tub. The clamor would resound again as soon as the heaters had the forges refired and rivets hot and the gangs started riveting the vertical laps, the holder-ups inside as before, and the riveters outside on the scaffold. The triple rows took 60 rivets; a gang would have one probably tight about every hour and 40 or 45 minutes. Then trailing the riveters on the scaffold around the outside, the calkers would go sealing the vertical seams. After probably five days of work, 5,280 rivets and 840 feet of seams supposedly tight, the tub would stand ready to test--some 69 tons resting on the horses.

The test was easy. The spread foreman would have already arranged for sufficient water, hose, and a pump on site. The crew would hoist out the forges, clear the bottom, and rig the hose and pump to fill the tub maybe overnight five inches deep (adding 134 tons to the weight on the horses). Underneath and outside the setter and his second would mark leaks, and have the water pumped out. Depending on the pump, this might take an entire day, ideally for the setter a Sunday. Then the tankies would make faults tight, doctoring the detected loose rivets, or (as ordered) cutting them out and reriveting the holes, and recalking bad seams.

The third task was the most delicate, lowering the tub to the ground. "…an event resembling in importance the launching of a ship," it was typically "attended with some degree of anxiety." The foremen would not only give orders, but check closely and continually that all really was right. Having removed ladders and scaffolding, the tankies would set 20 heavy screw-jacks every 18 feet around the 360-foot rim, each jack in a frame standing just clear of the rim but with a foot projected underneath it to support the bottom. One man then at a jack, the setter would shout commands. And as one man 20 tankies would crank the nuts on top of the frames around and lift the bottom plumb off the horses. Crawling under the impending steel, they would pull the horses out lengthwise and sideways. This gave room for several hours of the most despised work. As many fellows as the setter could bend to his orders would crawl back under the bottom with short mops and buckets of hot asphalt, coat the steel overhead, crawl back under again with short rakes and buckets of oil, and from the dark center out toward the light scratch the oil into the ground. Then at the jacks again, as the setter commanded, they and the others making 20 would synchronously screw the feet down and in half an hour lower the thing plumb to grade.

Fourth was erection of the shell's five upper courses, each like the first of 24 duly curved and marked 5x15-foot plates. To recommence, the tankies would clear the jacks, rehoist the forges onto the bottom, lift inside and put in the middle (out of the way) a 30-foot-long 6- or 8-inch swing pipe, move timber inside too, build there a 40-foot gin-pole, and rig scaffolding outside and inside around the shell. Then as on the first course they would hang and bolt the second course (lapped inside the first), 7/16-inch plates, each nearly 1,500 lbs., which also took 3/4-inch red-hot rivets, horizontally and in triple rows vertically. And reorganized as heaters, hot gangs, and calkers, they would rivet and seal the plates, heaters, catchers, and holder-ups inside, riveters and calkers outside, except that on the third day of riveting and calking, which would be the last on that course, only one gang and calker would be hammering steel, while close behind them, organized as a shell gang, several fellows using the gin-pole would be rigging the scaffolding higher and hanging and bolting the third course. So they would go up with "ascending inside courses," but faster on each course, because of thinner plates, fewer rivets, smaller rivets. The third course's plates were 3/8-inch thick, about 1,300 lbs., with 3/4-inch rivets horizontally and in two rows vertically. The fourth's were 5/16-inch, about 1,050 lbs., again with 3/4-inch rivets horizontally, but with 5/8-inch cone heads in the double vertical rows. That high, standing on the inside scaffolding 15 feet over the steel bottom, a hot gang's catcher earned his name, catching in a can the red-hot rivets that the heater below tossed up to him, for him to pass to the holder-up. When the rivets in the fourth course were all down, the work went yet faster. The fifth course's plates were 1/4-inch thick, about 850 lbs., with 7/16-inch flat head rivets horizontally and in two rows vertically, driven cold. The setter therefore had the forges hoisted out, more men riveting, and more men in the shell gang. The sixth and last course's plates were like the bottom's, only 3/16-inch, with 7/16-inch rivets horizontally and in only one vertical row. Outside around the top riveters and holders would finally hang, bolt, and rivet 16 angles (and shoes), but lighter than those inside around the bottom, every 4-1/2 inches a 7/16-inch rivet, cold; and calkers outside would seal the joints and the seam. All the work since the tub had gone down to ground, the rigging, driving over 18,000 rivets, closing over half a mile of seams, would be a matter of probably 12 days.

Before the top angles were all on, the setter would have most of the tankies at the fifth task--making the roof. One of them he would have outside bringing carpentry tools and timber to hoist or hand into the shell, others inside taking loads of long 2"x8"'s, 6"x6"'s, etc., and stacking them on the bottom. As soon as the riveting and caulking around the top were done, the crew would take down the scaffolds, build ladders again up the outside and down the inside of the shell, and start on the roof"s supporting structure. On the bottom around against the shell the tankies would lay 24 15-foot-long 2"x8"s for sills, and fix midway on each sill a short 2"x8" footing. Then using the gin-pole, they would raise an "outer circle" one after another on the footings, 24 probably 28-foot-long 6"x6" posts upright (some to serve also as ladders), tie one after another together about 20 feet up with 1"x6" braces, and spike edgewise on corbels from top to top 24 5"x12" girders. Likewise in a "third circle" about 14 feet in from the shell they would raise upright 16 probably 29-1/2-foot-long 6"x6" posts, tie them to the outer circle's posts and together with braces, and spike on their 16 5"x12" girders. From the outer to the third circle of girders some fellows would lay edgewise 120 2"x8" rafters, sloping upwards about 5º, while in a "second circle" about 14 feet farther inward other fellows would put up 10 31-foot-long 6"x6"'s, tie them to the third circle's posts and together, and spike on their girders. As the raftering continued between the third and second circles, the men on the bottom would put up about 15 feet around the center a "center circle" of four probably 32-1/2-foot-long 6"x6"'s, tie them out to the second circle and together, spike on their girders, and in the very center stand one probably 34-foot-long 6"x6", tie it high and low out to the center-circle posts, and cap it. The rafters on the girders, they would take down the gin-pole, and clear the tools, loose timber, scrap, and trash from inside. Then the crew would reorganize to lay the roof. A few tankies on the ground would hoist materials to others on plank platforms on top. The fellows up there would nail 1”x6” or 1”x12” boards across the rafters for sheathing; on that, roofing felt; and on that, maybe 370 No. 24-gauge 3x10-foot black steel sheets. All this, the supports and the low-coned, supposedly waterproof roof, would take probably two more weeks of work.

