by the cam, *C*, coming in contact with the roller, *R*. The cam is of a spiral form and broader at one end than at the other. It is moved longitudinally on the shaft, *D*, as the speed varies by the throwing out of the governor weight, *G*. Thus when starting or running slowly the ignition occurs at or near the dead center. As the speed advances, the time of ignition is advanced ahead of the center. The adjustment is so timed that at any speed the ignition occurs at just the proper instant to give the maximum power and the maximum cushioning effect. Not only is great economy of fuel thus secured, but the greatest smoothness of operation is assured. As the ignition cannot occur ahead of the center in starting, there is no possibility of a dangerous back kick, and starting is exceedingly simple. When the maximum speed of the engine, usually 850 revolutions per minute, is reached, the cam, *C*, overruns the roller and no explosion occurs, so that an excessive speed of the motor cannot be obtained. This method of ignition regulation is a radical departure from the usual American method of throttling the mixture with fixed spark, and the French system of controlling the motor by hit-and-miss governing or by hand-regulated spark; and it unquestionably makes a distinct advance in the method of control of the engine.

Packard machines have given general satisfaction from the very start, probably because of the care given to details and the thorough testing each machine receives before it is sent out. The manufacturers aim to have the quality of their product always of the best, and no pains or expense are spared in fulfilling this aim. Four of their carriages won first-class certificates in the endurance contest last fall.

THE DURYEA GASOLINE CARRIAGE.

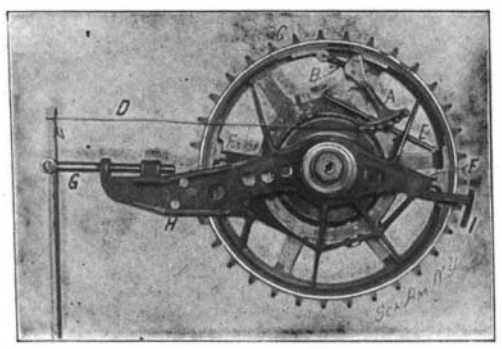
Our illustration shows the Duryea three-wheeled phaeton, which the inventor claims has many advantages over his regular four-wheeled machine, such as better traction, less liability to skidding, greater ease in steering and in making sharp turns, and numerous other good points he is always ready to demonstrate. This machine differs only from the regular model in having but one front wheel. Its mechanism is just the same as the latter, and consists of the following parts:

The motor, which has three 4½ by 4½-inch cylinders, develops from 6 to 10 horse power, according to its speed. One fuel pipe, *D*, supplies the three cylinders, the exhaust valves, *B*, of which are operated mechanically while the inlet valves, *C*, are opened by the suction of the piston and can be limited in their opening by the tapered slide, *F*, which is suitably connected through the lever, *G*, and the rack, *H*, to the controlling handle. When the handle, *R*, is turned a wide pinion on the lower end of the sleeve turns with it and moves the rack, which acts through its lever connection, *G*, to slip the slide, the springs under the inlet valves thus keeping them from opening and throttling the motor. The spring fingers attached to the slide slip over the inlet valve and relieve compression when the motor is started. The gasoline is vaporized in a float feed carbureter of the atomizing type, situated below the controlling handle, and having a needle valve capable of being set from the seat by turning a spindle that is level with the latter beside the controller. Contact igniters are used, and the wiring is all plainly to be seen, as well as the spark coil in the corner. A belt-driven magneto at *N* supplies electricity for the spark.

The clutches are contained in the drum at the left of the motor. They furnish the usual two speeds ahead and one reverse. The high-speed clutch locks the whole mechanism to the motor shaft and leaves no gears running. The low speed and reverse are obtained by one set of planetary gears. To obtain the former a band brake holds the internal gear and the spider on which the pinions are mounted revolves at a slow speed and turns the driving sprocket. To obtain the reverse the pinion spider is held and the internal gear is connected to the sprocket. The slow and fast speeds are obtained by pushing down or pulling up the controlling lever, which acts on the clutch lever, *K*, while a foot pedal tightens the band brake, *L*, for the reverse.

The controlling lever steers the carriage when pushed to the right or left, owing to its two levers being connected by chains to the steering arms of the wheels. Thus it will be seen that the machine is completely controlled by a single lever, and this with the greatest ease by but one hand, except when throwing in the clutches, which requires the use of both hands. As the motor is amply powerful to drive the machine on the high gear, however, the low-speed gear seldom has to be used, and the speed of the carriage is controlled solely by throttling the motor. This method of control, in combination with the triple-cylinder motor, gives great flexibility to the carriage. The vehicle can be suddenly brought from full speed almost to a stop by a slight twist of the wrist, and when it seems as if the motor must cease to turn unless thrown out of gear it can be sped up again instantly by a twist in the opposite direction.

The new form of band brake is of the expanding type, and acts on the inside rim of the sprocket on



DURYEA BRAKE.

