PRIMITIVE ROPE-MAKING IN MEXICO

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Some seventy-five miles east of the ancient mining town of Catorce and twenty-five miles east of the village of Doctor Arroyo (or Valle Purissima) lies a valley skirting the western base of the eastern Sierra Madre of Mexico. This, like neighboring valleys, is partly occupied by Mexican rancheros, whose feudal haciendas are centers of dependent population, chiefly native. One of these haciendas lies midway between Doctor Arroyo and the mountain-bound hamlet of Miquihuana; it is crossed by the Tropic of Cancer, near the meeting point of the three states of Tamaulipas, Nuevo Leon, and San Luis Potosi, and is a three days' mule trip southwest of Victoria, capital of the first-named state. The scant population is of the customary mixed character; estimated roughly, a half or two-thirds of the individuals are Spanish-Indian, the remainder pure Indian; there may be half a dozen pure blood Spaniards in as many valleys; and the aggregate blood is probably three-fourths or four-fifths Indian. The Indians probably belong to the Guachichil group of the Nahuatlan stock.

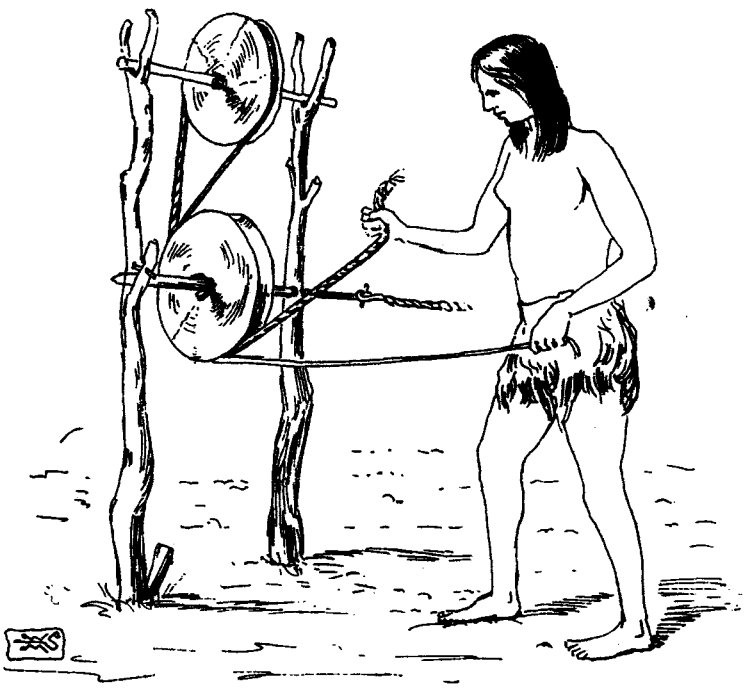
With one exception, the chief industries are agriculture and stock-raising, both conducted in a small and rather sporadic way, under the direction of the patriarchal dons of the haciendas, aided sometimes in part by a tributary yeomanry, always in chief measure by an Indian peasantry—peons before Diaz, and little more than nominally elevated above that condition today. The industrial methods are largely aboriginal, since the Spaniard assimilated most things native instead of displacing them like the Anglo-Saxon; the silver mine at near-by Matehuala was put down two hundred meters without the use of pick or shovel, drill or explosive, by native miners under Spanish and American superintendence; and the agricultural methods are equally unlike those familiar to los Americanos. The exceptional—and principal—industry is still more purely native; it is the harvesting of a crop never cultivated or even planted. This crop is taken annually from a fiber-yielding agave, related to sisal, known locally as lechuguilla. The plant grows in bunches or

tufts sparsely scattered over the foothill slopes; the harvest is gathered by solitary and wide-wandering Indians, provided commonly with machete for use as knife and heckle, sometimes only with implements of stone. Each adult harvester has a weekly stint of seventy-five pounds of clean fiber, which he exchanges at the hacienda for corn and manta, the customary food and wear of the peasantry, with now and then a few centavos or reales to be expended for lethal mescal, staked on the Sunday cock-fight or dissipated in gambling. The fiber is carefully stored by "el Patron," in the original sheaves or bundles until a quantity is accumulated, then packed on burro trains to the nearest seaport or railway station, whence it is shipped under the name of ixtli; its ultimate destination is vaguely supposed by the rancheros to be Liverpool, where it is probably transformed into sisal cordage. This fiber is the chief commercial product of the district.

