THE PACKARD GASOLINE TOURING CAR.

The Packard gasoline automobile is a very good example of the latest and most successful American practice, and shows what can be accomplished by following persistently a given line of design. The manufacturers have succeeded in producing a smooth-running, powerful machine of the greatest possible simplicity and reliability, using but a single cylinder, four-cycle gasoline engine of what may be termed the Benz type. By means of the special construction of transmitting gear and engine control described below the shock of the explosions in the engine are greatly reduced and communicate no perceptible annoying vibration to the body of the carriage.

One illustration shows the general appearance of the Model F Packard machine with detachable tonneau body, and the other the complete mechanism without the body. The frame of the machine is made of one piece of channel steel bent to shape and reinforced with longitudinal and cross braces. To this is securely bolted the engine, which rests in a horizontal position with the cylinder end to the rear, and the inclosed gear case containing the change speed and driving gears. No underframe, so common in American practice, is used, but instead the rear axle is connected to the main frame by means of radius rods whose forward ends are pivoted at practically the same point as the center of the driving shaft, thus keeping the rear axle always in line and at a fixed distance from the secondary gear shaft carrying the driving pinion. By adjusting these radius rods the proper tension of the chain is secured. Bending of the springs is not depended upon to allow for forward and back motion of the rear axle, but the springs are of double elliptical section, the upper section being connected to the lower by links, allowing the necessary fore-and-aft motion. The front axle is connected to the frame by a parallel-motion device, consisting of a simple pair of ball joint rods reaching forward on a bracket bolted to the channel frame and a corresponding bracket on the front axle. The usual construction of semi-elliptical springs in front is abandoned in favor of the double cross spring, which allows the maximum of flexibility, giving in effect a three-point support to the main frame. This is clearly shown in the illustrations. Steering is by means of hand wheel fitted with worm and sector, and is nearly irreversible so that shocks communicated to the front wheels are not transmitted to the steering wheel. The action, however, is not entirely rigid, and undue strains on steering gear and parts are thus avoided. The wheels are of the artillery type with fourteen 1½-inch wood spokes. They are 34 inches in diameter, and fitted with 4-inch single-tube or clincher tires. The rear axle is provided with the usual spur gear differential driven by 1½-inch pitch roller chain. Ball bearings of ample size are used.

The speed-changing gears are carried on a short shaft directly in line with the engine shaft and connected with it through the clutch and spring transmission seen in the flywheel in the view of the mechanism. This spring transmission prevents much of the hard blow of the explosion from being imparted to the rear wheels and the body, and undoubtedly contributes greatly to the smooth running and long life of the transmission gear. It is an added advantage that the engine shaft and the gear shaft may be thrown out of line without producing strain or undue friction, as the driving plate of the clutch is loosely keyed to the spring-driven spider in the flywheel, making practically a universal joint. Directly below the main gear shaft is supported an intermediate gear shaft carrying the driving sprocket. On this latter shaft is a fixed train of gears. The main gear shaft carries two sets of shifting gears. By means of the single gear shift lever, *C*, these gears are engaged as desired, giving three speeds ahead and one reverse, but only one pair of gears can be engaged at a time, and the operation consists simply in placing the lever in the desired one of four slots in the H-shaped speed-changing gear standard. An interlocking safety device is provided by which gears cannot be shifted when the driving clutch is in engagement. Thus any possibility of stripping gears by making a mistake in shifting is avoided. The arrangement shown has a distinct advantage over the well-known Panhard system in that whatever speed is desired can be picked up directly without passing through the intermediate speeds. Thus if the carriage has been running on the high speed and it is desired to put in the reverse it is not necessary to shift through the intermediate and slow speeds, but the high-speed gears are thrown out and the reverse gears are engaged by one operation of the lever. When the proper gears have been put in mesh the clutch is engaged by pulling backward on the clutch and brake lever, *D*. Pushing forward on this same lever throws out the clutch and applies the powerful band brakes to the rear wheels. An auxiliary band brake is provided at the end of the intermediate gear or sprocket shaft. This brake is applied by means of pedal, *A*, operated by the left foot. The speed of the engine can be regulated from 100 to the usual maximum of 850 revolutions per minute by pressing on the foot pedal, *B*. This, by plain rod connections, actuates a wedge sliding across the admission valve and limiting its opening.

