CHANGES OF SPEED FOR BICYCLES.

In studying the rational gears for bicycles, we have reached the conclusion that for a cyclist of given strength the ideal gear would be that which, being modified according to the nature of the ground and its declivities, would cause the cyclist to work under constant conditions of angular velocity of the pedals, of pressure upon the pedals and of muscle. The progress made in the mechanics of the cycle will doubtless furnish a solution of this interesting problem ere long, but, in the interim, we may content ourselves with an intermediate solution that takes advantage of the elasticity of the human machine, from the standpoint of the three factors considered, viz., speed, pressure and strength, and simplify the problem by reducing the gears that a machine ought to present to two only, viz., a high one for smooth roads, even ground and feeble gradients, and a low one for steep hills and dangerous descents.

We propose in this article to examine the principal solutions of the problem in so far as they have received a material practical sanction, and as we have been permitted to see them or experiment with them. A word in the first place as to fruitless tentatives and incomplete solutions. At the Salon du Cycle of 1895 there figured two changes of speed with "shifting chain." The axis of the wheels and that of the pedals each carried two gear wheels over which a rather complicated mechanism caused the single chain to pass alternately, according as it was desired to obtain a high or a low speed. In order to cause the chain to pass from one train of gearings to the other, it was necessary to tauten the chain by jointing the axis of the pedals or by using a movable tightener. The system has not become popular, and the inventors have given up improving upon the first models constructed upon this principle.

A solution was afterward sought in the use of a double transmission with two pairs of gearings and two chains, only one of which operated at a time.

The Pegasus System.—The Pegasus bicycle, the essential parts of the change of speed of which are shown in Fig. 1, is founded upon this principle. In this apparatus, the axis of the pedals carries in the center a hexagonal part, C, upon which slides a double grooved pulley, B, provided with teeth upon its two extreme lateral surfaces. This pulley is actuated through a lever, A, at the will of the cyclist, who, moving it to the right or left of its mean position, causes its teeth to engage with those at the sides of the hubs that carry along the wheels, E. These teeth, D, cause one or the other of the wheels, E, to gear with the axis of the pedals, according as the pulley, B, is moved to one side or the other. When one of the wheels is in gear the other is loose, and vice versa. In properly selecting the sprockets that are actuated by the two wheels, E, respectively, one has at his disposal two very unequal gears that are easily modified by simply changing the sprockets that the two wheels actuate. The change may be quickly effected, during a run, through the simple maneuver of a lever and without the cyclist getting off the machine. The use of two chains and two pairs of gear wheels is an inconvenience that is counterbalanced by the fact that, if one of the chains happens to break, it is possible to finish the journey by utilizing the second chain and throwing the corresponding wheel into gear. Mr. E. Fontaine has found here a simple and elegant solution of the problem, but the arrangement gives the machine a somewhat heavy aspect.

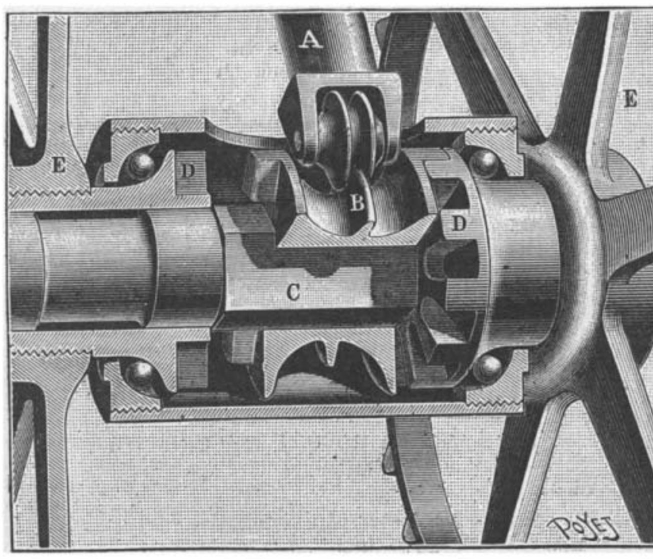

Fig. 1.—THE PEGASUS SYSTEM OF DOUBLE CHAIN CHANGE OF SPEED.