While the greater part of the ixtli is exported, a portion is used locally in making cordage and a variety of coarse fabrics, especially pack-ropes, riatas, and other equine appurtenances, together with smaller cords used in thatching roofs and walls with the stipes and bast of a yucca, here developed into a lofty and wide-branched tree. With this use of the fiber a highly developed art of rope-making has grown up, and there are usually two or three rope walks on each extensive hacienda. It is uncertain whether the art is strictly aboriginal or essentially acultural, though it is certainly primitive, and the most skillful rope-makers are either Indians or Mexicans of predominantly Indian blood.

The typical rope walk is merely a well-trodden path, perhaps a hundred feet long, from which the greasewood and other shrubbery have been cleared, with a simple device at one end for converting alternating reciprocal motion into the continuous and uniform rotary motion required to twist the rope. This device is of interest partly because of its simplicity and effectiveness, partly because it seems not to have been recognized hitherto by students of technology. The mechanism consists of two wooden pulleys or sheaves, mounted one above the other in about the same plane, on wooden shafts supported by upright posts set in the ground, together with a strap or harness (a rope six or eight feet long) laid over the upper pulley and bent under the lower; the ends of this strap being grasped and alternately pulled by the

right and left hands respectively of the operator—usually a half-grown girl. The shaft of the lower pulley is prolonged in the line of the rope walk, and the initial loop of the rope is simply laid over its tip and fastened with a wooden pin. The entire apparatus is rude, being hewn out of mesquite and ironwood and put together with no other tools than machete, ax, and awl. It is represented in the accompanying figure, drawn by Mr Wells M. Sawyer from oral description. Within reasonable limits the



dimensions are immaterial and determined by convenience of the maker, though commonly the lower pulley is the larger and the more carefully rounded. The average dimensions may be, for the upper pulley twelve inches in diameter by two inches in thickness, and for the lower fifteen inches in diameter and two and a half inches in thickness; the groove in the upper pulley is commonly V-shape, and that in the lower U-shape and sufficiently broad to accommodate easily both strap ends. In none of the observed cases were the pulleys turned; they were simply

rounded by the eye, and subsequently squared and centered on the shafts by means of wooden wedges driven into the rudely chopped eyes.

The operation of the apparatus is simple and easy in appearance, though actually it requires a sleight gained only by considerable experience. To illustrate it more clearly, the strap in the illustration is drawn with a taper. Neglecting the initial or starting manipulation, it is as follows: The left-hand end of the strap is slackened, perhaps so far as to fall away from the lower pulley, while the right-hand end is pulled strongly and steadily; the weight of the slack end gives the central part of the strap a moderate frictional hold on the upper pulley and a still better hold on the lower, which accordingly rotates at the rate of pull. At the end of this pull (ordinarily about thirty inches) the right-hand end is cast quite slack, while the left-hand end is pulled steadily; this gives a slight frictional hold on the upper pulley, which gradually checks its momentum and motion, meantime giving the requisite frictional hold on the lower pulley to rotate it at the rate of pulling. At the end of this pull the first movement is repeated, and so on indefinitely. The effect, under the manipulation of a skillful operator, is to give uniform rotary motion to the lower pulley, while the motion of the upper pulley is irregular, ranging from a rate corresponding with that of the lower to a slight reverse rotation about the end of each left-hand pull. The solid wooden pulleys are of course sufficiently heavy to act as balance wheels, and it is probable that the elasticity of the whole mechanism, including the incipient rope in the hands of the rope-maker, contributes toward the steadiness of motion.

