when throwing in the high speed, it causes the toothed segment, *S*, to mesh with and turn a pinion on the end of the shifting fork lever, *T*, with the result that the gears 2 and 5 are moved to the right, so that they mismatch with 1 and 6, thus allowing the shaft, *B*, to remain idle. This is a refinement of the transmission gear which is found on but few cars as yet, but which will doubtless soon come into vogue, as it causes the machine to run very quietly on the high gear. The reverse is had by gear 4 meshing with an intermediate pinion below the gear 7 and in mesh with it. Chain oilers like that shown on the opened bearing of the transmission are used on all six of its bearings, as well as on the two end bearings of the motor crank shaft. These oilers consist of a small chain that dips in an oil well and, as it is carried along by the rotating shaft, brings the oil up on it. The three-cylinder motor is fed from a single carbureter of the constant level, spraying type, and exhausts into a single muffler in the rear. The mouth of the air suction pipe is seen at *A*, and the inlet pipe coming from the carbureter at *I*. The water pipes are seen on the top and sides of the cylinders, running direct to the honeycomb type of radiator. A belt-driven suction fan is arranged back of the radiator. The circulating pump is gear-driven from the motor crank shaft, and is of the revolving gear type. The cut of the motor, Fig. 2, shows the half-speed cam shaft that operates the exhaust valves. The inlet valves are automatic. The contact device is also seen in this picture, as well as the three spark plugs. The cranks are set at 120 deg., thus giving an explosion every two-thirds of a revolution. Adjustable bearings are provided between each crank, and are oiled by splash lubrication.

The sight-feed pressure oilers on the dash supply oil to the cylinders and end bearings of the motor, while the oil in the crank case needs renewing about once in 1,000 miles.

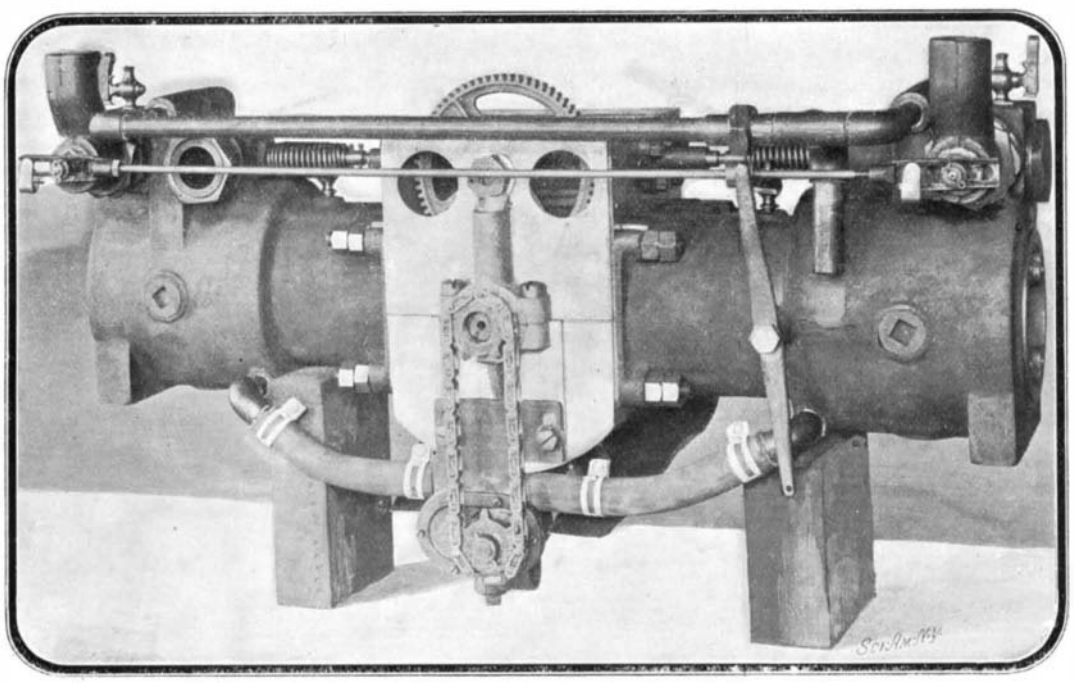
The countershaft is fitted with a band brake drum near each end, as shown in the detail picture. These drums were not in place when the photograph was made, nor was the belt-driven fan that is located behind the honeycomb radiator. Otherwise the view of the chassis is complete. The outside lever of the two shown at the side changes the gears, while the inside one applies the rear wheel brakes, at the same time releasing the clutch by means of a sector (*M*, Fig. 6) pushing a rod that depresses the clutch pedal. A longer sector, *N*, has holes in it, corresponding to the different positions of the gears. A rod rides on this sector and keeps the clutch disengaged while the gears are being changed. Not until the gears are properly in mesh does the plunger rod drop into the corresponding hole and allow the clutch to slip in. When the clutch has thus engaged, the gears can not be shifted till after the clutch has been released with the pedal. This locking device is one of the features of the car.