The systems that we are about to describe are based upon the principle of epicycloidal wheels. They are generally applied to the hub of the hind wheel, whose proportions and weight they increase to but an insignificant degree.

The U and R System.—This system, thus designated by the American Importing Company, consists essentially of a pinion, K (actuated by the chain), loose upon the axis of the hind wheel and with which mesh four small toothed wheels, H, whose axles are mounted upon the hub, M. Upon the fixed axis, G, slides a pinion, D, through the intermedium of the rack arm, C, actuated by the wheel, B, and axis, A. This pinion is capable of occupying three distinct positions, according as it is thrust wholly to the right (as shown in Fig. 2), toward the left or placed in an intermediate position.

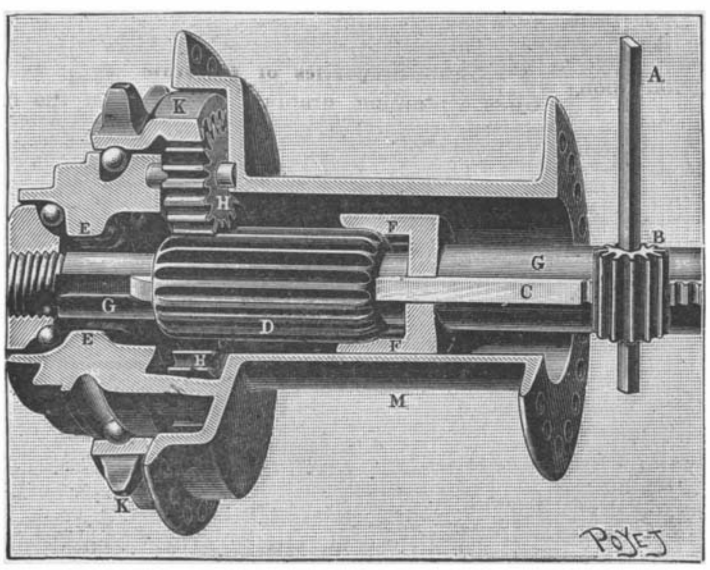

Fig. 2.—THE U AND R SYSTEM OF CHANGE OF SPEED.

The position represented in the figure corresponds to the reduction of speed. In this position the pinion, D, is rendered immovable in space, since its teeth mesh with those of the clutch, F, which is fastened to the fixed axis, G. The wheel, K, actuated by the chain, acts thus upon the hub, H, only through the intermedium of the wheels, H, engaging with the fixed pinion, D. The result is that at each entire revolution of the wheel, K, the hub, M, describes less than one revolution. If, for example, the wheel, K, is provided with 60 teeth and the pinion, D, with but 20, when K will have made one revolution, that is to say, will have moved forward by 60 teeth, the hub, M, will have moved forward but by $60-20=40$ teeth, say by two-thirds of the revolution. The ratio of the number of the respective teeth of the pinion, D, and the wheel, K, therefore regulates the reduction of the speed, which may, in principle, be of any degree. In practice, it varies between 25 and 35 per cent.

In the second position, the pinion, D, is pushed wholly to the left. It has left the clutch, F, and has come into gear with the piece, E, which is concentric with the axis and toothed internally. But the clutch, F, the wheels, H, and the hub are interdependent. Therefore, when the pinion, D, is pushed toward the left, the entire mechanism is blocked; that is to say, the wheel, K, the wheels, H, the piece, E, and the pinion, D, revolve together at the same angular velocity. Thus, in this position, there is no longer anything but an ordinary transmission. In order to pass abruptly from one position to the other, the extremities of the pinion, D, are rounded off, as are also the entrances of the toothed pieces, E and F. The piece, C, that carries along the pinion, D, does not enter the latter, but, for the entire length of the pinion, is reduced to the diameter of the fixed axis, G. The pinion is therefore loose upon the latter, which is fixed with respect to the frame when it is not held by the clutch, F.

In the intermediate position, in which the pinion, D, is not in gear with either E or F, all the parts of the mechanism become independent. The wheel, K, is capable of revolving while the hub is immovable, or inversely. It is necessary to avoid leaving the mechanism in this intermediate position, unless the machine is descending a long and gentle slope, and is provided with a brake that permits of a quick and certain stoppage before an obstacle that is unexpectedly met with.

