

AN AUTOMOBILE STREET CAR.

BY W. E. PARTRIDGE.

The illustrations accompanying this article represent a highly interesting novelty—an automobile street car built for Thebaud Brothers, of this city. Although Yankee inventive ingenuity has been directed toward this end for perhaps fifty years, success has not been

heretofore attained by any of the designs which have been tried. Steam has failed chiefly for want of adhesion. The storage battery car has been too heavy. The compressed air schemes seem to have failed from a complication of difficulties, one of which, and perhaps the most important, was lack of adhesion. Singularly enough, the present successful combination is

not the result of Yankee enterprise. The idea comes to us from the city of Merida, in Yucatan, and the successful car is the result of the persistent efforts of Señor Don Nicolas Escalante-Peon, at present Director-General of the Consolidated Railway systems of Yucatan. After using and becoming familiar with American-built automobiles of various systems, and after

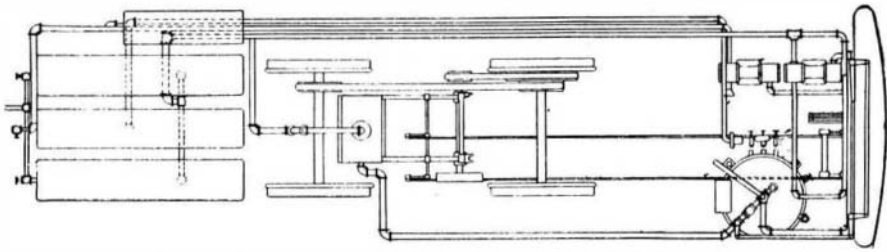


Fig. III.—Plan Showing the Drive Connection Between Car Axles

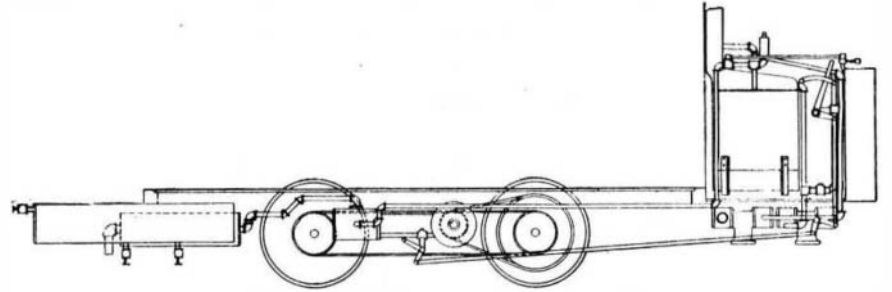
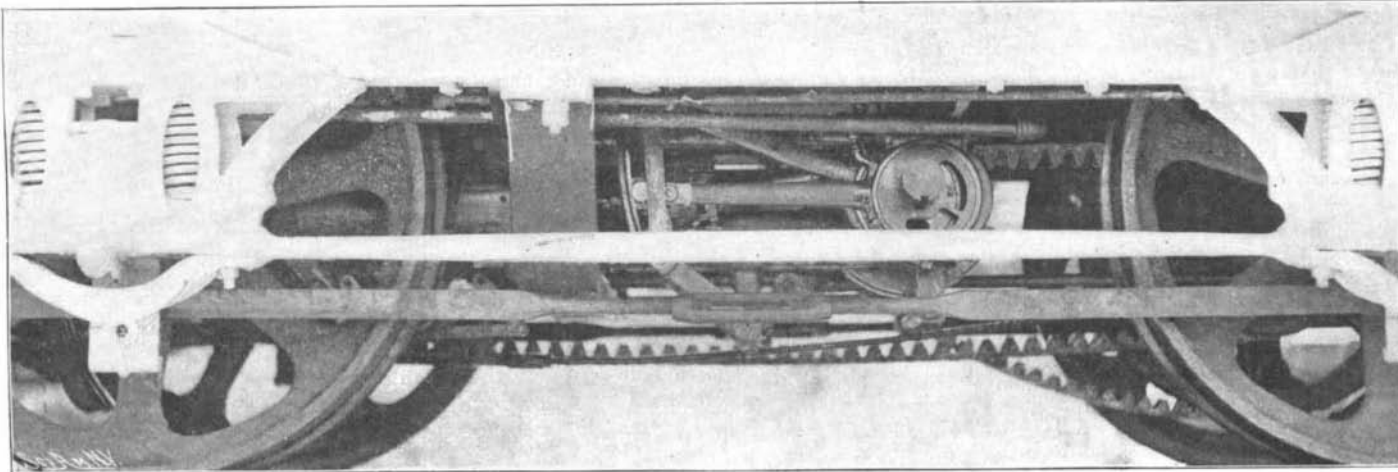
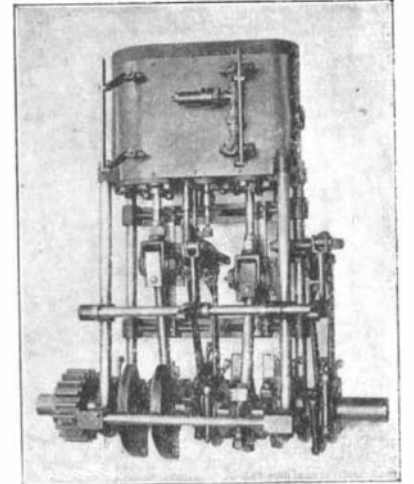