In closing, a word should be said regarding the workmanship and material entering into the construction of the Thomas machines. A visit to the company's factory will convince anyone that these are of the best throughout. The motor cylinders, after being cast, are tested for blowholes, and, if found perfect, are then bored, ground, and lapped. They are put in a special jig when the valve and lug holes are bored, so that these are always bored accurately, thus making the cylinders interchangeable. The gears of the transmission are all cut from solid stock, and have their teeth slightly beveled and thoroughly case-hardened. The whole mechanism of the car is assembled on a riveted channel steel frame and sub-frame of substantial construction.

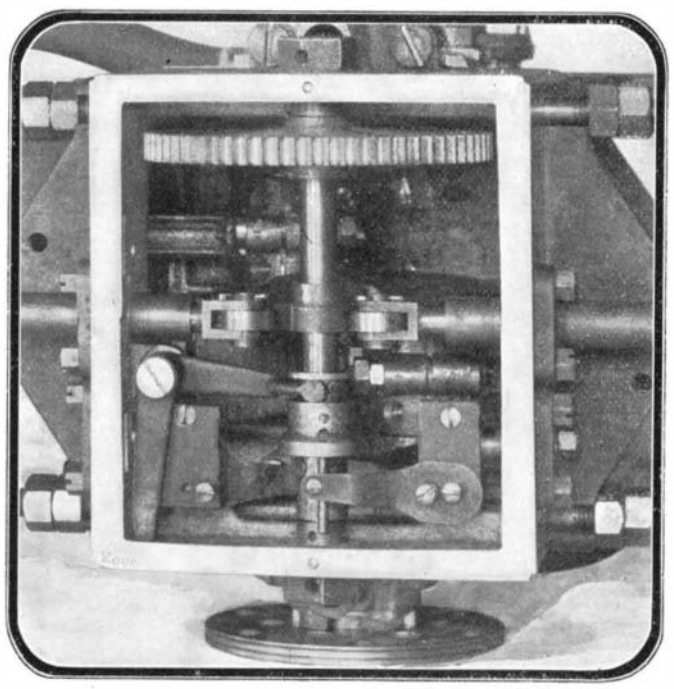
The general specifications of the car are as follows: Weight, 2,000 pounds; horse power, 24 brake; wheel base, 7 feet; tread, 56½ inches; tires, 4 x 34 Fisk detachable; speed of which car is capable, 45 miles an hour.

THE STEVENS-DURYEA GASOLINE STANHOPE.

The machine illustrated on this page is the result of many years' experience in the building of automobiles on the part of Mr. J. F. Duryea. It is a typical American runabout of the double, opposed-cylinder type, and besides its many good points and several novelties, it holds enviable records for speed, reliability, and rapid hill-climbing powers. A chassis of this type, driven by O. Nestman, made a mile on the Ormonde-Daytona beach recently in 57 1-5 seconds, thereby reducing the previous record for cars under 1,000 pounds by 9 seconds.



