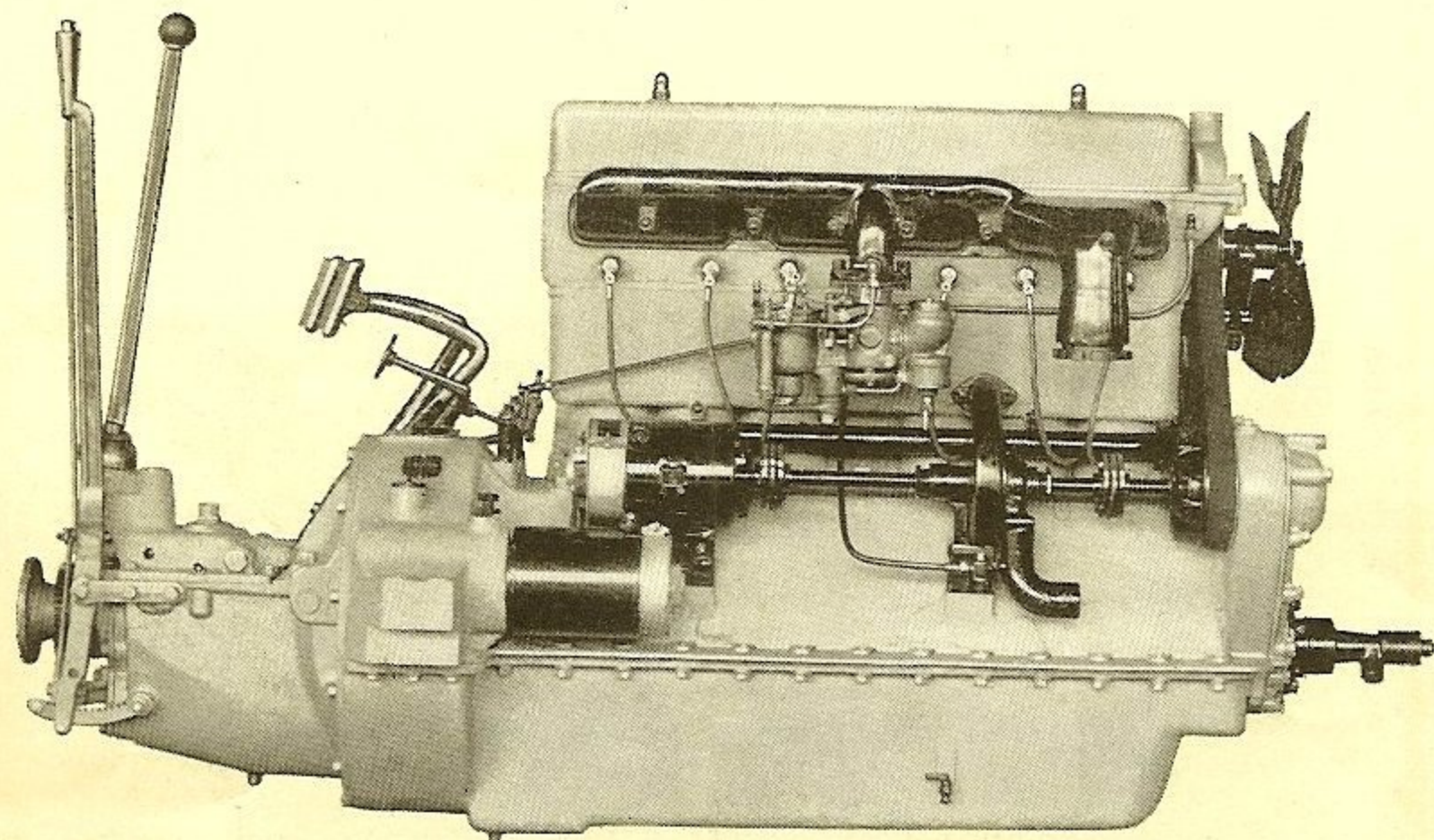


