

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

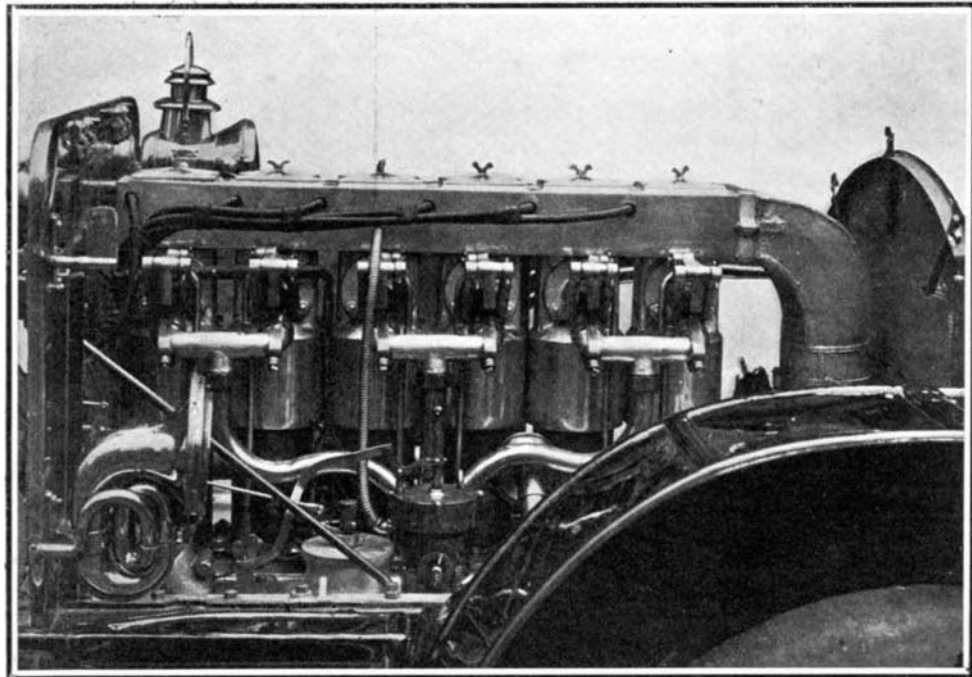
50 horse-power. The cylinders are cast with pin-like projections around the heads, as shown in the smaller cut. The valves are attached to each side of a cylinder head, and the whole cylinder is jacketed with an air jacket of aluminium. Air is blown by a powerful blower, gear-driven from the crankshaft 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

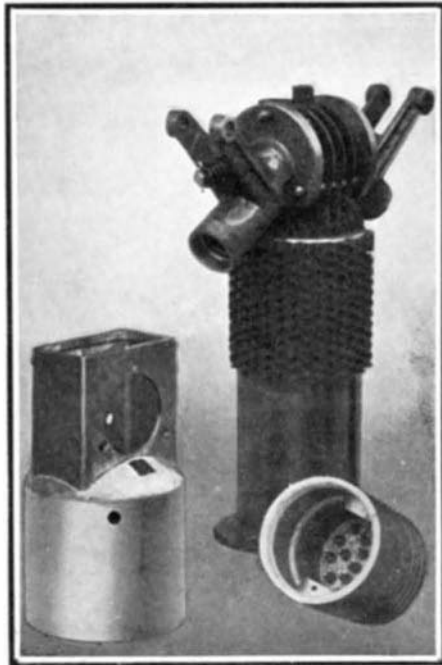
sub-frame, the elimination of chains and universal joints, and the mounting of both the body frame and sub-frame upon three pivoted points, which gives it extremely easy riding qualities. The photographs reproduced herewith show the general appearance of the

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.



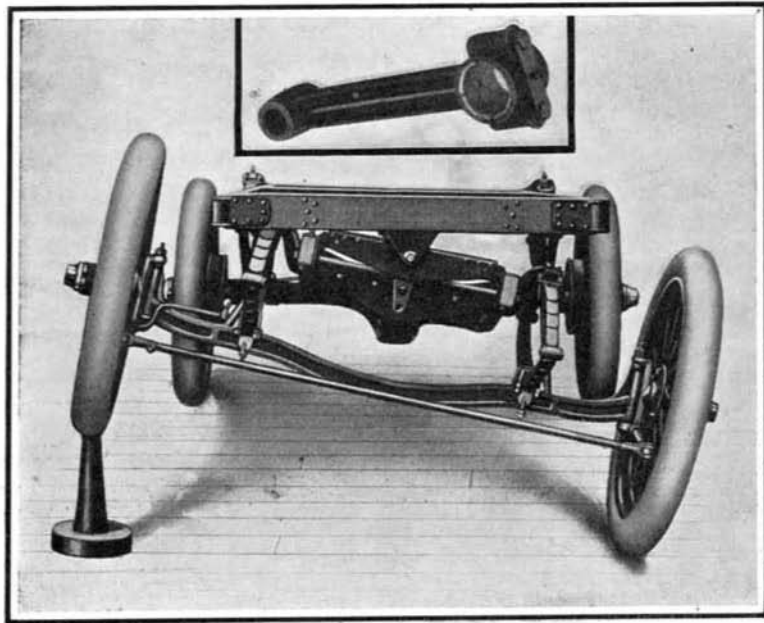
CYLINDER, AIR JACKET, AND PISTON OF FRAYER-MILLER MOTOR.