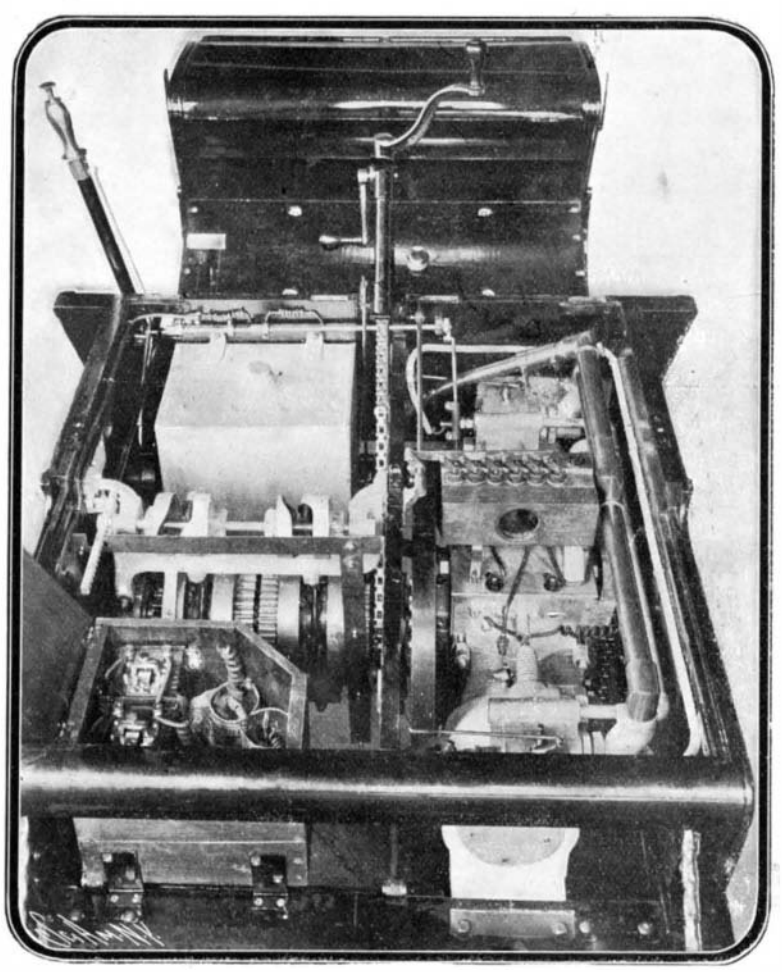
SIDE VIEW OF STEVENS DURYEA OPPOSED-CYLINDER MOTOR.



PLAN VIEW OF MOTOR CRANK CASE.

The side view of the motor shows the suction-operated inlet valves with their throttling device, consisting of long wedges that slide under washers on the valve stems and thus hold the valves from opening to their fullest extent. The wedges are connected and are operated by pressing a button in the end of the change-gear lever. The two-to-one gear can be seen projecting above the crank case, and the rotary pump driven by a chain is visible below the motor. The plan view of the opened crank case shows the exhaust valve stems fitted with rollers, and the ignition contact springs, one above and one below the cam shaft next to the bottom edge of crank case. These flat contact springs are insulated from the motor and connected to separate spark coils. Directly under the upper one in the sleeve slidable on the cam shaft by means of the bell crank in left-hand corner, is a rounded steel contact piece. A spiral slot in the sleeve and a pin on the cam shaft, projecting into this slot (seen at end of upper contact spring), makes it pos-