The mechanism is modified somewhat by different rope-makers—indeed, no two are exactly alike in form and dimensions. In some cases the two pulleys are of approximately equal size, while in others the lower is much the larger. Again, the rude axles may be made thick, one or both, when the driving strap may be laid over and bent under the axles beside the pulleys, which then serve merely as balance wheels; while the most skillful rope-makers use a double machine, in which another shaft (perhaps carrying a balance wheel) corresponding to the lower is mounted just behind it, the two shafts being connected by means of a rope belt in such manner that their motion corresponds as exactly as the rude mechanical construction permits.

Distant observations indicated that the harness also is modified somewhat by different operators.

The work of the rope-maker also looks simple, though it requires a sleight only to be developed through years of experience, particularly when two strands are twisted at the same time. Taking a truss (or large armful) of fiber, which he supports with the left hand, he with his right hand doubles a wisp over each of the shaft ends and fastens them by means of the pins, allowing the ends of the wisps to lie in contact with the truss; then the operator starts the machine, while at the same instant the rope-maker moves backward at such rate as to permit the squirming wisps to lay hold of just the requisite quantity of fiber in the bundle; he continues backing away, using his right hand to aid the incipient rope in selecting fiber when necessary (though if he is skillful this necessity rarely arises) and to help his left in raising, lowering, and slightly turning the truss as the twisting strands creep about gathering material, until the last handful of fiber is consumed and he is at the end of the walk. He then has two strands of astonishingly uniform size, say a fifth or a quarter of an inch in diameter, according to the size of the projected rope; holding one in either hand, while the operator continues driving the machine, he gradually tightens the twist, giving a tremulous or wavy motion to the strands in order that the tension may be equalized from end to end; at length the two are brought together and allowed to intertwist at a rate controlled by the strength of his pull, the driving machine being kept in operation, and the twist, as before, being equalized by an undulatory movement; finally the machine is stopped, the operator takes off the loops and brings them together, and the two-strand cord is done. These cords are commonly doubled to form four-strand ropes. When a single machine is used, an assistant is required, either to help take off the first strand while a second is made, or else to hold the center of the single strand while it is doubled by the rope-maker, who returns to the machine to complete the operation; the rope walk in the latter case including additional paths. The ropes made by the single machine are generally inferior to those of the double apparatus, though three-strand cordage is sometimes made on the former.

The greater part of the product of these primitive rope walks is used locally, but some of the better ropes are exported into

neighboring districts, at least as far westward as the Mexican National railway.

The observations herein recorded were made in the autumn of 1891, during an extension of a geologic excursion through the southern states. The party in the portion of Mexico described comprised R. T. Hill, of the United States Geological Survey; Anita Newcomb McGee, M. D., A. C. Truehart, of San Antonio, and the writer. The customary hospitality of Mexico—the graceful compound of Castilian courtesy with aboriginal communality—was enjoyed by the party at Doctor Arroyo, at Miquihuana, where no white woman, and Bustamante, where no white man was ever seen before in the memory of the elders, and especially at Hacienda el Carmen, the principal center of ixtli-gathering and rope-making in the lechuguilla (*Agave heterocantha*) district.

BOOK REVIEWS

The Biological Problem of Today. By Professor Dr Oscar Hertwig, Director of the Second Anatomical Institute of the University of Berlin. Authorized translation by P. Chalmers Mitchell, M. A. The Macmillan Co., New York. Price, $1.25.

This is a translation of Hertwig's "Präformation oder Epigenese," the tract in which the most celebrated embryologist of Germany examines and discusses the theory of Weismann upon cell development and heredity.

This theory owes its force to the fact that it involves certain hypotheses of cell structure suggested by the atomic theory of chemistry. As the latter supposes matter to be composed of atoms aggregated into molecules that give it its physical characters, so Weismann conceives that protoplasm is composed of aggregations of a still higher order, of biologic units or *biophores*, each of which has a complicated but definite molecular constitution that produces the special phenomena of cell activity. To account for the specialization of cells, he holds that each special kind contains a group of groups of biophores peculiar to itself. These groups he calls *determinants*, since they determine the special character of each class of cells. To account for hereditary transmission, he assumes that certain portions of the ovum and spermatozoon contain groups of determinants from all parts of