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.

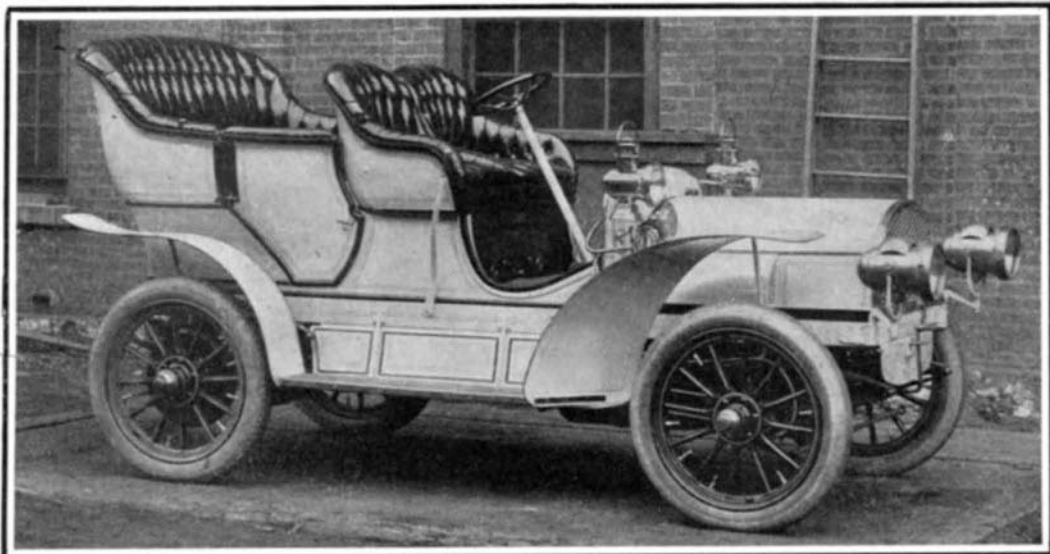
The motor is a 4 1/8 x 5 1/2-inch four-cylinder engine with cylinders in pairs set at an angle of 90 deg. It develops 28 horse-power at about 1,200 R. P. M. The valves are in the cylinder heads, operated mechanically, and fitted with large spiral springs. A belt-driven fan sends a powerful draft of air 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.

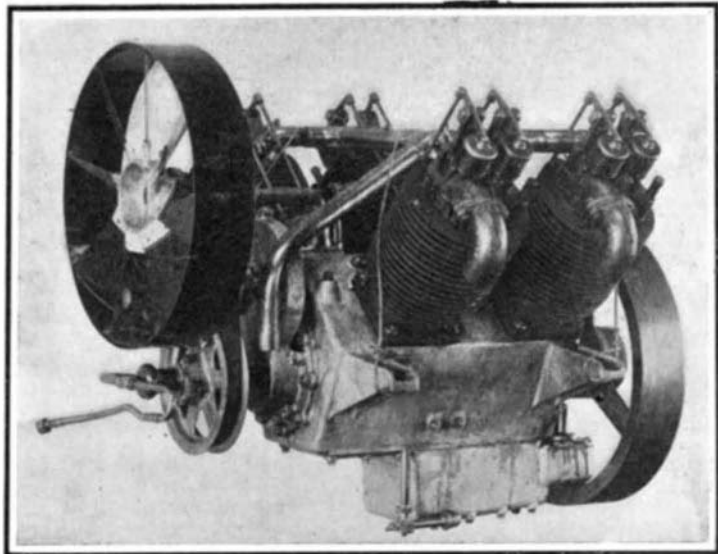
As a result of the double three-point suspension, the sub-frame is tipped but the main frame remains horizontal. Small cut shows pipe for carrying forced circulation of oil to wrist pin of motor.

(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.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. In every case it is necessary to give the number of the inquiry.
MUNN & CO.