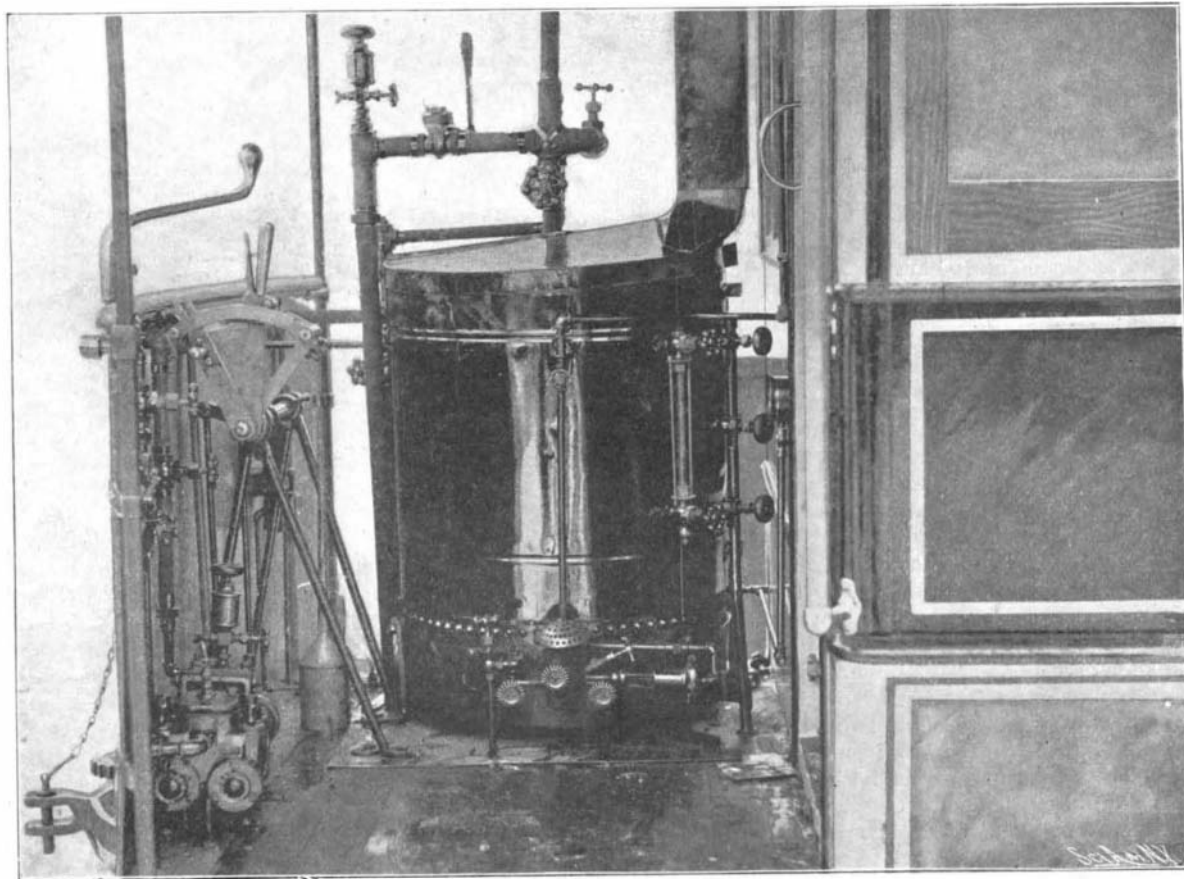
Fig. II.—Side Elevation; Storage Reservoirs at Left End.