Considerable weight is saved in the engine construction by the use of a cylindrical copper water jacket. This has been found in practice to be entirely trustworthy, giving no trouble from leakage. By doing away with the casting of the jacket assurance of a better cylinder casting is given, while the jacket can readily be soldered should it spring a leak from water freezing in it. Forced circulation is used for cooling the water jacket, and is assured by a centrifugal pump on the longitudinal cam shaft of the motor, which operates the exhaust valve and carries the contact-making apparatus as well. Ribbed and flanged cooling coils are carried below the frame in front of the wagon body. All the bearings of the motor and transmission gearing are lubricated from a direct-connected multiple oil pump, *G*, placed just back of the engine cylinder. The receiver of this pump will carry sufficient oil for a run of fully 200 miles. The main and secondary gear shaft bearings and the gears themselves are automatically lubricated by oil contained in the tight gear box.

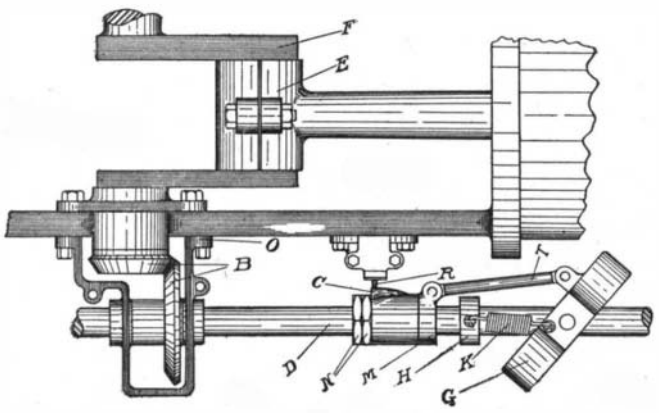


Fig. 1.—PACKARD IGNITION GOVERNOR.