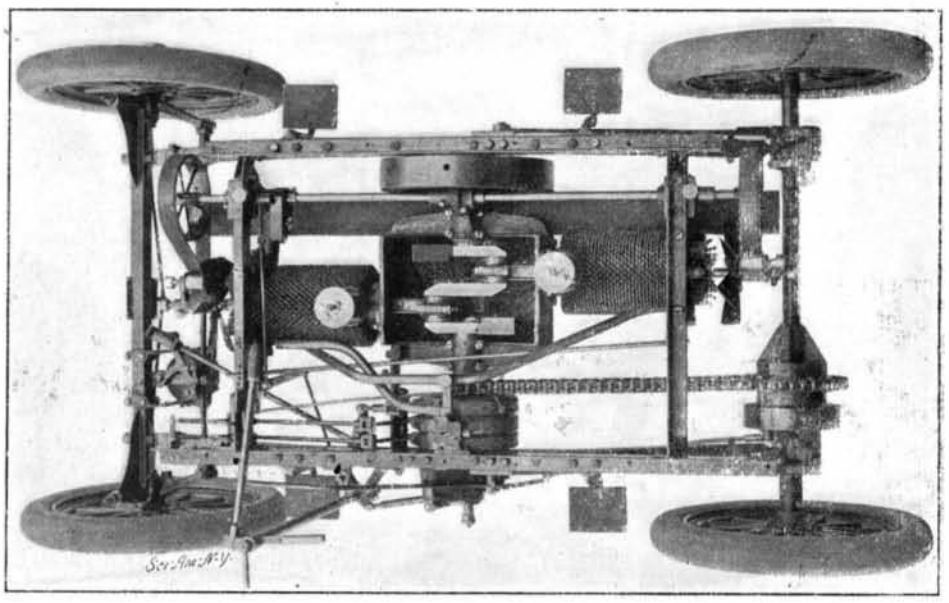
THE STEVENS-DURYEA ON A WINTRY DAY IN THE PARK.



ARRANGEMENT OF MECHANISM WITHIN THE BODY.

sible to advance the spark by moving the sleeve with respect to the shaft while they are rotating together. The bore and stroke of the engine cylinders are 4¼ and 4½ inches respectively, and 7 horse power is claimed for it at 700 revolutions per minute. This powerful motor weighs but 160 pounds, 78 pounds of which is in the flywheel. That this rating is conservative is shown by the car's performances. The cylinder heads of the motor consist of large caps that are screwed in with a special wrench. This makes it possible to remove the head quickly if for any reason the cylinder needs inspection. The disk at the bottom of the plan view picture is on the crank shaft and is bolted to a similar one on the transmission.

THE KNOX 16-HORSEPOWER TOURING CAR.

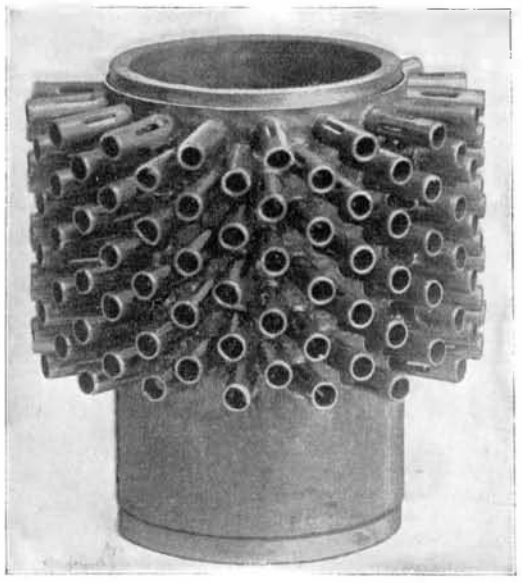


KNOX CHASSIS, SHOWING OPPOSED-CYLINDER MOTOR AND FANS.

The picture of the chassis shows the body, which is hinged at the edge of the front seat, tipped forward. The gears and their individual clutches are visible, as well as the specially shaped cams above them. These are operated by a rack and pinion, when the speed-change lever is moved, in such a manner as to throw in one clutch after another in their proper sequence, and yet, when the lever is moved from the third speed back to the "off" position, the second and first speeds are passed through without engaging the clutches. With the individual clutch system, which is used on very few cars, the gears are always in mesh and turning idly when the motor is running. The motor is set going from the seat by turning the small handle beside the steering lever. This is a very convenient feature of the machine. On the bottom of the steering post is a horizontal sprocket which is connected by a chain with a similar one on the front axle, the latter of course being connected so as to move the tie rod of the front wheel steering knuckles. The steering is sensitive and is geared down so that a slight movement of the handle will accomplish the desired result. The multiple oiler on top of the motor feeds all bearings and is turned on by a small handle in front.