- Marine Iron Works. Chicago. Catalogue free.
- Inquiry No. 7660.**—For makers of oil burner capable of use in a wood heater.
- "U. S." Metal Polish. Indianapolis. Samples free.
- Inquiry No. 7661.**—Wanted, a manufacturer to make pressed paper tubing, particularly strong and durable, 1.0 millimeters inward clear diameter and corresponding thickness, to bear inward pressure of nearly 20 atmospheres; tubes to be about 120 centimeters long.
- Drying Machinery and Presses.** Biles, Louisville, Ky.
- Inquiry No. 7662.**—For makers of portable table to be attached to any chair.
- WANTED.—Purchaser for Monazite, Molybdenite and Wolfram. Apply Monasite, Box 773, New York.
- Inquiry No. 7663.**—For manufacturers of powder in bulk, made from silica rock.
- I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.
- Inquiry No. 7664.**—For manufacturers of machinery for making, nailing, etc., wooden boxes, as large as 29 x 19.5 x 11.7 inches.
- The celebrated "Hornsey-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company, Foot of East 138th Street, New York.
- Inquiry No. 7665.**—For manufacturers of pins.
- WANTED.—Ideas regarding patentable device for water well paste or mudjacking bottle. Address Adhesive, P. O. Box 773, New York.
- Inquiry No. 7666.**—Wanted, makers of small water tube boilers for marine use.
- I have for sale the U. S. and all foreign rights of new patent improvements in Water Tube Types of Boilers, Great economizer. J. M. Colman, Everett, Wash.
- Inquiry No. 7667.**—For manufacturers of dental goods, such as teeth and filling materials.
- Young American permanently residing in Lima, Peru, S. America, wishes to hear from firms interested to be represented there. Further information, K. Thorn, Milford, Mass., P. O. Box 181.
- Inquiry No. 7668.**—For parties engaged in erecting fire escapes.
- FOR SALE—PATENTS.—Life saver; great money maker; it is a great invention; something never introduced before; can be seen; only buyers. Apply by letter, Nicholson, 651 3d Avenue.
- Inquiry No. 7669.**—Wanted, addresses of makers of two-cycle gas engines.
- Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery tools and wood fibre products. Quadriga Manufacturing Company, 18 South Canal St., Chicago.
- Inquiry No. 7670.**—For dealers in name plates, trunk emblems, old badges, etc.
- PATENTS.—Wanted, the service of a patent expert and experienced specification writer. No one need apply who has not had a thorough education along technical lines, and who has not had experience in patent practice. Munn & Co., 361 Broadway, New York.
- Inquiry No. 7671.**—For manufacturers of producer gas machines.
- Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.
- Inquiry No. 7672.**—For manufacturers of astronomical telescopes.
- Inquiry No. 7673.**—Wanted, manufacturers of railroad iron.
- Inquiry No. 7674.**—Wanted, makers of elastic bed mattresses and pillows.
- Inquiry No. 7675.**—Wanted, name and address of the makers of the Electric Shoe-shining Machine.
- Inquiry No. 7676.**—For makers of wire artists' supplies, such as jewelry and beads.
- Inquiry No. 7677.**—Wanted, a 1,000-foot gas holder.
- Inquiry No. 7678.**—Wanted, hand knitting machines for cheap cotton stockings.
- Inquiry No. 7679.**—For makers of thermostats and heat regulators.
- Inquiry No. 7680.**—For manufacturers of molds for molding plaster.
- Inquiry No. 7681.**—For dealers in crude rubber.
- Inquiry No. 7682.**—Wanted, manufacturers of glass bottles.
- Inquiry No. 7683.**—For dealers in Canada or Brazil wax.
- Inquiry No. 7684.**—Wanted, makers of machines for weaving "K" woven wire fence.
- Inquiry No. 7685.**—Wanted, catalogues of the latest fire extinguishers by carbonic acid or other chemicals.
- Inquiry No. 7686.**—Wanted, makers of advertising clocks, about 6 feet high by 2 feet wide.
- Inquiry No. 7687.**—Wanted, a pump for drawing water out of a suck line for natural gas.
- Inquiry No. 7688.**—Wanted, machines for drying, cutting and evaporating fruits.
- Inquiry No. 7689.**—Wanted, makers of apparatus suitable for general metallurgical and heating purposes.
- Inquiry No. 7690.**—For makers of parts with which to construct a dynamo.
- Inquiry No. 7691.**—Wanted, recipes for making first-class rubber-stamp ink.
- Inquiry No. 7692.**—Wanted, recipes for making colored mill crayons.
- Inquiry No. 7693.**—Wanted, makers of hosiery machines, also of a machine by which 2 to 3 dozen Guernsey frocks can be made in 8 hours.
- Inquiry No. 7694.**—Wanted, a cement-making apparatus for mixing rubber cements.
- Inquiry No. 7695.**—Wanted, the name and address of the makers of the celebrated Chime Hall Clock movements, tubular chimes.
- Inquiry No. 7696.**—For makers of novelties or aluminum goods.
- Inquiry No. 7697.**—For makers of coal oil stove burners, also crude oil stove burners.
- Inquiry No. 7698.**—For manufacturers of induction coils.
- Inquiry No. 7699.**—Wanted, address of parties who bend sled runners.
- Inquiry No. 7700.**—For manufacturers of peppermint.
- Inquiry No. 7701.**—For manufacturers of nails, saws, wire, hinges; also cotton goods.
- Inquiry No. 7702.**—For manufacturers of ball bearings.