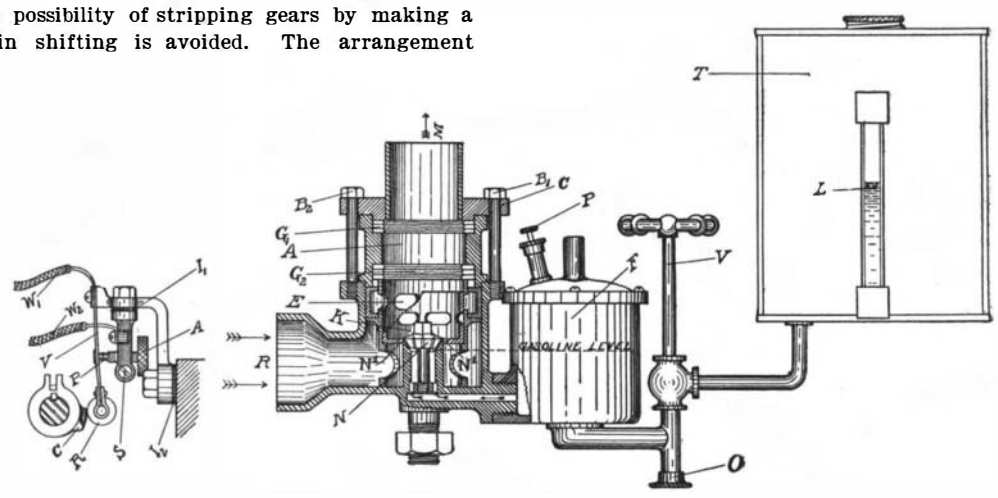
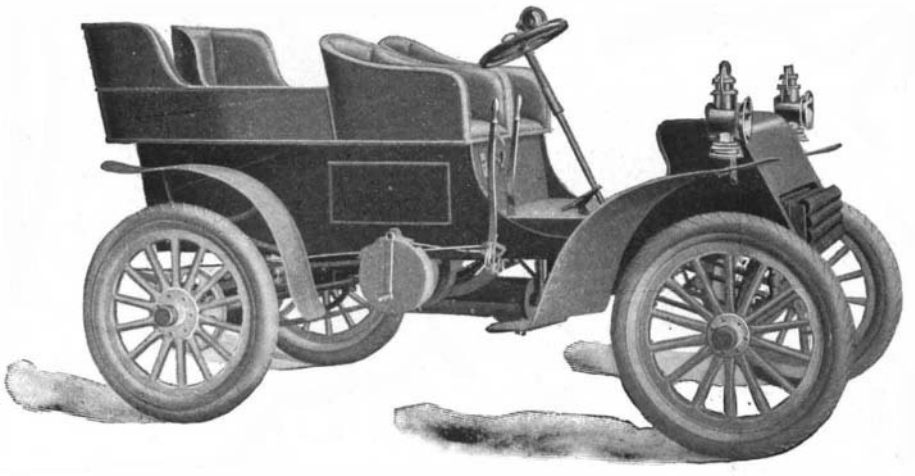
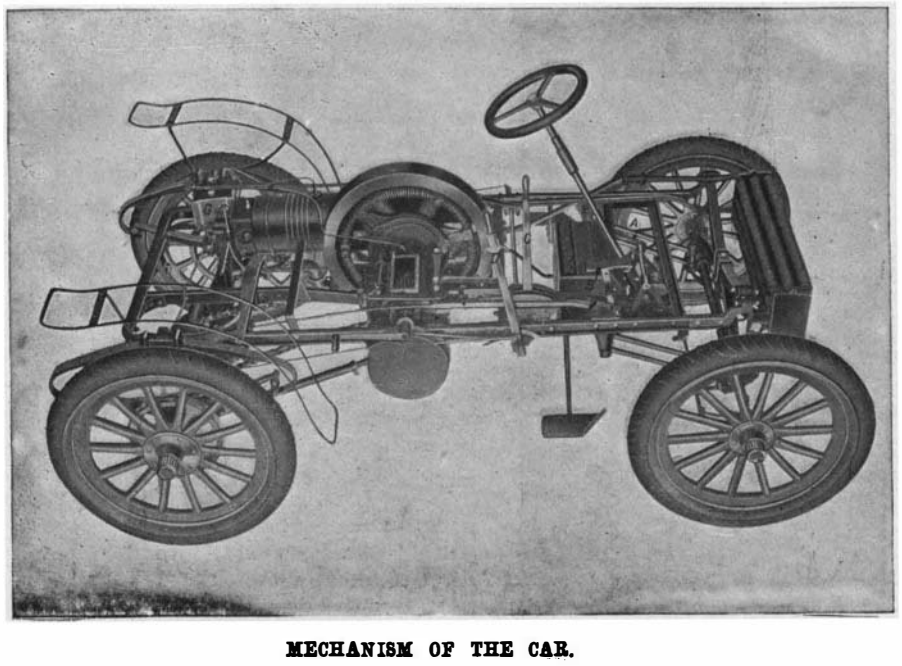


Fig. 2.—PACKARD CARBURETER.



THE PACKARD GASOLINE TOURING CAR.



MECHANISM OF THE CAR.

The vaporizer, which is a modified Longuemaire of the float feed, pulverizing type, is shown at *F* in the carriage mechanism and also in section in Fig. 2. The gasoline contained in tank, *T*, which is fitted with gage glass, *L*, is led through a connecting pipe and the shut-off valve, *V*, to the bottom of the float chamber, *F*. The float in this chamber by means of a needle valve maintains the gasoline in the chamber and in the adjoining feed chamber at a constant level. The air for forming the gas enters the pipe, *R*, and passes upward through the small annular space *N'* around the spraying cone, *N*, drawing up the gasoline by its suction through very small grooves in the face of this mushroom-shaped spraying nozzle. Instead, however, of the passage for the inrushing air being open and of fixed form, it is limited at first to the small annular space by the bottom of the cylindrical air valve, *K*, which normally rests level with the top of the nozzle, *N*, as shown in the diagram. This valve is lifted by the suction of the motor, thus affording a larger entrance space for the air and at the same time causing holes in the upper part of the valve to register with similar holes in the wall of the mixing chamber. Through the passage thus opened, an additional supply of pure air is admitted to form the mixture. The amount of additional air which is thus admitted can be regulated by a hand-operated valve. The height to which the shifting air valve, *K*, is lifted is dependent entirely upon the strength of suction of the motor, and the speed of the incoming current of air past the gasoline jets is maintained approximately constant by the valve at all speeds of the engine, thus insuring an invariable mixture. Wire gauze baffle-plates arrest any possible unvaporized gasoline and complete the mingling process. The mixture passes directly to the back of the suction valve of the motor through the pipe, *M*.