A roofed shell, however, was not yet a tank, for working at a pumping station or for storage. There were various appurtenances necessary outside and inside. On the ground a hot gang and calker would rivet and seal to the shell a cast-iron or steel neck through the 20-inch hole in the first course, for the manhole, and likewise fasten flanges through the two smaller holes, usually a few feet to the right, the nearer and bigger of them 6- or 8-inches for the “suction line,” or oil outlet, the other maybe 4-inches and lower for the pipe to draw off bottom water. And just to the right of the manhole, left of the suction-line flange, they would raise upside the shell and bolt onto the roof an iron ladder. Inside on the bottom a few fellows would install the 30-foot pipe till then often in the way, screwing a swing joint into the suction-line flange, screwing the pipe’s bottom end into the joint, and fitting on the other end a clamp to which they attached a 50-foot wire cable. Up on top directly over the joint other fellows would cut a maybe 2x3-foot hatch through the roof, bolt on a specially punched plate, and install a winch box and windlass, on which they would wind the other end of the cable. If the tank was to be a working tank, there would be about a foot right of the winch box over the side just under the top angle a pre-cut 5- or 6-inch hole in the plate, where they would rivet (cold) a flange for the “discharge line,” or oil inlet, the holder-up inside at that height tied to a chicken ladder to have both hands free. For a working or a storage tank, about four feet right of the discharge-line flange would be a couple of maybe 2-inch holes, where they would rivet flanges for steam pipes, to choke fire. Farther up on the roof, near the center, they would cut a maybe 8-inch hole and fix a “gauge hatch.” These essentials 23 tankies could finish in but several hours. Then the fellows outside would join any inside, and clean the bottom.

Everybody out, the covering plate bolted on the manhole, all flanged up and plugs tight, the tank stood complete--except for the final test and last task. With the strongest pump then probably available the test might take four or five days. So would the task. While the setter had 55,000 barrels of water pumped into the huge steel container, the tankies would clear the surrounding grade and build a dike around it, for a firewall. Ordinarily the tank would not spring an egregious leak. Before it was empty again, ready for oil, the tankies would have loaded tools and equipment on wagons and left for the next job.

During the same months it took to build a line's tanks, the other groups required to construct the line would be laboring under the same sun up and down the right of way. As soon as the hauling outfit had pipe strung on the ground, these groups would have commenced the task of connecting it--for gathering lines from the field tanks to the initial pumping station and for the mainline between the stations and the terminals--and the three other tasks involved in putting the main line underground. The work on the main line was at best daily exhausting. The joints of line pipe strung along the way, in random lengths averaging 20 feet, were steel, lapweld screw pipe, an average joint of the 8-inch size weighing about 550 lbs. On the front end of each joint was a 6-inch-long collar with 20 threads inside, on the back end a 3-inch-long protector over 20 outside threads. The ditch for an 8-inch line, on the general rule of "two sharp-shooters wide and two sharpshooters deep," was about 16 inches wide, sides straight down maybe 24 inches, so that every joint lowered into the ditch and covered counted also as three tons of dirt dug up and backfilled. The only means for handling the pipe and moving the dirt were a few simple tools and human muscle, common labor. Muscles often failed before a day was out. As common as the labor were broken hands, smashed feet, ruptures, and heat prostration.

To construct the line fast, the smallest force would be around 160 men, divided according to task in maybe five specialized gangs, moving one after another along the way. (As they made about 2,500-3,000 feet a day, they remade camp about three miles ahead of their point of progress about every two weeks.) Ordinarily first would come the laying gang, la cuadrilla de tiendetuberos, the Mexicans called them, a foreman and 40-odd men, as many as 10 or 15 of them U.S. Americans, the others Mexican. Laying the pipeline meant screwing one of the strung joints after another into a thereby continuously lengthened line on the ground alongside the surveyor's staked line. It was a task at once heavy and delicate, requiring intense care, patience, and precision in successive coordinated maneuvers and quickly shifting rhythms, repeated usually 150-200 times a day. In the detailed sub-division of the gang's labor each fellow had a definite sequence of parts that he did again and again. The different routines varied in stress and inevitable effort. The U.S. Americans, who regarded themselves as "old cats," would have the commanding and coordinating positions, foreman, stabber, collar pounder, and point. They also typically had the "snaps," the lighter duties. A couple of snappers would be ahead along the string, with a 22-foot swab and a monkey wrench, swabbing joints clean of dirt and animals and removing protectors. The other snaps were clubman, barman, jackman, jackboardman, growler-boardman, ropeman, and mope. Mexicans had the "ass work," subordinate, messier, and more strenuous duties, greaser and tongman. Snappers rarely changed places with ass workers. But the cooperation among the 30-odd fellows who actually screwed the joints together was practically intimate.

