

### THE FRAYER-MILLER SIX-CYLINDER AIR-COOLED MOTOR.

One of the greatest improvements in automobile motors for this year is the development of the six-cylinder, four-cycle gasoline motor. The Napier Company, of England, was the first to bring out a racer with a six-cylinder motor, and to demonstrate the superiority of the same motor on touring cars. A number of foreign firms, as well as several of the leading American companies, are manufacturing six-cylinder water-cooled motors this year; but the annexed illustration shows a positively-cooled waterless six-cylinder engine of 4 1/16 bore by 5 1/8-inch stroke, which is capable of developing

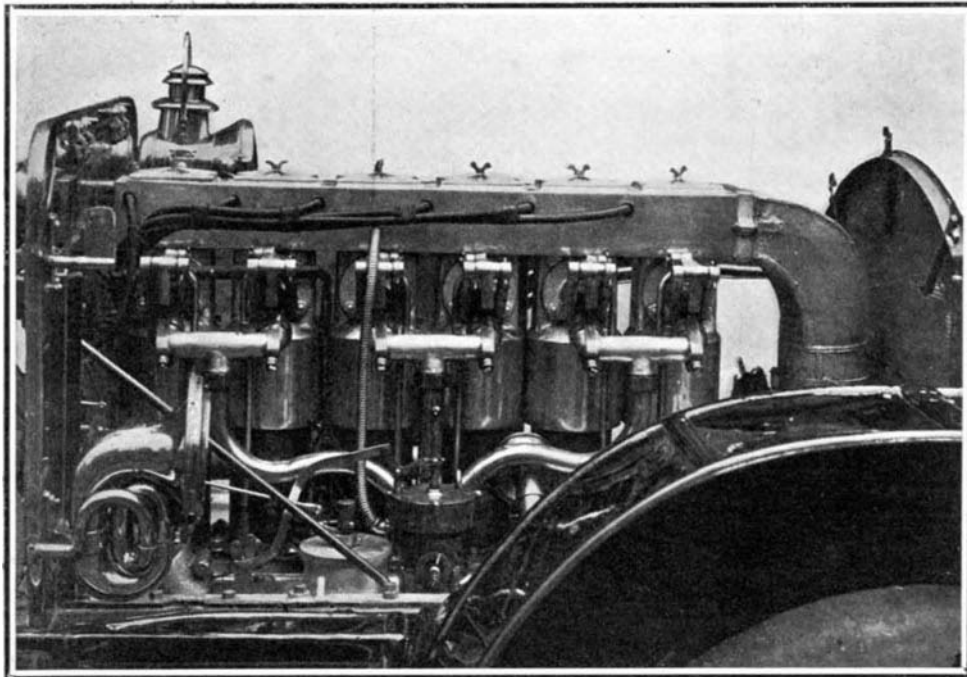
50 horse-power. The cylinders are cast with pin-like projections around the heads, as shown in the smaller cut. The valves are attached to each side of a cylinder head, and the whole cylinder is jacketed with an air jacket of aluminium. Air is blown by a powerful blower, gear-driven from the crankshaft in front of the motor four times as fast as the motor revolves. A pressure of about 2 ounces is produced in the large pipe running over all the cylinders, and this pressure is sufficient to force the cooling air down through the jackets and pins which project from the cylinder walls. So efficient is the cooling, that a relatively high compression—75 pounds—can be used without danger of premature explosions from heat. This system is one of the few in which the motor is positively cooled at all speeds. The car upon which this motor is mounted is fitted with a four-speed, selective-type transmission and bevel gear drive to the rear axle. Non-adjustable ball bearings are used liberally throughout the car, both in the transmission and the rear axle. The wheel base of the machine is 100 inches, and the tires 34 x 4. The difference in smoothness of running between a four-cylinder and a six-cylinder motor is found in the almost imperceptible impulses obtained from the latter, while those of the four-cylinder are distinctly noticeable. Furthermore, the six-cylinder engine is so flexible that the car can be driven at any speed from 4 to 60 miles an hour on the fourth speed gear under throttle control.