THE KNOX DOUBLE-CYLINDER CARS WITH FAN-COOLED MOTORS.

After exhaustive tests throughout the past year, the Knox Automobile Company has now brought out a new line of tonneaus, surreys, and delivery wagons fitted with a 16-horsepower, 5 x 7, double, opposed-cylinder motor of their well-known, fan-cooled type, with which 1,760 threaded steel pins, 2 inches in length, are screwed into the surface of each cylinder to radiate the heat. This arrangement makes it possible to obtain 32 square inches of heat-radiating surface per square inch of outside cylinder surface, which is about four and one-half times that obtainable with the ordinary type of air-cooled cylinder with cast flanges; and it is for this reason that the Knox Company has been able to use a single cylinder of as large dimensions as 5 x 8 (the size used on the runabout) where most other manufacturers have heretofore not been able to go above 3¼ x 3½. The chassis of the double-cylinder cars is quite similar to that of the single-cylinder ones. It consists of an angle iron frame bolted down to the middle horizontal part of two reach springs that connect the front and rear axles. The front axle is a single trussed casting of a special aluminium bronze having a tensile strength of 60,000 pounds per square inch and also the property of bending rather than breaking. The rear axle is one solid steel shaft. It is keyed to the hub of the wheel on the end farthest away from the differential, and is supported in a Timkin roller bearing, while from the differential to the other end it passes through a sleeve which is keyed to one of the bevel gears in the differential, as well as to the hub of the nearby wheel, and which also runs in a roller bearing in the bearing box next to the differential. The reach springs are slidably and revolubly mounted in the bearing boxes; and each of the radius rods screws into a nut placed between two projecting lugs of one of the boxes. By unscrewing this nut with a wrench, it is backed off on the radius rod and carries the axle with it, since it pushes against the lug of the bearing box. This tightens the chain. The emergency brake is of the expanding ring type, the ring forming part of the bearing box and being cast of the aluminium-bronze alloy before mentioned.

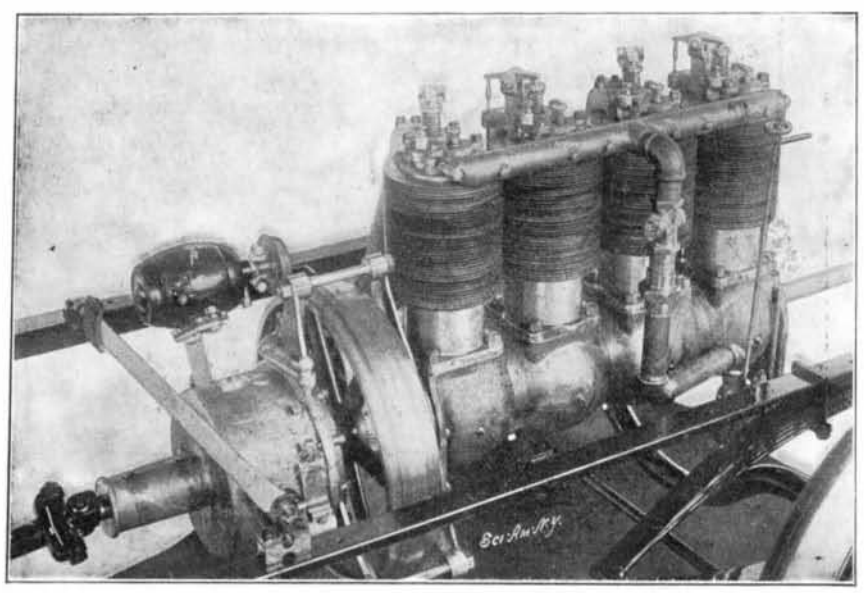


ARRANGEMENT OF SLOTTED TUBES ON REGAS CYLINDER.