Every four or five minutes the gang would have a joint just laid. At that moment the 20-foot-long steel pipe would be up on two pipe jacks, one forward toward its collar maybe four feet off the ground, the other toward its back end, just set up tight in the joint behind, maybe three feet high. The foreman otherwise preoccupied, the stabber would be standing in front of the joint, looking back at it and the men on either side of it. Next to him would be the clubman, club in hand, the ropeman, with four 25-foot lengths of 1-inch rope, and the greaser, with dope pot and brush. A few feet away at the string a couple of barmen would be lifting with caliper tongs the back end of the next joint to lay, and another snapper would be wiping the threads clean. Usually on the left side of the joint as the stabber looked back, a jackman and jackboardman would be holding firm the front pipejack and its brace, some 10 feet to the rear another jackman and jackboardman would be holding firm the back supports, and by them the growler-boardman would be waiting. Behind them, at the connection just made, the collar pounder would be standing, a 2-lb. ball-peen hammer in hand. Just behind him but out at the end of a maybe 15-foot-long wooden lever, the mope pole (its short end stuck over a block and under the new connection), the mope would be waiting. On the right side of the joint, a foot or two behind the new connection, the backupman would be holding up the end of a five-foot-long pair of tongs hooked under the previously laid joint. Forward from him, opposite the jack- and jackboardmen, would be a crowd of probably two dozen tongmen, pulling down in hard strain on four five-foot-long tongs hooked over the joint. In detail these were the ace, deuce, three, and four lay tongs, hooked respectively at four, eight, 12, and 16 feet of the joint's length: each tongs would have probably six men on it, three on each side, facing each other, called from the inside out (in U.S. English) "butt," "five," "four," "three," "two," and "point." At that moment the stabber, collar pounder, and four pointmen would have clearly in mind how may joints in a row they had just done, for every 10 they would rest for the next 10, their places taken by another stabber, another collar pounder, and four other pointmen.

Immediately the stabber would command amid oaths of encouragement and insult, "Undress…! Up on the mope…! Out, growler board…! Next joint…! Bar her over…!" The tongmen would unhook the backup and lay tongs, which each weighed about 100 lbs., and drop them, watching out for feet. The man at the end of the mope pole would pull it slightly down, lifting the joint slightly off the pipe jacks. The jackmen and jackboardmen would throw down the jacks and braces and pull them away, the growlerboardman would pull out the growler boards (the foundations on which the supports had stood), and the mope would let the joint down. The growlerboardman would drag the boards forward to their places for the next joint. The jack- and jackboardmen would bring the supports forward to the boards. The ropeman would ready the ropes in four piles near them. The mope would bring the pole and block forward and fix the leverage under the just laid joint's collar. And maybe 10 tongmen would bring the tongs forward. Meanwhile maybe 10 others, "heavers" so called (in U.S. English) for their next maneuver, would step with a couple of carrying bars to where the barmen had the next joint, take almost all the weight, and carry the joint over to the line. Into the joint's front end the clubman would poke the club, as a steering stick. The joint's back end the barmen would hold just in front and above the last laid joint's collar. There, probably on the left side and swearing again, the stabber would command, "Dope them threads…! Up on the mope…! Heave…! Put her in the bell…! Up in the round-eye…!" The greaser would paint dope (crude oil and graphite) on the exposed threads, the mope would lift the last joint's collar maybe 2-1/2 feet off the ground, the heavers would raise the next joint high and angled enough, the barmen would move the end to the collar, the clubman in front would align the joint, and the stabber in back would put his arm around it and try to catch its threads in the collar's, praying they would not cross and jam. "Let me feel it," the stabber would bellow. "There she is…! Catch her there, jack…! The other pin…!" Instantly the back and front jack- and jackboardmen would fix the supports at the proper height, again at about three feet in back, four feet in front, to take the weight and keep the alignment. The clubman would withdraw the club. The barmen would remove the calipers. The relieved heavers would toss aside the carrying bars.

At once the stabber would bark, "She's loose as a goose…! Wrap your tails around her…! Give her an honest roll…! Breakout deuce…!" And he would take his place at the new front end. There he would see four tongmen on the joint's left side each wrap the short end of a rope two or three times over and around the joint and grip the end tight, 16 tongmen on the right side, four on each length of rope (the points resting), grab the lengths, the collar pounder begin hammering a cadence on the collar of the new connection, then the men on the first and third lengths all pull hard, turning the joint toward them probably a full revolution and screwing a full thread into the collar, then, while they regained slack, the men on the second and fourth ropes all pull hard, turning the joint probably another revolution, and so on in cadenced, alternate, double pulls, until they could not turn it any more.

"Take off your tails, cats, and put on the hooks," the stabber would command. The fellows holding the ropes on the left would unwrap them, the ropeman collect them, the fellows on the right position the tongs, the backups behind, handles low and tight, the ace, deuce, three, and four on the new joint, handles high and open, and all the tongmen take their places. "Deuce and four, ace and three…!" The points on the second and fourth tongs would press the handles together, so that those tongs' jaws bit the joint. The collar pounder would begin hammering a cadence on the collar again. As one, the six fellows on the second tongs and the six on the fourth would pull down and turn the joint maybe an eighth of a revolution. Instantly on the collar pounder's beat the two points down would open handles, the other two points would close handles, and as one the ace and three tongmen would pull down for maybe another eighth of a revolution, by which instant the deuce and four men would have recovered for the next pull. So, fast and as rhythmically as the hammer rang, the tongmen would iron the joint on, but not to the end. Maybe two or three threads still to go, the turns would be too short for the strain. "Now all together," the stabber would command. The collar pounder would change his beat, and as one all 24 tongmen would pull down for maybe another full quarter turn, again and again. "Hit her like you live…! Hard…! High like a tree and down to the velvet…! Bounce, you cats, bounce…!" Maybe the stabber would see some of the second and third tongmen failing. "Windrow," he would bark, "snappers load on…!" The exhausted tongmen would stagger aside, replaced by a clubman, ropeman, and growlerboardman. The stabber would know precisely when the fellows on the tongs had buried the last thread into the collar. "That's high!" he would cry. "Ring her off, collar pecker!' And that ring would mean that joint laid. This was how connections happened maybe 200 times a day on level stretches, in 200 moments of collective, concentrated force, human strength summoned, leveraged, and spent, again and again, until the foreman screwed the bull plug into the front collar for the night.