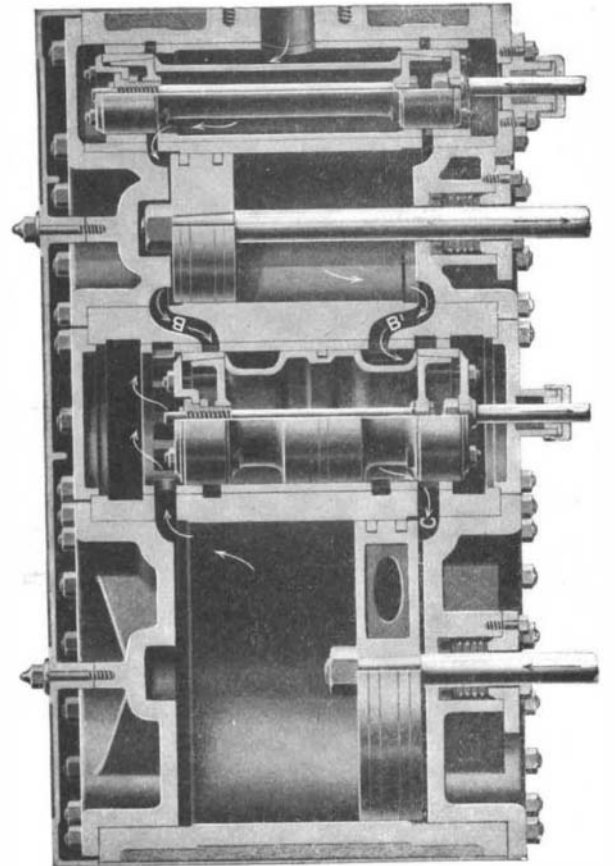
Looking Under the Car Showing the Engine Shaft and Drive Belts.



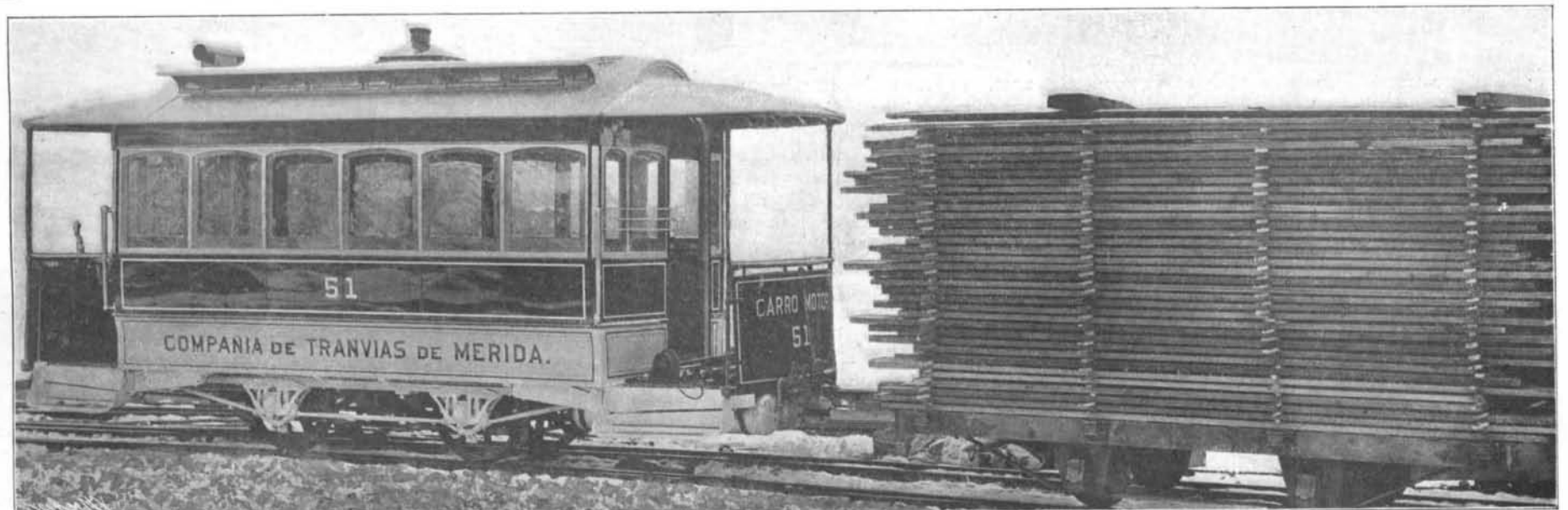
The Engine, Counterweights and Driving Pinion



The Boiler, Pumps, Reversing Lever and Throttle Lever on Front Platform.



