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THE PHYSICS OF THE BICYCLE.

When a wheelman is moving forward on a bicycle, what keeps him up? That is the question asked by inquisitive minds, as the rider passes swiftly along on a wheel base practically without width. Sitting on a still wheel is an almost impracticable feat; but it is simple enough to maintain an upright position when moving at a very slow speed. It is a physical fact that a body in motion persists in maintaining its plane of motion, and unless some additional force acts on the body at an angle to the original line of motion, it will continue to move in its original plane until stopped by friction or arrested by an obstruction. A body set in motion tends to move in a straight line, and will do so unless affected by a force acting on it in a different direction from that of the first movement.

To illustrate this point we might refer to the rim of a flywheel, which moves in a certain plane, but not in a straight line, because it is confined to a circular path by its spokes. Should the flywheel burst, its parts would fly off in paths that would be perfectly straight but for the force of gravity, and it is only too well known that these pieces are not easily deflected from the paths taken by them at the moment of the explosion.

A wheelman is propelled through space at a velocity sufficient to cause him to maintain his plane of movement. Should he desire to change this plane of motion, as in describing a curve, he can do it only by calling in the aid of gravity, i. e., he must lean to the concave side of the curve, more or less, according to the radius of the curve he is following. And further, in describing a curve, he is impelled outwardly by centrifugal force, which is more or less, according to his velocity, and he must oppose this force by a centripetal force, which in this case is gravity. This he does also by inclining his body toward the center of curvature of the path he is describing. In this case the wheel sometimes forms a considerable angle with the ground, so that under some conditions it slips from under the rider. It is in view of this fact that the circular bicycle race track at Manhattan Beach, Coney Island, has lately been constructed with a considerable downward inclination toward the center, so that wheels spinning on this curved track would be more nearly at right angles with the surface on which they roll.

The ability of a bicycle and rider in rapid motion to do serious damage in a collision with another machine or with a pedestrian is fully appreciated by few wheelmen. A man weighing 150 pounds and moving at the rate of ten feet per second (which is only about seven miles per hour) has a momentum of 1,500 pounds, leaving out of the account the weight of the wheel. This is sufficient to upset any pedestrian with terrific force. It has been suggested that the pneumatic tire forms a sort of fender which would prevent serious concussion in case of a collision. It would undoubtedly have a slight modifying effect, but it would be of little account. A collision between two wheels, each with a 150 pound rider, spinning at the moderate speed of seven miles per hour, would result in a smashup with a force of 3,000 pounds. In view of these facts, it is no wonder that bicycle accidents are often very serious.

The tractive force required to propel a bicycle over a smooth level surface is estimated at 0.01 of the load; calling the load 150 pounds, a force of 1½ pounds would be required to move the wheel forward, and this calls for a pressure on the pedals of 6¼ pounds on a wheel geared in the usual manner. When, however, the road is rough or on an up grade, the case is different. On a grade of 1 in 10, for example, the rider, in addition to the tractive force, actually lifts 1/10 of his weight and that of the machine.

With a rigid or semi-rigid tire the rider is obliged to exert sufficient force to lift himself over every obstruction encountered by the wheel; the descent from the obstruction gives back a portion of the power expended in surmounting it, but not all of it. In the case of the pneumatic tire, however, the small obstructions are not an opposing element of any consequence, as the tire yields, in lieu of the wheel being raised, and the result is the wheel travels as upon a smooth track.

NEW PRIZES FOR MOTOR CARRIAGE COMPETITIONS.

In the belief that the invention and perfection of the vehicle motor is destined to work a revolution in road transportation, and with a view of stimulating invention along that line, the proprietors of two papers, one in America and the other in England, have offered substantial cash prizes to be given to the winners in two new races. In America the Chicago Times-Herald offers \$5,000 to be awarded in a race between Milwaukee and Chicago; and in England the Engineer offers one thousand guineas (\$5,000) to the winners in a race to be held in some place in England, which will be decided upon later. The Times-Herald contest will take place about the 1st of November and definite details as to the exact date of the contest, with such regulations concerning it as may be decided upon, will be soon announced. The first prize will be \$2,000 and a gold medal, the same being open to the compe-

tition of the world; second prize \$1,500, with a stipulation that in the event of the first prize being awarded to a vehicle of foreign invention or manufacture this prize shall go to the most successful American competitor; third prize, \$1,000; fourth prize, \$500. The third and fourth prizes are open to all competitors, both foreign and American.