Where the surveyor's line went through hilly country, the laying gang made slower progress. Every 10 or 12 joints it might have to spring or bend a joint. Ordinarily it did the bends cold, the joint already set up, the biggest tongmen sitting on the front end extended over a pipe jack. Occasionally a joint would buckle, or break out of the collar behind. Then the gang would have to unscrew it, dump it aside, rob the string for a replacement, lay it, and try the bend again.

Crossing water was slow too. In swamps and shallow streams the gang would simply use boards for footing, build dams, get wet, and raise the jacks higher. Across a river it would lay the joints on a raft tethered from bank to bank and pulled along as the line lengthened. Struggling against disastrous shifts of balance on the raft, the tongmen would bolt around each connection a 500-lb. cast-iron clamp, to strengthen the line and weight it so that it would sink. The slowest struggle was laying the submarine lines off Tuxpan, one 3,608 feet, the other 5,150 feet from the beach out into 40-odd feet of sea. The two gangs there laid the lines as if across a river, hauling the first lengths through the breakers, laying the rest from continually reanchored barges to extend the lines as far as ordered; the diver who rigged the armored hose on the ends reported bad bends and twists in the last joints.

About a day behind the laying gang on a hurried cross-country pipeline would come the second specialized group, the ditching gang. It would consist ordinarily of a foreman (often U.S. American) and 40-odd Mexican "muckers," i.e., common ditch-diggers, zanjeros as they called themselves. From surveyor's stake to surveyor's stake, with picks, No. 2 round-point, long-handle shovels, sharpshooters, and No. 4 square, short-handle shovels, these fellows would open the ditch, trim it to specification, and crumb the rocks and loose dirt from the bottom, banking the spoil alongside the ditch opposite the laid line. Driven hard, they would make the same linear progress as the laying gang before them, the maybe 30 round-shovel men digging each on the average about nine feet of ditch an hour, all the men together removing daily some 370-450 tons of dirt.

A day behind the ditching gang would come the third specialized group, the lowering-in gang, typically a U.S. American foreman and some 15-18 Mexican laborers. At daybreak these fellows would look ahead to maybe 3,300 feet of supposedly clean ditch and maybe 3,000 feet of pipeline on skids over the ditch. The skids and the line they themselves would have put in place the previous day, a skid (a 7-foot 4"x6") across the ditch about every 20 feet, one behind every collar in the line. For equipment they would have several shovels, probably two portable windlasses with a 2-1/2-inch rope, 10 or 12 long pry bars, and a team and wagon. Until the cool of the morning faded into the heat of the day, around 10 a.m., they would proceed taking out the skids and lowering the line into the ditch. The smallest fellow or two would go in front for the last crumming, if necessary crawling down under the line. Four fellows would carry the windlasses forward, again and again, for alternated use (on a level stretch) about every 120 feet, on every sixth joint, all four fellows at a time every time taking one of the heavy hoists 240 feet ahead and setting it in position astraddle the line and midway over the joint. Two fellows would operate the windlasses. Together at each position they would raise the line there, hitching the rope around the middle of the joint below, hoisting it about three feet in the air, holding it. A fellow behind would pull out the three skids to the rear, and a fellow in front would pull out the next three. At two places the foreman indicated, usually about 100 feet apart, two or three other fellows together on one or the other side of the lifted line would stick pry bars down into the ditch as guides to the opposite side of the bottom. The men on the windlass would then lower the six suspended joints to the bottom, unhitch the rope, and go to the next position. The fellows with the bars would pull them out, shovel enough spoil on the slack to hold it, and go ahead too, leaving the line behind staggered and half-buried in the ditch about every 100 feet. A swamper and teamster would follow, loading the loose skids on the wagon. Averaging six or seven lowerings an hour, the gang would have some 3,000 feet of line in the ditch and some 150 skids in the wagon by 10 a.m. At that point the line ahead lay curved aside and still on the ground along the ditch. There maybe 1,500 feet behind the ditching gang, the foreman would have the windlasses set aside and reorganize the gang to move the foregoing line over the ditch. The teamster and swamper would proceed stringing the skids. The other fellows would follow in a file about 60 feet long. Three or four on the ditch's spoil side would carefully put the skids one after another to get each behind a collar, while the other 10 or 12, along the outside of the line on the ground, would continually advance sticking pry bars under the joints and squeezing the progressive curve of the line over onto the skids. Averaging 500 feet an hour, the gang by the end of the day would be (as it had been the previous evening) only 300 feet short of the ditch diggers, with 3,000 feet of line on the skids behind to lower tomorrow morning.

If the ditch for tomorrow ran through alkaline soil, however, or near brackish water, a responsible foreman would not continue the lowering-in until he had the line going in the ditch protected. Probably the next morning he would have on site not only the regular gang but also a special section of maybe 20 men, in all 35-40 fellows whom he would organize as a papering gang to paint the cool, bare steel line with hot asphalt and wrap it with tar paper. The regular teamster and swamper would continue to load, haul, and unload, but the equipment and supplies were special, axes, a heating frame, maybe 10 or 11 52-1/2-gallon (500-lb.) barrels of hard asphalt, rolls of paper, wire, and there was a sled and kettle to drag from site to site along the line. Likewise the fellows who carried and operated the windlasses would work as usual, but with only one hoist, again about every 120 feet, but only to lift the line for painting and papering, then let it back onto the skids. Four others would go ahead as brush and sack men, scraping dirt, blisters, and mill scale off the line into trash sacks, which they left along the way. The newly arrived fellows worked in a kind of shifting purgatory. A kettleman and a dipperman took the worst heat, standing at the kettle of boiling pitch. About every hour, when the painting had progressed about 150 feet beyond them and the kettle was running low, they would have the teamster move the frame and kettle forward about 300 feet. There they would reset the fire, strip the staves off a barrel of asphalt, chop the big black block into handy pieces, dump them in the kettle, melt them, and heat the liquid to 300-350º. Meanwhile nearby a couple of other newcomers would reset a frame horse, unroll paper over it, measure for joints and collars, and cut the pieces. Not far behind, soon alongside, in an hour at least 150 feet ahead, would come a long file of eight painters, each with a 3-1/2-gallon bucket, five painting hot pitch on the joints (two coats in 15-20 minutes), three painting collars. A full bucket would just do for an 8-inch joint, short of the collar, so that every few minutes a paint carrier, one of four such unlucky fellows from the regular gang, would appear at the boiling kettle with an empty bucket, which the dipperman would fill, and then carry the bucket, 30 lbs. of molten tar, back (or forward) to a painter. Next, as close as they could stay behind the painters and not burn themselves on the still sticky paint, would come in a pack the paperers, three wrapping joints, three wrapping collars. On their heels would come another painter, sealing the paper seams. A few minutes behind him would come the last man, another unlucky regular, wrapping wire tight around the paper. By evening, if all 3,000 feet of line needed protection, the covering gang would have it ready for lowering-in tomorrow morning. If this day's new ditch also threatened bare steel, the foreman would probably have 15-18 more laborers on site tomorrow to go ahead with the special section, while the lowering-in gang, reorganized as before, would return and lower the line it had helped to cover.