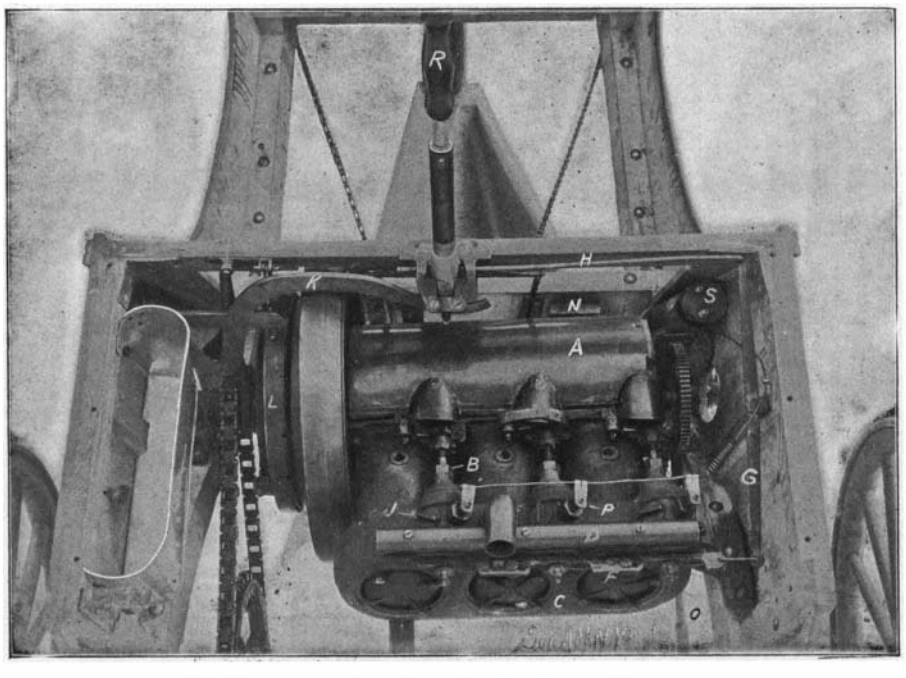
the differential gear. It brakes on a 14-inch drum, ⅞ inch wide. The ends of the band are separated by a lever, *A*, hinged at one end and carrying a band in which an adjusting screw, *B*, is threaded. This is swiveled in the hinge, *C*, on the other end of the band, so that a forward pull on the end of the lever, *A*, expands the band and makes it bind against the inner surface of the sprocket. The pull is transmitted from a brake lever at the front of the carriage to the lever, *A*, by means of a small flexible wire, *D*. The lever, *A*, has an arm projecting at such an angle that the spring, *E*, gives a powerful pull when the brake is nearly off and has less effect as the brake is applied. By this arrangement and the arrangement of the toggle a very slight pressure will expand this brake quite forcibly and ordinarily slip the wheels on the ground. The large friction surface contributes to long life and lessens the danger from overheating on a long hill. The band is of metal lined ordinarily with gray vulcanized fiber. This band is supported by two lugs, *F F*, one in front and the other behind, which fit loosely in elongated eyes attached to the band. From this construction it will readily be seen that the braking effort is taken on the bottom side of the lug farthest from the brake lever in the line of motion, and since the lugs are at about 90 degrees from the brake lever, three-quarters of the brake band tends to apply itself, the friction on the end of the band assisting the push of the brake lever. This action is the same whether the motion is forward or backward. The method of support secures a brake nearly self-applying, and much lessens the effort required to stop the vehicle. If more self-applying effect were desired the frames supporting the lugs, *F F*, could be so shaped as to bring them nearer the brake lever, and thus make a greater proportion of the brake self-applying. In addition to the lugs, *F F*, on the frame or spider there are five other points or fingers which prevent the brake band from coming off at one place more than at another, and thus insure an even release all the way around, making an effectual safeguard against dragging, so common with most band brakes. Perhaps no other feature of a motor vehicle contributes so largely to lost efficiency as the dragging of the band brake, and a little attention to the fingers provided for holding the band in place effectually prevents this happening with this brake. The frame is also provided with a projecting forward end in which is screwed a rod, *G*, used to adjust the tension of the chain. In practical service both the chain and sprocket are covered with a leather guard supported on a framework secured to the frame shown by the screws, *H*, and the lug, *I*, in which screws are also placed.

The differential gear is of the bevel variety and is placed inside the large sprocket. It has four bevel pinions which, together with a central bearing, properly support the sprocket and effectually transmit the power.

From the above description it will be seen that the Duryea is a simply constructed carriage with a well-built, reliable type of motor. The latter is so situated that it can instantly be got at by removing the seat and front panels, and any necessary adjustments can be made without getting out of the vehicle. Built into the back of the latter is a water tank, and under the floor a gasoline tank is placed. The carriage is strong yet light, weighing about 800 pounds.

The Duryea motor has been successfully used in launches as well as in automobiles. A 22-foot boat equipped with one was found to develop a speed of 12 miles an hour in the Hudson River last spring; and launch users generally will find it a very suitable motor for light, high-powered pleasure craft.

THE DURYEA GASOLINE CARRIAGE.



DURYEA THREE-CYLINDER AUTOMOBILE ENGINE,

The King as an Automobilist.

The third motor vehicle constructed on the order of King Edward is being built at the works of the Daimler Company at Coventry. This royal vehicle is a pattern of safety and elegance. It is, according to The Sketch, the model motor of 1902—a fitting car for the coronation year. A couple of cars were built last year to the King's order, and he is so satisfied with the performances of these that he has ordered the third, and it is stated that he will be seen driving this one himself.

A gentleman connected with the household tells an interesting story of how the King was cured of an obstinate and long-standing case of insomnia by the simple expedient of taking an after-dinner spin in his car. When his friends ask him for his prescription for sleeplessness he invariably laughs and answers, "I advise you to take some large doses of Daimler."

A great wave of automobilism has passed over the country, and nobody can claim to belong to the smart set unless he has a motor in his stable. Royalists are beginning to follow the Kingly example, and insist that their vehicles shall be of English construction. Continental cars were for a short time fashionable, but many of these were found flimsy and unsatisfactory in the wear.

The general feeling in England is opposed to racing and record breaking or law breaking. Space annihilators and time pursuers are not altogether in harmony with British views. No particular object is served by a mile-a-minute demon. What is in most demand is a comfortable car for locomotion, social purposes and pleasure making.

The Cornwall Canal in Canada is lighted by 250 inclosed arc lamps, placed 300 feet apart, and the locks are lighted with a number of lamps.