The Cohendet System.—The Cohendet system is based upon a principle analogous to the one just described, but the mechanism is of a simpler and more compact form, and this permits of arranging it at will either upon the hind wheel or upon the axis of the pedals. We find here (Fig. 3) the internally toothed wheel, D, the small wheels, E, four in number, and the wheel, C, with which they gear. The method of actuating alone differs. When the machine is running at a normal speed, the toothed piece fixed to a disk that is fastened to the wheel, C, engages with the toothing, D, and renders the entire affair immovable. But if through the external maneuver of a combination of levers, not shown in the figure, we bear to the left upon the piece, A, we at the same time arrest the piece, C, and disengage the piece, A, from the teeth, D. The transmission of motion is no longer effected, except through the intermedium of the wheels, E, gearing with the fixed wheel, C. The ratio of the velocities depends upon the respective numbers of the internal teeth of D and the external ones of C.

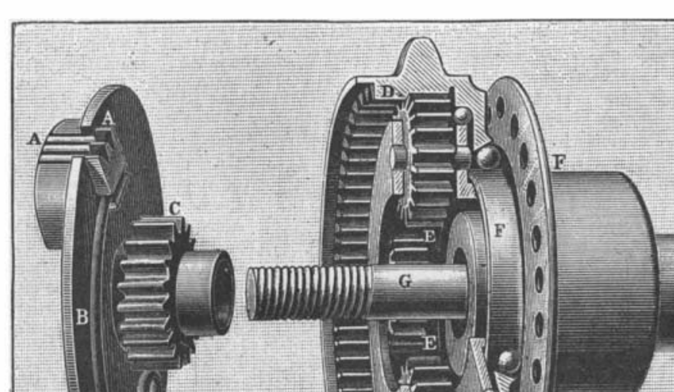

Fig. 3.—THE COHENDET SYSTEM OF CHANGE OF SPEED.

The two systems that we have just described are reducers of speed, that is to say, the internal gearings enter into play only during a small fraction of the total time, at the moment of ascending hills, and under conditions in which the easing up introduced by the reduction of multiplication more than compensates for the loss of useful effect occasioned by the introduction of an intermediate mechanism.

Some inventors have solved the inverse problem and devised a multiplier of speed, that is to say, an apparatus in which the auxiliary mechanism acts during the entire time, and is suppressed at a slow speed. In such a combination there are numerous inconveniences that render it unnecessary to dwell upon such systems, which are not so perfect as the reducers of which we have just given a few examples.

The objections made to changes of speed are three in number: complication, weight and cost. The complication is merely apparent, since the present processes of mechanical construction and the rational use of ball bearings permit of making light of difficulties and of reducing friction to insignificant proportions. Weight likewise is only of secondary importance, and we are getting somewhat over the idea that it is necessary before everything else to construct a light bicycle, with tubes too slender and fragile, with pneumatic tires too small to surmount obstacles, with frames too paltry, with crank arms too short, and with saddles too uncomfortable, through their want of good seating capacity. As the result of our experience, we think that an increase of weight of about two pounds introduced into a machine along with a change of speed device is largely compensated for by the advantage that it gives of ascending all hills without fatigue, and especially of descending them. As for the cost, that is evidently the most serious objection, but it is not of a nature to intimidate a goodly number of tourists, who will quickly get back in pleasure the amount that a good change of speed now costs. And, then, the last word is not said, and perhaps the fourth Salon du Cycle now opening will reveal to us some marvels that, the case occurring, we shall present to our readers as the natural sequel of this preliminary study, which recapitulates the present state of the question.—E. Hospitalier, in La Nature.

PROF. GILBERT DENNISON HARRIS is making a remarkable collection for Cornell University of the marine shells of the Eocene period in North America. He has finished work on only the first "stage" out of five or six. From this one "stage" alone, however, he has secured for the Cornell Museum specimens of every species previously known (about 100) and fifty more, hitherto unknown, which are consequently in no other museum than that at Cornell. Similar results may be expected from the remaining "stages," and great advancement of scientific knowledge in this field.