### THE MARMON AIR-COOLED TOURING CAR.

The main features to be noted about this car are the carrying of the entire power mechanism on an independent triangular

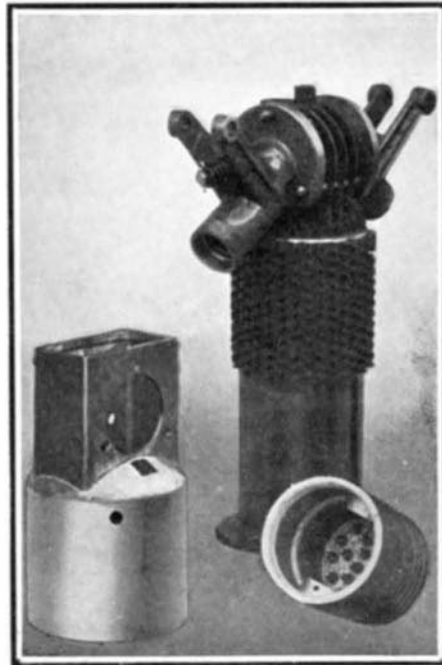
sub-frame, the elimination of chains and universal joints, and the mounting of both the body frame and sub-frame upon three pivoted points, which gives it extremely easy riding qualities. The photographs reproduced herewith show the general appearance of the

ing a short distance forward. The cross member of the sub-frame is pivoted at each end, and has rising from its center a pivotal support for the main frame. This pivot allows the latter frame to tilt and assume any inclination given it by the rear springs, which support its other end. A vertical movement of either front wheel does not affect the main frame (as shown in the cut), and it merely causes the sub-frame to rock around its point of support at the rear without any strain to the mechanism this frame carries. A vertical movement of either rear wheel, on the other hand, tips the main frame correspondingly but affects the sub-frame not at all, save to raise its rear end the same distance the rear axle rises



SIX-CYLINDER AIR-COOLED MOTOR OF THE FRAYER-MILLER CAR.

A gear-driven blower in front maintains an air blast in the pipe and down through the aluminium air jackets. The spark plugs are in the cylinder heads. Three pipes from the carburetor supply the three pairs of cylinders. Note also the vertical fender from mud guard to frame.



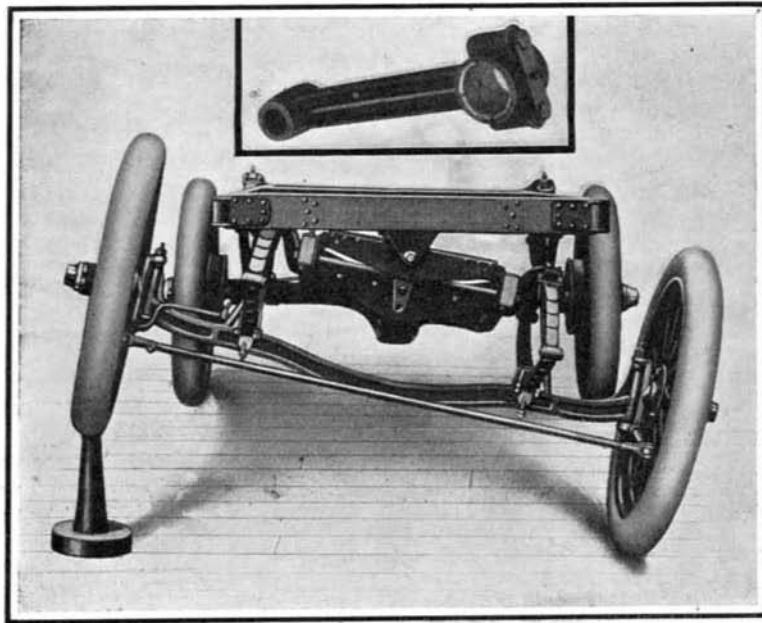
CYLINDER, AIR JACKET, AND PISTON OF FRAYER-MILLER MOTOR.

The cylinder has small heat-radiating pins cast on it, as has also the under surface of the piston head. The valves are bolted to cylinder head. The spark plug in top is got at through hand hole in bus pipe.

car and motor, and the great flexibility of its running gear. In the end view of the chassis, in which one of the wheels is raised a foot from the ground, is this flexibility noticeable. The front end of the sub-frame is hung from the front springs, while its rear end, which forms the apex of an isosceles triangle, is revolvably mounted on a sleeve extending forward from the differential gear casing on the rear axle. The propeller shaft within this sleeve is supported in a ball bearing back of the driving pinion and in a roller bear-

in the center. Thus it can be seen that neither frame is submitted to any twisting strains whatever, and that the carriage body is not affected by obstructions passed over by the front wheels. Both frames are of armored wood. The sub-frame consists of an oak I-beam inclosed in steel.