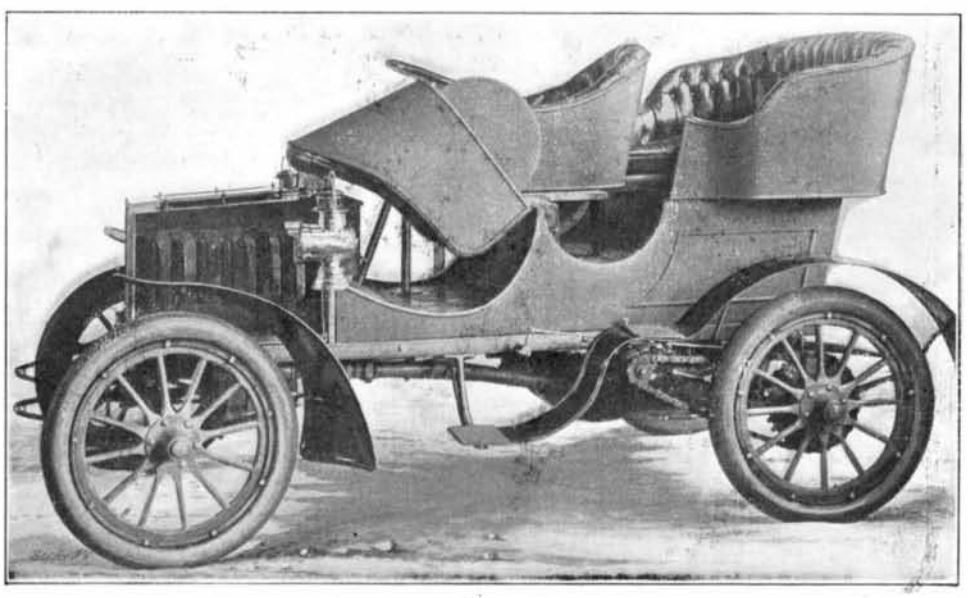
The other features of the Knox chassis can be seen almost at a glance, so simple in arrangement is the whole structure. The two cylinders are bolted to the cast-iron crank case, and are supported by four large cap screws that pass through holes in the cross members of the frame, and screw into lugs projecting from the cylinders. The heavy, 2-inch crank shaft, mounted in long bearings in the crank case, carries a flywheel on one end and the planetary transmission gear on the other. The three band brakes of the latter are, from the frame toward the motor, (1) the reverse drum brake, (2) the brake drum one, and (3) the low speed brake. The first two are operated by pedals, and the third by the handle projecting backward near the top of the steering post. The smaller handle, that projects outward, advances or retards the spark and at the same time opens or closes the throttle. The high-speed clutch consists of a ring of round hardwood blocks placed between two metal surfaces within the transmission, and clamped thereto when the clutch is thrown in. This clutch of small wooden blocks has been adopted in place of the expanding ring clutch formerly used. It is readily adjusted, and the wear upon it is slight. It can be slipped a good deal without burning the blocks, and it is unaffected by centrifugal force. Being within the transmission, it is completely protected from dirt.

The half-speed cam shaft is driven by a worm and spiral gear. It passes through bearings fitted with grease cups, near each end; and on each end there is a pulley for the fan belt, which is kept taut by adjustable jockey pulleys. These and the fan pulleys also are fitted with small grease cups. The contact box, seen on the cam shaft near the left-hand cross-member of the frame, contains a cam-and-spring make-and-break device of large size. Platinum-iridium contact points are used, which wear but little with long use. Besides the quart oil cups on each cylinder, which lubricate the pistons and hollow wrist pins, the motor has large grease cups on the flywheel end of the crank shaft (for the crank shaft and crank pin bearing on that end) and on the inner crank side member (for the other crank shaft and crank pin bearings and the transmission). The transmission is also oiled by squirting oil through small holes in the drum.

The regular Knox float-feed atomizer is used. It draws its air through small holes in the perforated



24-HORSEPOWER FRANKLIN AIR-COOLED MOTOR, SHOWING IGNITION DYNAMO AND TRANSMISSION GEAR.



REGAS 12-HORSEPOWER CAR WITH SIDE ENTRANCE TONNEAU AND 4½ x 5 TWO-CYLINDER AIR-COOLED MOTOR.