At the end of the construction, a day behind the lowering-in gang if hurried, would come the covering-up gang. Typically under a U.S. American foreman, 25-30 Mexican laborers in a long line on the spoil side, a fellow with a round-point shovel about every five feet, would steadily work ahead, throwing rocks in the spoil away, backfilling the ditch, and leaving a nice, fresh ridge, each fellow every day moving about 15 tons of dirt. In the rear would be four or five more fellows, picking up thread protectors, broken tong keys, and joints, and other odds and ends, and loading the debris on a slowly advancing cleanup wagon.

So in 1910 the work proceeded for Mexico's (and Veracruz's) fourth crude-oil pipeline. By mid-May Águila managers had two fields in the Tuxpan district to develop, Potrero del Llano and about 2 miles as the crow flew northeast Tanhuijo, where three freakishly shallow wells were already good for 125 barrels a day, only eight miles southwest of the south shore of Tamiahua Lagoon. They therefore ordered construction to connect both fields with Tampico. The immediate project was a Decauville railroad and a 6-inch pipeline for 6,000 barrels a day from Potrero del Llano through Tanhuijo to a terminal on the lagoon, barges to ship the oil from there to the lagoon's north shore, and another 6-inch, 6,000-barrel line thence north to a terminal on the Pánuco River across from Tampico. Promptly a surveying party began mapping and staking a way from about 150 yards north of Potrero del Llano No. 1, the site of the first pumping station, north-northwest through another Águila lease, northeast through Tierra Amarilla and Tanhuijo, sites of the second and third pumping stations, nearly to the lagoon, north across Las Milpas Estuary and through the little town of Tamiahua, and north-northwest to the right bank of Tancochín Estuary (beyond which lay Mexican Petroleum property), altogether about 39 miles. And it found sufficient sweet water for the stations' boilers year round only a few miles up the Tancochín. In June, supplied from Tampico, a clearing gang, hauling and grading outfits, and the other necessary gangs and crews built a landing about six miles up Las Milpas at a place on its right bank called La Peña, two miles northeast of Tanhuijo camp, and began building a wagon road, telephone line, railroad, and pipeline. By July they had the road open from La Peña through Tanhuijo and Tierra Amarilla to Potrero del Llano, about 26 miles. During the summer rains, which slowed but did not stop them, they made alongside the road the telephone line and railroad from La Peña to Potrero del Llano, and did 78-1/2 miles of pipeline from Tanhuijo down to the bend north across Las Milpas. By December they had "near completion" the pipeline from Potrero del Llano to Tamiahua.

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Meanwhile in the field, development was usually simple and straightforward. A field or lease boss took charge. A geologist planned a system of locations for drilling holes around and away from the discovery wells, to determine the extent of the pool below. Rigging crews erected as many derricks as current production and expected transportation warranted. Construction gangs made buildings to work and live in. Following the logs of the discoveries as guides down through the formations, drilling crews drilled. Where the holes were dry, as at Juan Casiano No. 3 and No. 5, they marked the pool's assumed limits in their directions, and the next holes in other directions were drilled. Where the holes were producers, so called "inside wells," e.g., Juan Casiano No. 6, they were piped to storage or shut in to wait for transportation, and drilling continued farther out. Tank-building crews might erect more tanks. And connection gangs, special outfits of pipelayers and pipefitters, connected wells to tanks and eventually the tanks to the pipeline. But development too sometimes presented surprises, the greatest of them in 1910.

The first was in the Juan Casiano field. There, only 10 miles south of Dos Bocas, the big gusher that the drilling crew brought in at No. 6 on July 26 increased its flow to 14,000 barrels a day in August, and the whale that blew in at No. 7 on September 11 at 60-70,000 barrels flowed steadily at 35-40,000 barrels a day. It seemed natural to the men in the field that so close to Dos Bocas there was so much oil. It was the oil's evil stink that surprised them. Dos Bocas's vast and poisonous gases were supposedly vapors, the result of the oil exploding and burning and steaming in the crater. There was no fire or steam at Juan Casiano. Yet the oil smelled like an emanation from hell, so "very sulphurous" that a good whiff would give a splitting headache, and a couple of minutes of it would knock a man cold. Nothing extraordinary (by oil-field standards) proved necessary to control the oil. In mid-August Nos. 1, 2, and 6 were easily shut in. No. 7 was harder. Although the blowout was shut in, the flow would not be stopped. Its pressure rose so high, 535 psi at the valve, that it lifted the casing off the bottom and made oil springs come up 100 yards away, 3,000 barrels a day. But in short order tankies built a 10,000-barrel iron flow tank on a hill 1,500 feet north, and a connection gang cemented the casing and laid a 6-inch line from the well head up to the tank and another from the tank eastward down to the field's two 55's. Under 400 psi at the valve, with some leaks, the well flowed about 15,000 barrels a day into storage. But the stink only reconcentrated at the flow tank. "…a continual cloud of gas floats over it," spreading whichever way the wind went, across the public road nearly a mile north, into the settlement of Chapopote on a ridge a mile south. And as around Dos Bocas, animals, birds, and the fish in the streams around Juan Casiano began dying, insects disappeared, and soon the grass and weeds and trees died. In mid-November the gas killed three local people in their house.