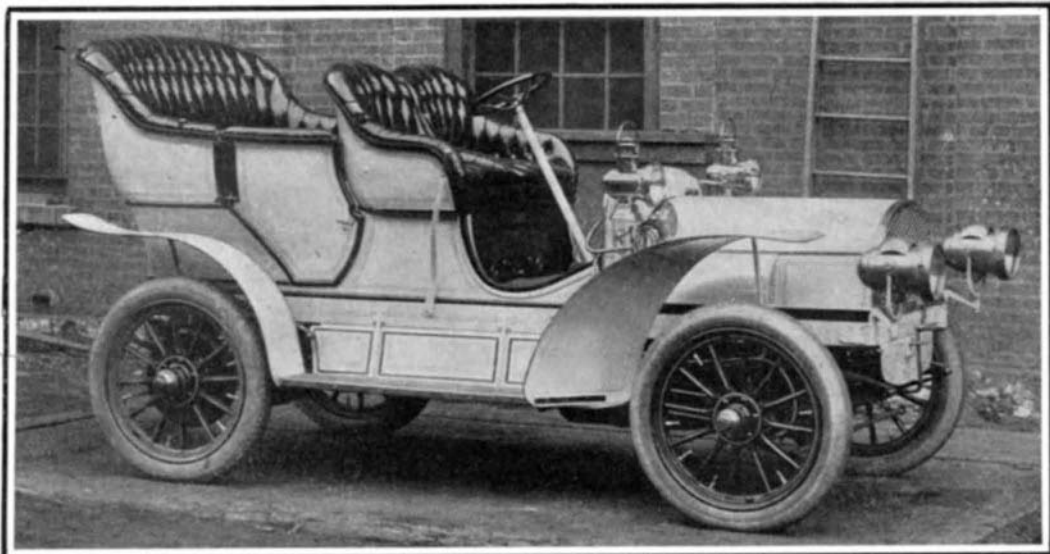
The motor is a 4 1/8 x 5 1/2-inch four-cylinder engine with cylinders in pairs set at an angle of 90 deg. It develops 28 horse-power at about 1,200 R. P. M. The valves are in the cylinder heads, operated mechanically, and fitted with large spiral springs. A belt-driven fan sends a powerful draft of air between the cylinders, and a plow within the bonnet diverts it to the heads. The draft produced by the motion of the car strikes the heads directly by passing through openings in the sides of the bonnet. An oil pump in the base of the crankcase forces oil from an oil well through a suitable pipe and stuffing box into the front end of the crankshaft. This is hollow and has small holes opening into all the bearings. The crank pin boxes have corresponding holes connected by straight oil pipes to the wrist pins, so that the oil is forced to all parts of the engine, and a spray of oil, exuding from the bearings, lubricates the pistons. A gage on the dash indicates the oil pressure. The two-speed planetary transmission is carried on the propeller shaft, which is without support between the engine and the foremost of the two bearings that carry its rear end. The transmission is without internal gears. Its three sets of three pinions are each formed from one piece. The clutch and bronze brake bands are large and run in oil. The reverse can be used as a brake if



FRONT END OF MARMON CHASSIS WITH WHEEL RAISED ONE FOOT.

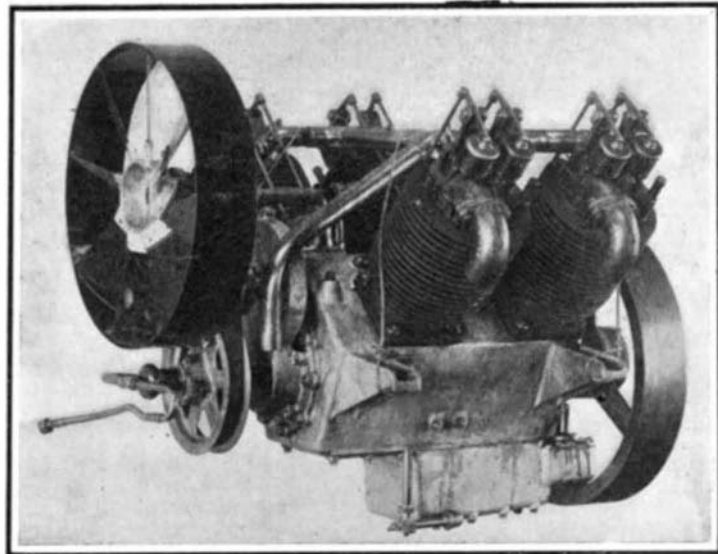
As a result of the double three-point suspension, the sub-frame is tipped but the main frame remains horizontal. Small cut shows pipe for carrying forced circulation of oil to wrist pin of motor.

(Continued on page 49.)



THE MARMON AIR-COOLED TOURING CAR WITH ALUMINIUM BODY AND DASH.

Note the fenders between running board and body in addition to those over the wheels.



THE 4 1/8 X 5 1/2 MARMON AIR-COOLED MOTOR, SHOWING PIPE CONNECTED TO HOLLOW CRANKSHAFT FOR CIRCULATION OF OIL FROM TANK IN BASE.