THE MARMON AIR-COOLED TOURING CAR.

(Continued from page 28.)

necessary, but the large expanding-ring brakes in the rear wheels are usually ample. The rear axle has an aluminium gear case, whose two halves are cast upon two axle sleeves, thus making an integral piece of each. The wheels and differential revolve on Hyatt roller bearings. Floating interior half-axes drive the wheels through jaw clutches on the hubs. The thrust of the bevel pinion is taken up by a rolling contact of the pinion against the bevel gear—a very simple arrangement.

Aluminium is used wherever possible throughout the car. The body is constructed almost entirely of cast aluminium, as is also the dash and fenders. Vertical fenders from running board to body are one of the good features, as they keep down both dust and mud. The entire machine, with the exception of wheels and tires, is constructed in the large new addition the company has made to its plant for this purpose. The car is one of the best-built air-cooled machines on the market. That it can make fast time under all ordinary circumstances was demonstrated by its performance in the economy test held last November.

NEW FOUR-CYLINDER AIR-COOLED MOTOR,

(Continued from page 29.)

fit into notches in the shifter bars to locate them securely when the gears are completely in mesh. The bars are shifted by a single hand lever working in an H-shaped quadrant on the selective system. The selector box is dustproof, and contains a simple device which positively locks, in their neutral position, all the shifter bars except the one in use.

This transmission is modeled after the latest Mercedes speed-change gear. The shafts run on the non-adjustable ball bearings (which are also used on the road wheels), and the differential countershaft across the rear of the transmission is used for transmitting power to the wheels by means of sprockets and chains. The outer ball bearings of the countershaft are exactly under the sprockets. The advantages claimed for the transmission are that the divided shaft with one part running on the other (which makes a bearing difficult to oil and subject to great wear) is entirely avoided, while the shafts are much shorter between bearings, and hence have no tendency to spring while the intermediate gears are in use.

Six years ago the Knox Company built their first machine, fitted with a single-cylinder air-cooled motor of 4 horse-power. This was the first slow-speed motor of large bore and stroke to be made commercially successful. It was superseded by still larger motors of the double-opposed, horizontal type, and this year a still larger vertical, four-cylinder motor has been placed on the market. The cylinders of this engine have a 4 1/4-inch bore by 5 1/2-inch stroke. They are cast separately, and besides having reinforcing ribs near their base, they have about one-third fewer pins per square inch of cylinder surface, and the pins are about half the length of those that were used heretofore. Experiment has shown that the Knox cylinder is more efficient when a lesser radiating surface is used. As heretofore, everything is very substantial about the Knox car. The 1 3/8-inch crankshaft is supported in five separate bearings attached to the upper half of the crankcase. These bearings are 3 and 4 inches long, and those of the hollow wrist pins are 2 1/4 inches long. The valves, which are located in the cylinder heads, are 2 inches in diameter and interchangeable. They are made of a special steel and nickel alloy. Each valve cage fits into a pocket, from which it may be removed without disturbing any of the connections, and simply by unscrewing one nut. The valves can, therefore, be ground outside of the engine. Separate camshafts operate the inlet and exhaust valves, by means of push rods and rocker levers. Special auxiliary coil springs are