The details of the ignition apparatus are one of the distinctive features of the Packard system. The ignition contact maker and controller or so-called governor is shown in the cut. Following the now universally adopted French practice, the ignition is by jump spark with a vibrator on the coil, but unlike other systems, the timing of the ignition is entirely under the control of a very simple automatic device. The primary circuit of the induction coil is at the proper instant closed between the platinum points, *P*. These points are brought together

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.

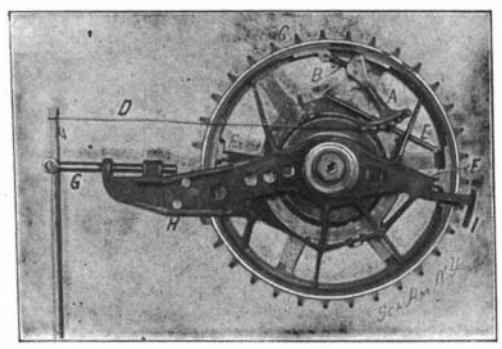
Our illustration shows the Duryea three-wheeled phaeton, which the inventor claims has many advantages over his regular four-wheeled machine, such as better traction, less liability to skidding, greater ease in steering and in making sharp turns, and numerous other good points he is always ready to demonstrate. 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.

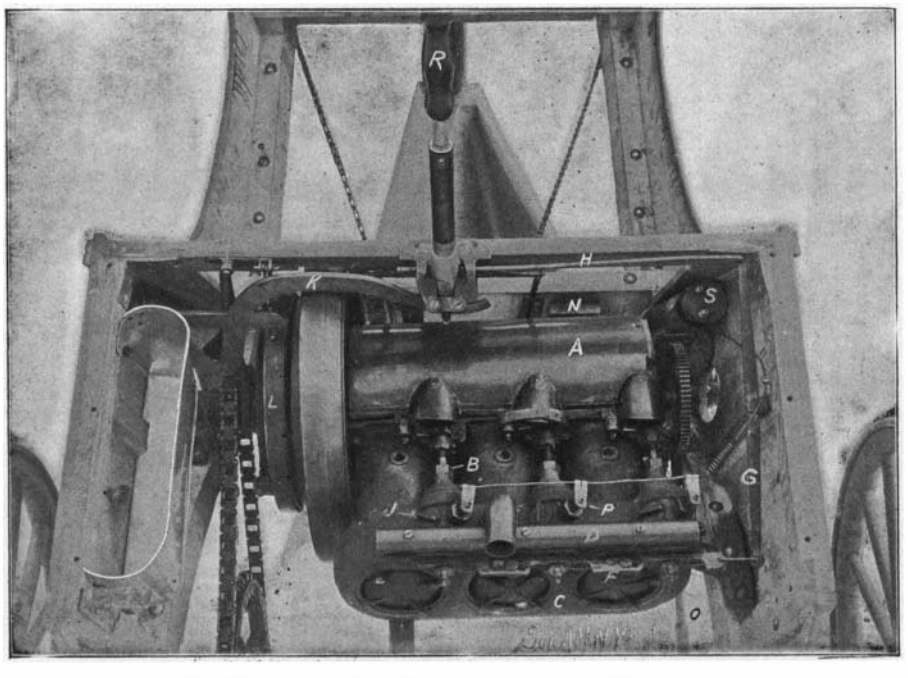
the differential gear. It brakes on a 14-inch drum, ⅞ inch wide. The ends of the band are separated by a lever, *A*, hinged at one end and carrying a band in which an adjusting screw, *B*, is threaded. This is swiveled in the hinge, *C*, on the other end of the band, so that a forward pull on the end 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.