The most annoying surprise occurred, however, at Potrero del Llano. After well No. 2 came in on May 12, proving the field and "its enormous gas pressure," development there took shape according to progress on the pipeline. As Águila's consulting geologist (the U.S. Geological Survey's chief geologist) instructed his young protegé (a U.S. Geological Survey trainee) in charge of the field, drilling was to make holes at as many locations as possible, but none as deep as the known pay sand until the pipeline was almost ready for oil. Well No. 3, over a quarter of a mile north-northwest of No. 1, deepened easily. On May 7 the drilling crew had spudded through 20 feet of gravel and heavy chapopote into blue and white marls and shales. Crew and roustabouts had set and clamped 13-inch casing at 72 feet. And the footage then came very fast. Running a screw every hour and a half or two, the drillers kicked down nearly 500 feet a week, past a show of gas at 420 feet, more gas and some oil below 1,375, for 10-inch casing to 1,435 feet. Into reddish shales at 1,735, limestone at 1,835, the crew had a big hole for the intended pay string of 6-5/8-inch casing run to 1,878 feet. Down through two more feet of limestone, two feet of iron pyrites and limestone, four feet of marl, then into sandy limestone, it got 1,890 feet by June 4. There only four weeks after starting it stopped drilling, supposedly "at the top of the Tamasopo limestone," hopefully just above the pool, and capped the hole.

The summer rains did not interrupt the work in the field either. Nor did it matter that the aspirant geologist in charge took a French leave (to get married in Oklahoma and install the bride in Tuxpan). A rigging crew finished the derrick at No. 4, about 330 yards west-southwest of No. 1, down by the banks of the Buena Vista. From No. 3 roustabouts brought the cordage, machinery, tools, and appliances. And after refitting connections from the field boiler, another cable-drilling crew rigged up, put on a roof for the rain, and spudded in No. 4 on June 9. This hole was harder and slower going, but nevertheless promising. Through sandy gravel and boulders crew and roustabouts sank the drivepipe to 45 feet, and the drillers spudded to 35 feet by Saturday, June 11. Into blue marl and shales at 52 feet on Monday the drillers pounded down for crew and roustabouts to pull the drivepipe and set 13-inch casing at 77 feet. As the hole deepened, the drilling went faster, down to 400 feet by June 18. Below 700 feet by the middle of the next week the crew found oil flowing heavily, almost filling up the casing. Even so, continually bailing the oil, it had 835 feet by June 25. The aspirant geologist returned, reported to his chief in Washington, D.C., and promised him frequent bulletins from the field. Below 900 feet the flow of oil ceased, and the drilling slowed, to 1,127 feet by July 2. That deep on Monday, after shortening the first string, crew and roustabout set and clamped 10-inch casing. The drillers made footage only to 1,473 feet by July 9, 1,755 by July 16. The next week the bit hit lime shell at 1,814 feet, and oil began seeping into the hole behind the 10-inch casing. Into sandy shell at 1,819 feet, lime rock at 1,845, oil still seeping, the crew deepened for 1,846 feet of 8-inch casing. This, because of the seepage, it cut short at the top inside the 10-inch, which it also cut short, fitted with a 10-inch-to-8-inch swedge nipple, reclamped, and retopped with a 3-1/2-foot 8-inch piece for the head. At 1,856 feet on July 23 it stopped drilling and shut the hole in.

Meanwhile construction gangs supplied both from Tumbadero and from La Peña had built and fenced a field camp. Along the hillside from 200 yards southeast to 400 yards south of No. 1 were a blacksmith shop, corrals, a storehouse, an office, a library, "men's quarters," and "married quarters." North and farther south were "peon houses."

On July 29, over a quarter of a mile south-southeast of No. 1, a rotary crew commenced drilling No. 5. Through the same formations as at the other locations it made hole at fine speed, setting 13-inch casing at 37-1/2 feet and cutting down at nearly 600 feet a week to 1,836 feet on August 20, when it stopped, set 8-inch casing, and capped it. By then the pebble pup had made five more locations farther out. On September 11, about 300 yards east-northeast of No. 5, a rotary crew using the machinery from No. 5 commenced drilling No. 6. Through yellow, sandy clay, gravel, and boulders to 30 feet, where it set 13-inch casing, down through layers of blue marl, limestone, and shales, it deepened the hole to 1,835 feet by October 13, and shut it in.

The consulting geologist advised drilling the four suspended holes before trying outer locations. As the rains ended and work on the pipeline proceeded, laborers and teamsters with fresno scrapers dug a reservoir between Nos. 1, 2, 5, and 6 to hold some 50,000 barrels. Told the pipeline was "near completion," the aspirant geologist on December 1 had Well No. 1 opened into the reservoir, and from December 4 to December 11 had No. 2 opened into it too. He estimated the combined flow as he expected at about 1,000 barrels a day, not enough for the pipeline, and ordered a cable crew to drill ahead at No. 4, where more tools remained than at any of the other locations. He would have the other holes deepened as soon as he could. It would take 112 500-barrel wells to run the pipeline at capacity.

On December 23, 1910, a Friday, the new crew reopened Potrero del Llano No. 4. It found so much oil in the hole that it spent hours bailing it clean before drilling ahead. On the Saturday tours the drillers deepened from 1,856 feet into a formation they knew from the slush was hard shale. They therefore did not bother to put a control head on the casing; they would put it on when they hit the Tamasopo limestone, or some other reason for precaution. They noticed but did not worry that the bit was wearing on one side, as if drilling in faulted and broken stone. Sunday, a day off and Christmas besides, the consulting geologist himself visited the location. The hole was then 1,904 feet deep. A "somewhat discouraged" driller wondered if the crew should go deeper. The geologist predicted "a good supply of oil" just 12 feet farther down. He and his protegé left for Tuxpan. The Monday tours passed, much bailing to clean the hole again, a little drilling, still in hard shale, and still without a control head.