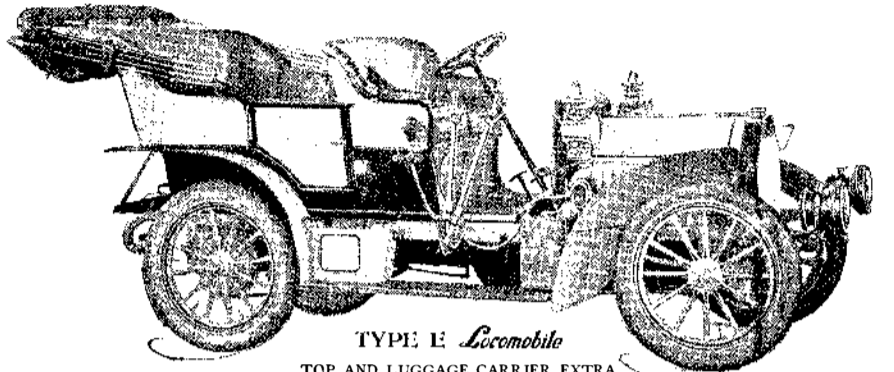
Locomobile

"Easily the Best Built Car in America"

30-35 H. P., \$5,000

15-20 H. P., \$3,000

These models are almost identical in design; contain the same carefully selected materials; and are constructed throughout with equal care. Both models are furnished with complete touring equipment



TYPE E Locomobile
TOP AND LUGGAGE CARRIER EXTRA

Specifications of Type "E" 15-20 H. P. Locomobile Price \$3,000

- EQUIPMENT, 5 brass lamps; horn; tire carrier; jack; tools and extra parts; locked box with trays for tools and parts; compartment carrying 4 tin cases for extra lubricants.
- MOTOR, 4-cylinder, 3 3/4" bore, 4 1/2" stroke; manganese bronze base; gears enclosed. Same general type as made by us for four seasons.
- CRANK SHAFT, machined from one solid forging.
- CAM SHAFTS, hardened ground forgings—one solid piece.
- CARBURETOR, automatic type with balanced throttle valve.
- IGNITION, make-and-brake system used by us for the second season. Ignition cams solid with admission cam shaft which slides in bearings to advance or retard spark.
- MAGNETO, low tension, our design; permanent magnets from the best makers in the world; impossible to disturb any electrical adjustments by removing or replacing magneto. Oil proof armature.
- LUBRICATOR, large mechanical oiler. Large supply pipes.
- GOVERNOR, centrifugal type, prompt and positive in action.
- CONTROL, gas and spark levers on steering wheel.
- CLUTCH, cone type with ample leather face.
- UNIVERSAL JOINT, between clutch and transmission.
- TRANSMISSION, 3 speeds and reverse; direct drive on high gear; clutch shifting mechanism, gears, bearings, and differential all encased and lubricated by same oiling system.
- DRIVE, double side chains; hardened sprockets.
- RUNNING BRAKE, double acting type; 3 1/2" x 10" located on differential shaft, metal to metal surfaces.
- EMERGENCY BRAKES, internal expansion type, compensated. Large and powerful, metal to metal surfaces.
- SPROCKET DRUM, bolted to each rear wheel spoke.
- AXLES, 3 1/2" section axles front and rear.
- TIRES, 32" x 4" on all four wheels. Larger than the size recommended by the Tire Association.
- BODY, double side entrance, seating 5; extra wide doors; fitted with top irons; color and striping optional; running boards, covered with pyramid rubber bound with brass.
- WHEEL BASE, 93".

NOTE.—Our 30-35 H. P. Locomobile Type "H" \$5,000, is intended for those requiring greater power and greater seating capacity. The specifications are the same as those printed above with the following exceptions: Motor 4 1/2-in. bore, 5 1/2-in. stroke; Body seats 5 to 7 persons; Tires, 34 in. x 4 1/2 in., front and rear; Wheel Base, 106 in. Full illustrated descriptive matter of both cars on application to factory or any branch office.

For 12c. in stamps we will mail 12 souvenir postal cards showing 12 different views of the Locomobile running in the Vanderbilt Cup Race, making the best showing of any American car in any international contest. For 10c. in stamps we will mail a five-color poster showing the Locomobile finishing the race.

The Locomobile Company of America, Bridgeport, Conn.

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PATENTS

The Wealth of Nations

A PATENT gives you an exclusive right to your invention for a term of seventeen years. You can sell, lease, mortgage it, assign portions of it, and grant licenses to manufacture under it. Our Patent system is responsible for much of our industrial progress and our success in competing in the markets of the world. The value of a successful Patent is in no degree commensurate with the almost nominal cost of obtaining it. In order to obtain a Patent it is necessary to employ a Patent Attorney to prepare the specifications and draw the claims. This is a special branch of the legal profession which can only be conducted successfully by experts. For nearly sixty years we have acted as solicitors for thousands of clients in all parts of the world. Our vast experience enables us to prepare and prosecute Patent cases and Trade Marks at a minimum of expense. Our work is of one quality, and the rates are the same to rich and poor. Our unbiased opinion freely given. We are happy to consult with you in person or by letter as to the probable patentability of your invention.

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