Sectional Elevation of the Compound Engine.



A NEW STEAM AUTOMOBILE STREET CAR.

trying unsuccessfully gasoline motors attached to street cars, the case was put about in this way: "Steam automobiles are successfully used which weigh as much as our street cars, and operate at a higher rate of speed than we require. Send us out a car of our standard patterns, to be operated like an automobile." It was a difficult task to find firms willing to undertake this apparently simple engineering problem, and some two years has elapsed since the order was given to execute the idea. The John Stephenson Company, of Elizabeth, and the Reeves Engine Company, of Trenton, N. J., finally undertook the construction of the car and the equipping of it with an automobile engine of sufficient size and power for the purpose.

Our lower engraving represents an external view of the car with a truck load of lumber attached to it as a trailer, for the purpose of testing its power. The car body is 14 feet long, similar in every respect to the street cars used in the city of Merida.

The street railway system of Merida is an extensive one, but peculiar in that it radiates from the central plaza in all directions. The gage is 3 feet, and the motive power hitherto employed has been the small mules of the country, singly and in pairs. Switches and turnouts seem to be the exception rather than the rule, and the cars from the different lines come into the plaza in succession, so that the last in is the first out. As electricity is out of the question, the need for a self-propelled unit becomes unusually great.

The small size of the car is in some respects advantageous, but the narrow gage makes it difficult to find space for the machinery. The arrangement is shown in Fig. II., which is a side elevation, and Fig. III., which is a plan. These diagrams show the machinery with the car body removed. The boiler is located at one side of one platform. The engine, shown in a vertical position, is placed horizontally between the wheels under the car body. There is barely room between wheels for the compact little machine and the necessary gear wheels and chain.

The large view shows the location of the boiler, pumps, etc., on the platform. In the long view, looking upward under the side of the car, will be seen one of the broad cradle straps, by which the engine is held against the heavy subsills of the car. The engine and driving machinery is, however, self-contained and does not transmit any of its strains to the car body beyond those occasioned by its weight.

The boiler itself is an upright tubular of the standard automobile pattern. It is 2 feet high and 2 feet in diameter, with an automatic burner suitable for either gasoline or kerosene. The engineer, standing by the side of the boiler, finds within easy reach the reverse lever, throttle whistle, and all the valves necessary to control the apparatus. In fact, this part of the car resembles a magnified automobile.

The engine and the driving apparatus present the greatest novelties. The engine is the Reeves Engine Company's new compound engine, modified to suit the peculiar conditions of automobile service.

One view shows a partial section of the engine and its frame. The cylinders are 6 inches stroke by $3\frac{1}{2}$ inches and $6\frac{1}{2}$ inches in diameter. Two piston valves are employed, both of them capable of being adjusted at each end by taking off bonnets. A remarkable economy in steam is obtained by reducing the clearance to an unusually small amount.

For stationary purposes the cranks are set, as shown in the upright view, at 180 degrees, and exhausting directly across the low-pressure valve without the use of a receiver. This was impracticable for automobile purposes. The cranks being of necessity placed at 90 degrees, changes have been made in the ports and passages, and the high-pressure cylinder exhausts into the space around the low-pressure valve, which is used as a receiver. The low-pressure valve admits steam to and controls the exhaust from the low-pressure cylinders. These valves are controlled by eccentrics and a link motion, which gives a very perfect steam distribution and a perfect control of the engine. There are many interesting details in the construction of this engine, such as metallic packed stuffing boxes, counterbalances for the cranks and other things highly important, but which cannot be mentioned here. The engine drives a crank shaft, or jack shaft, upon which is placed a gear wheel. On the axle opposite the cylinders is another gear wheel. These two are connected by a Renold silent chain gear. These chains have been very happily described as "flexible internal gears." The speed ratio is $3\frac{1}{4}$ to 1, the engine being geared down to the 30-inch driving wheels. Both axles also carry gear wheels of equal size, over which a second Renold chain is placed, thus making all four wheels drivers.