At 2 a.m. Tuesday, December 27, the pusher later recorded in the log, "We struck oil at 1911 feet. The well broke loose absolutely without any warning, throwing the bailer, which was in the hole at the time, clear out of the hole. We got boilers shut down at once." The driller on duty gave a longer and more pungent account to the geologist's protegé a few days later:

> "I had just come on the Blankety blank tower and we had a blankety little blank blank gas. I run a little water in the blankety blank old blank but she wouldn't mix. I says to [the toolie], 'Stick the blank blank pipe in the blank bailer and tie up the blank dart.[']

> We run in some more water and I stuck my hand over the blankety blank hole and felt a little gas. I says to [the toolie], [‘]See what a little blank water will do’. Jist then the old blank shot the bailer up against the roof and the blank blank blank thing comes down through the derrick roof. [The toolie] fell out backwards through the blank forge room and by blank blank blank I crawled through the blanked little hole under the bull wheel and run my blankedst out into the monte but I couldnt [sic] hardly get to camp and the blanked thorns tore my face and by the blankety blank blank I wuz gassed. I crawled on my knees a trying to get the blanked fire out an [sic] when they wuz I wuz gassed. I’ll tell you, it’s the blankedst blank biggest well I ever worked on and the gas is so bad that I wish that I hadnt ever seen the blanked blank thing and the blanked blank blank gas certainly is bad.”

In fact this was one of the biggest wells anyone anywhere in the world had ever worked on. Through the dark hours of Tuesday morning its terrific roar and gas (carbon dioxide, methane, hydrogen sulfide, butane, and propane) spread fear among the men in the camp that the entire field would explode. The night sky rained hot oil and chunks of hard, white, flinty limestone. The air because heavy, foul. By the early light the great gusher was finally visible. From up on the hillside, oil rain soaking into their skin, the constant roar in their ears, a choking stink in their nostrils, heads aching, eyes burning, the men saw an 8-inch column of black oil rising from No. 4 some 230 feet into a gigantic black plume of spray 425 feet high. Only parts of the derrick and rigging still stood. The bull wheels lay broken in two, blown from the floor 24-30 feet away. Oil slick covered everything for a mile around, and oil streams were running into the reservoir and down into the Buena Vista, covered from bank to bank by oil on its way down to the Tuxpan River and on to the Gulf. Measured later, the pressure at the casing head was 850 psi; the oil’s temperature, 147º. The pressure estimated in the pool 1,911 feet below was 1,555 lbs. On Thursday, December 29, 1910, the driller who had made the strike left the field. The same day Águila’s general manager arrived. He calculated the well’s flow then at “over 100,000 barrels in 24 hours,” but still going grandly into the air and downriver. Figuring the pipeline would take another three or four weeks to be ready to operate, he immediately ordered work to enlarge the 50,000-barrel reservoir to hold 3,000,000 barrels. Pearson himself, by then Lord Cowdray (his coat of arms *dexter* “a diver holding in his exterior hand his helmet,” *sinister* “a Mexican peon, both proper”), rushed to the site and directed the engineering and work of 1,000 men to turn the black flood into the reservoir, valve the blast, and push the pipeline to Tamiahua.

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Águila’s gangs finished the pipeline to Tamiahua in good time to transport finally the company’s own crude to the company’s barges and new tanker for transport by sea to Minatitlán for refining. Águila had gone to fabulous lengths to fight the “oil war” without its own oil; on Pearson’s orders between October, 1908, and December, 1910, 33 shipments of Texas Company and Gulf Company crude (pipelined from Oklahoma) went by tanker from Port Arthur, Texas, to Minatitlán, at least 19 of them on the *San Cristóbal*. Once Águila had its own crude from the new, northern field, in full production carried by its own transportation, it expected to fight Standard-Pierce-Doheny on the new strategic ground of refining, and in alliance with Hacienda win the war, monopolize the country’s oil market. But this war had already triggered another war, an insurrection in which (Standard-backed) angry, hopeful men with rifles were trying to overthrow the government, which led to a revolution, which led to other revolutions, which precisely during the Mexican oil industry’s Golden Age became the Mexican Revolution--but that is another, much more complicated story.

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So far as I can tell, no disruption happened in either Mexican Petroleum’s or Águila’s development (in the oil industry’s sense) from 1908 to 1910. No doubt at both companies’ construction sites individual workers for various reasons, including discontent with wages, hours, or working conditions, left their jobs; almost certainly groups did too, especially groups of Mexican laborers. But their departures, individual or in groups, did not stop development, for others at the site or quickly arriving took their place and did the work, so that development continued. Nothing in the record I have seen to date indicates anything workers did even slowed development then.

What could have stopped it, even slowed it? Plenty. Never mind outlandish possibilities, like arctic freezes, an earthquake, millennialism in the Huasteca, federal promotion of unions in the industry. Think of events within the realm of local risks, another hurricane, or two, or three, or an epidemic, which would have affected both Mexican Petroleum and Águila. Or imagine one company inducing locals to start armed attacks on the other company's supply lines and construction in progress (as in Pennsylvania in the 1890s), which might have shortly led to a real "oil war" out in the country between Tampico and Tuxpan. What about a rebellion in the Huasteca (shades of the Caucasus, 1905), guerrillas or bandits robbing the camps laying the Juan Casiano-Terminal pipeline, or hijacking the teamsters hauling freight for the Potrero del Llano-Tamiahua section, or capturing some tankies for ransom, or fighting each other to extort payoffs for the protection of the laying-gangs? Or simply a local cacique's promotion of unions in the company where his people drove the teams or did the common labor? If sufficiently strong, preemptive, serious, such events or action might have given a decisive advantage to one company over the other in reaching full production, gaining a monopoly (even if at the cost of provoking the other company to fierce counterattacks). But nothing of the sort happened, and even if it had, it would have been interesting only from a natural, social, political, or cultural perspective, not industrially or technically, not from an engineer's perspective. In the actual short story of development between 1908 and 1910, what is industrially or technically interesting? Were there workers in industrially or technically strategic positions, holding disruptive power in this construction? If so, if they had stopped working, how many other workers would have to stop, and for how long? And why did they not use their power?