Over twenty-one American inventors have already notified the Times-Herald of their intention of competing. The present indications are that there will be not less than fifty and possibly double that number of vehicles entered in this race. It is too early to state how many French and German manufacturers will enter the lists, but it is probable some of the prize winners in the recent Paris-Bordeaux contest will endeavor to gain additional prizes. It is likely that the Daimler motor, which has proved so successful in both of the competitions held in France, will be used on several of the carriages. The offer of the Times-Herald is made with no intention of starting a "horseless carriage fad" or of promoting a craze in this direction, but it is the opinion of the best mechanical experts that the inventive genius of the world is in a fair way to solve the problem of propulsion on common roads by mechanical means, if it is not already solved. America is a country of magnificent distances, and its resources can never be utilized to the greatest advantage until the mechanical genius of the country has brought transportation to its highest possible development.

For some time past the Engineer, of London, has urged the repeal of such provisions of the existing acts of Parliament as prevent the use of light vehicles propelled by steam or other power on the public roads of the United Kingdom. On July 20, Mr. Shaw-Lefevre introduced the bill in the House of Commons designed to facilitate the introduction of horseless carriages in England, and when he explained the matter, not a single member objected, which was the more remarkable, considering how hard it usually is to overcome British conservatism.

The Engineer believes that the introduction of the automobile carriage into England would throw open a new branch of trade, so that the start which Continental engineers have made may not be allowed to interfere unduly with the home industries of Great Britain. They have, therefore, offered the sum of 1,000 guineas in two or more prizes for public competition upon one of the main roads of the kingdom. The rules and details of the competition and the names of the gentlemen who have consented to act as judges will be given out at an early date, and will be duly announced in these columns.

The carriages driven by petroleum now cost a cent or one and one-half cents an hour per horse power to drive them, so that even for a long journey the cost for fuel is not very great. The first cost of an automobile carriage is about \$1,000, not much more than a good carriage. Hardly any one would care to run a machine carriage more than ten hours a day, the cost being 50 cents a day for fuel or \$15 per month. Under favorable circumstances a good horse cannot be kept in a large city like New York or Chicago for less than about \$30 to \$35 per month. Because motor vehicles for common roads are practicable in France and England, it does not necessarily follow that they would be in America. The roads in those countries are almost perfect; but in this country a fairly good road is the exception, i. e., roads that are good the year round. Between the mud of the rainy season and the roughness when this mud is frozen, there are long periods of time when the petroleum carriage would have great difficulty in transporting passengers or freight.

ATLANTA EXPOSITION NOTES.

The work of construction at the Cotton States and International Exposition is rapidly approaching completion. Several of the buildings have been finished and accepted by the Exposition managers. The work of installation in the Electrical building has already begun, and the Machinery building is ready for exhibitors. The parking is almost finished and the grounds and buildings are beginning to resemble the completed Fair. The water from the city water works has been turned into the lake.

Dr. Daniel C. Gilman, president of Johns Hopkins University, has accepted the position of chief of the Department of Awards at the Exposition. This should be a guarantee of the high merit upon which the awards will be based.

The General Council of Philadelphia has decided to send the Liberty Bell to Atlanta. The request was refused at first, but the permission was granted after the Legislature of Pennsylvania decided to make a State exhibit.

The electric fountain at the Exposition is being constructed under the direction of the designer, Mr. Luther Stieringer. The design is that of a twin fountain, rising from an island in the center of the grand basin, immediately in front of the Machinery Hall.

The island which forms the groundwork for the base