The secret of the success of the machine is largely due to the gears. The direct-connected steam motor has but a small fraction of the tractive force possessed by a geared engine. A three or four per cent grade represents about the limit which a direct-connected machine can overcome, while a geared engine can successfully operate on grades up to eight or ten per cent.

The engine, chains and gear wheels, and fixtures,

weigh about 1,000 pounds. The boiler, pumps, etc., bring the total weight of the machinery up to about 2,500 pounds. The running gear and car body weigh approximately 5,500 pounds. This makes a total load of 9,000 pounds. Loaded with the equivalent of twelve or fourteen passengers, this car handles with ease around sharp curves the loaded four-wheel truck shown in our lower engraving. This was a loaded lumber car, weighing about 9,500 pounds. The test was made in order to ascertain whether the car could handle a crowded trailer with ease, and it was evident that it could do so. Probably two of the smaller cars used in Merida could be hauled when crowded to their utmost capacity.

The steam pressure is 225 pounds, and the boiler is capable of maintaining this pressure when the engine is working to its fullest capacity. In the cases of the trial trip, the car on one occasion, without a load, pushed the trailer, weighing more than 9,000 pounds, with perfect ease on the straight track.

This car illustrates the fact that an invention or an idea cannot always be made successfully until the times are ripe for it. In this case we have the necessary features of a compact, efficient compound engine; a driving chain; a safety boiler; a burner, automatically controlled; liquid fuel; a compact direct-acting steam pump; an air pump, and an injector. All these individual features are the result of years of experiment in their lines, and success would be hardly possible with any one omitted.

INDIAN PHYSIOGNOMIES.

BY GEORGE WHARTON JAMES.

The study of facial characteristics has always been interesting. "The eyes are the windows of the soul," the poet tells us; and there are few people who do not believe themselves competent to judge somewhat of character from what the face presents. Lavater and his followers believed a definite science could be constructed, the laws of which would infallibly determine the reading of character from facial or physiognomic characteristics. Later scientists, while discarding Lavater's ideas, are emphatic in their statements that important ethnologic truths may be learned by careful study and competent measurements of facial, cranial, and other physical developments. Much work recently has been done by Dr. Hrdlicka, of the Hyde Exploring Expedition under the direction of the American Museum of Natural History of New York, along these later lines.

A few notes on Indian physiognomies may therefore not be without interest to the readers of the SCIENTIFIC AMERICAN. The Indians pictured are of the Mohave and Yuma tribes, residing on the Colorado River, on both the California and Arizona sides, and the photographs were made on a trip I took by boat from the Needles to Yuma in February of last year.

These tribes are akin and are classed by Powell as the Yuman family. By some they have been regarded as of Apache kinship, but there is little, either in their language or in any other characteristic, to connect them with this Arizona branch of the great Athabaskan family.

One thing is especially noticeable, and that is that all the older men have very wrinkled faces. These marks of time, of Nature's stern frowning, seem to me to have one clear significance. It is the outward and visible sign of the pathetic struggle for existence which has been never-ceasing in the history of most aboriginal races, and especially so since the advent of the white man. Indeed, when I made the photograph (Fig. 1) of a Mohave Indian he was telling me of the hard fight he was having to get a sufficiency to eat for himself and his family. It is not a distinctively Indian face. Dressed as a white man, smoothed and straightened up, he would not be far from a Caucasian in appearance. His lips are not so thick, the base of his nose not so broad, and his cheekbones not so high as those of most of his tribe. His hair was done up in long "tow" kinds of rolls, and then wound around on his crown somewhat after the fashion of the Chinese. (I coin the word "tow" to suggest the tow-like appearance of the hair as seen in Fig. 2.) The major portion of the old men of both the Mohaves and Yumas wear their hair in this fashion, and it is this custom that led the Indian Department a few months ago to issue an order that all Indians who were in any way dependent upon the government for bounty or pay must cut their hair shorter. Fig. 2 is of a much older man, toothless and almost blind. He is a tall, stately Mohave, and must have been a physical giant in his youth. The square jaw, thin lips (for an Indian) denote power. Yet there is a singular gentleness shown in the arch of the nostrils. The large coronal or brow development is remarkable. If one covers the eyes and back of the head, and looks but at the nose, lips and chin, an astonishing resemblance is readily seen between this face and that of Gladstone.