The teamsters had most workers depending on them, for until they delivered the supplies, tools, and equipment necessary for the work, no one else could work. But they had no leverage in timing; one day's delay was only one day's delay, many other workers waiting on them, tank builders, the pipeline gangs, but in the broad scheme of things only for a day, and as soon as the material arrived, able to go to work. And many teamsters stood ready to haul the freight. If some organized and pressed for a better deal, they would not likely have held up the loads for more than a day, before the spread foreman had others to haul them. There were no perishables or daily necessities to haul. Pipeline camps did not need milk. Only a Tampico longshoremen's or a Huasteca teamsters' union could have seriously stopped essential transport and supply. Neither existed.

The only skilled workers in these operations were the tank builders. But they had no workers depending on them. If they stopped their work, to try to force a better deal, they could not make other work for the pipeline stop too. It would probably have taken at most a week to bring replacements for them (from Oklahoma or Texas), a week of tank building lost, but later recoverable. In the meantime the other work could have continued. Only a tank builders' union, or organization or solidarity uniting the tank builders and the pipeline gangs, would have stopped it--a social action, not a technical determination.

Technically, the laying gang had the best strategic position, the most disruptive power. If it stopped working, the ditching gang too would soon stop, for technical reasons (an open, unused ditch would soon cave in, the work for it gone to waste), and necessarily then the lowering-in gang, the papering-gang, and the covering-up gang would also stop. No work in laying pipe took a skill (in the proper, technical sense), the distinction or understanding or mastery that a worker needed a year or more of training and practice to learn. Some old cats would have been at the work for some years, but not because they had needed more than a week or two to learn to do it right (and without hurting themselves or their fellows). Only one job there required a month or more of trained, devoted practice (and the confidence and authority born of practice), the job of stabber, aiming the joint into the connection, directing the gang. If he dropped dead, or got hurt, or quit, the only replacement right at hand would likely have been his apprentice (de facto), the connection man, still learning the feel of the swing and angle of things, but able to keep the work going, not as fast, with some stripped threads and wasted collars, mainly because whoever became his replacement at connection was learning as he went, but all still moving ahead. If, however, both the stabber and the connection man decided to stop work, the rest of the laying gang would have to stop, and all the gangs behind them. Technically then these two men could stop maybe 160 other men from working, in effect (except for the tank building) the entire operation. But once the gang's foreman discovered they were the culprits, he would have replacements for them probably within two or three days (from other construction crews in the field), and unless some social action followed, say, the replacements rejected by the other old cats, or by the ass workers, the work would resume as before. But these workers were replaceable maybe the same day (the ass workers from other gangs). At most, at worst, the disruption would last a week.

If the ditching gang quit, the workers behind them would have to quit. Maybe 45 workers downing their tools would then soon stop the work of twice their number, all told maybe 135 workers idled. But ditch-diggers were the workers almost the easiest to replace; the foreman would have another ditching gang at work within hours.

Likewise back down the line: The lowering-in gang could stop its own work, any necessary papering, and the covering up, but for no more than a day. The papering gang could stop its own work and the covering up, but for no longer. And the covering-up gang (the very easiest to replace anyway) could stop only its own work, and that for no longer than the foreman wanted to leave the line uncovered.

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Assuming (provisionally) the records so far available to us are representative, I think we have here only one interesting industrial or technical question about the strategic work of development in Mexico, 1908-10. It is, why did the laying gangs' old cats not have a union, or not act as if they did, not cause some notable disruption? Drilling-rig carpenters in U.S. developments held strategic positions technically much more powerful, but the key men on urgently needed pipelines in Mexico then, the stabbers, held positions technically worth considering. Why did they not use them, at least organize themselves and the other old cats informally?

I have two complementary hypothetical answers. First, stabbers and connection men probably did exercise their technical power in assigning the snaps, and collectively the old cats probably did have some informal organization, uneven in any gang, but from some common experience, mutual acquaintances, or prospective cooperation, enough to make them substantially more than a group of random recruits. If I had evidence of differential compensation, of these workers receiving higher pay or shorter hours or better working conditions than semi-skilled and unskilled workers on construction projects of less urgency in Mexico then, I could argue this hypothesis, and maybe prove the point. It would mean, among other consequences, these workers would be receiving a kind of rent, or premium, for the strategic importance of their work, not for any tacit skill or their nationality or language or physical features.

The second hypothetical answer, for which there is at least circumstantial evidence: Stabbers could not press their technical power more than they did, because they, their connection men, and the other old cats had very little economic protection, and no social, political, legal, or cultural protection. Their kind of labor power was cheap all across Texas and Oklahoma (cheaper still, as Furber observed, in Cuba). It was even cheaper, much cheaper, all across Mexico. Economically, to repeat, it would be easy to replace them. Economically, indeed, after maybe a month, it would make more sense to fire them, and hire Mexicans instead. But being U.S. Americans in rural, coastal Mexico, unlike Mexicans there, including Mexicans from elsewhere there, they worked in practically complete social isolation, culturally helpless, incapable of communicating with most of their fellow workers (Mexicans), and subject politically and legally to immediate deportation. They could press so far as far as they did, but no farther.

If some workers could use industrial and technical divisions of labor against the company, the companies could use social and political divisions of labor against all their workers.

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October 25, 2004

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