I doubt very much whether the most renowned physiognomist could have read cannibalism in the face of the Indian pictured in Fig. 3, but if his own confession goes for anything, he has often been a consumer of

human flesh. Though he wears a beard, he has more genuine Indian characteristics than either of the two hitherto considered. His nose is flat at the base, cheekbones high, lips thick, and his eyes are dark, liquid, and large. There is something positively "ogreish" in the manner in which he licks his lips and rolls his eyes when reciting his cannibalistic feats before the campfire to a circle of his admiring tribesmen.

Figs. 4 and 5 are front and side views of the same Mohave. Here is a pure Indian face, with a strange resemblance to that of the late Li Hung Chang. In the smile, there is a jolly good nature shown. The profile view is by no means displeasing, though the front face shows broad base of nostrils and thick lips. The eyes are diseased, as those are of many of his people, undoubtedly owing to the constant sitting over the smoky fire of a chimneyless hut. The cheekbones are not protuberant; the ears are well shaped and set on the head. In marked contrast to most of their people, this Indian, as well as the one pictured in Fig. 3, have beards. It is one of the most common of sights to see the Indian, with small mirror and a pair of tweezers, pulling out the hairs on his chin and upper lip one at a time. This, and not that they cannot grow a mustache and beard, is the explanation of their general hairless lip and chin.

The next group of four photographs is of Yumas all belonging to the so-called friendly faction of this tribe. In almost every tribe are to be found two factions, corresponding somewhat to Conservatives and Liberals. The former are those who wish to adhere to the "ways of the old"—the habits, customs, ceremonies, religion, and general procedure of their forefathers; the latter compose the progressive element—those who are willing to forsake the old ways, and, ostensibly at least, follow the Washington way. While the effect of this following the new way may be of benefit to their children, there is little doubt in the minds of those who know them that the old men follow the new way because of the "loaves and fishes" associated therewith.

Fig. 6 is of Pasqual, the leader of the Friendlies. While present with the Yumas, I got the chief of the hostile faction to call a powwow, in which I stated my desire to photograph them, and why. There must have been fully a hundred men, women, and children present, and their resentment to the whites was open and pronounced. The chief said little, and it was soon evident that he was a mere puppet in the hands of Miguel, the orator and spokesman of that faction. This man is a disappointed politician. Because he could not be selected chief, he is determined to give the authorities all the trouble he possibly can. It was his son, it is generally believed, who set fire some time ago to one of the Fort Yuma school buildings, out of revenge for his father's defeat and to show that he himself had daring blood in his veins.

The result of our powwow was a refusal to allow themselves to be photographed, and a request that the whites leave them alone and allow them to walk in their own ways.

Defeated in photographing the Hostiles, I appealed to the Friendlies, with the result that I was rebuked for not first going to them. The policeman (Fig. 7) was eminently mortified. His face is narrower than Pasqual's, and in his policeman's uniform few would take him at first sight for an Indian. It is astonishing what a great change follows the cutting of the long matted hair, and the removing of the bands and other articles of Indian wearing apparel and substituting therefor the dress of the white man. If it were not for his dark skin, the Indian of Fig. 7 could walk through any city and not be suspected as an Indian.

Fig. 8, though of a young man, is a far more decided Indian type. Forehead, nose, lips, chin, cheekbones, and eyes, as well as hair and skin, all speak him an Indian. He is one of the leading athletes of the tribe, and is skilled in playing a pole and hoop game common to many Indian peoples and described by Catlin long ago as the chief game of the Mandans.

Fig. 9, too, is an Indian face, though much less so than some of the others. There is a keenness about these eyes, though old, and a general look about the mouth that denotes cruelty, and he is one who, in olden times, would have added a little more torture to that already decreed against any enemy hapless enough to fall into their hands.

Of the Mohaves it may generally be said that they are the most degraded tribe in the southwestern part of the United States to-day. They are the lowest in the moral scale from our standpoint, having not the least idea of morality as we see it. They believe God—their God—to be dead, but that his spirit is alive and is an evil spirit corresponding to the devil of the orthodox whites; that he resides in the Needles Mountains (passed by all transcontinental passengers on the line of the Santa Fé Railway as they cross the great bridge over the Colorado River at the Needles). This spirit acts as a judge before whom all the spirits of the dead Mohaves must pass ere they are allowed to enter into their Paradise, which is located on the Williams Fork of the Colorado River.

The Yumas are slightly more progressive, having