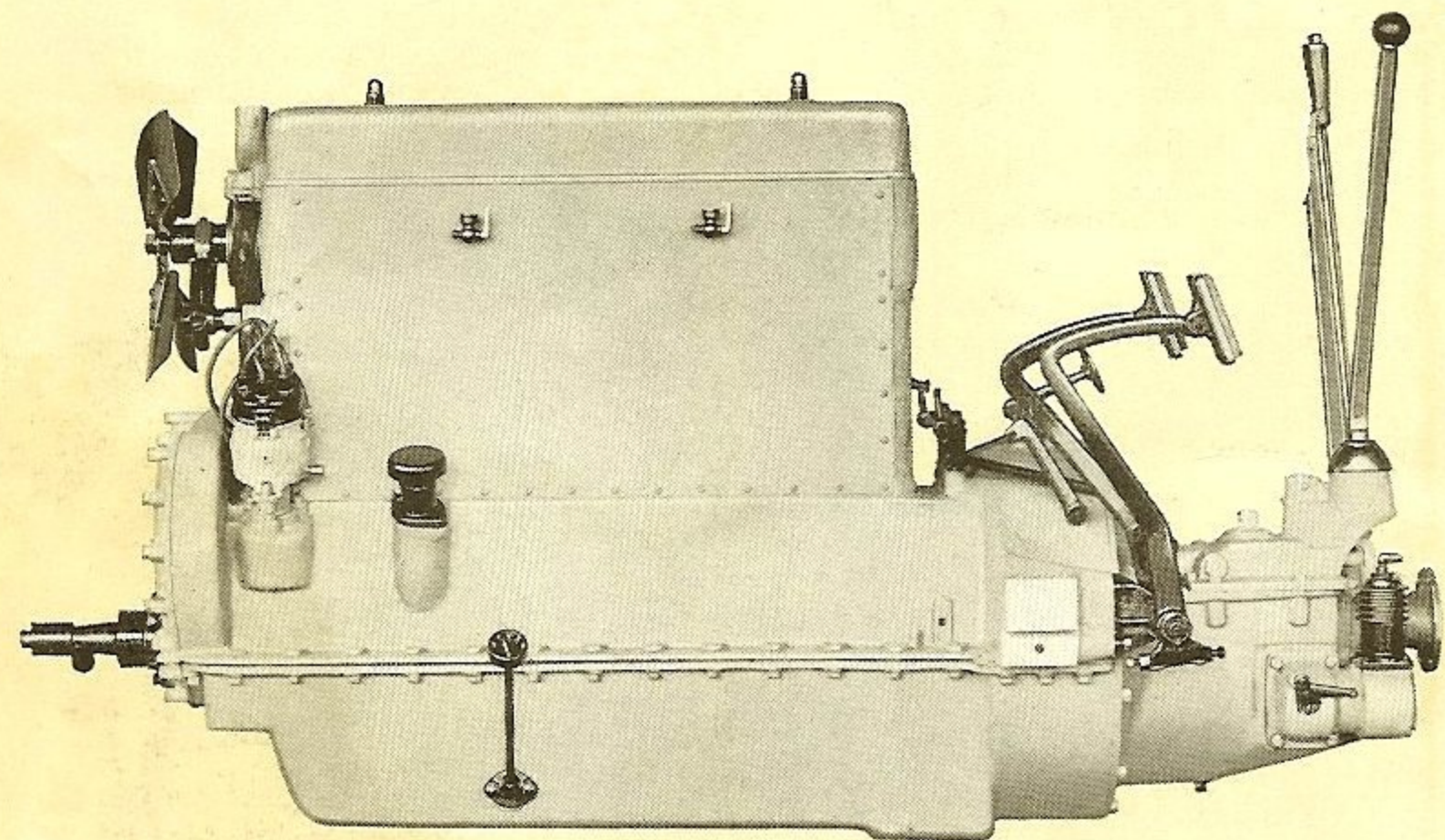
*The*  
NATIONAL  
SEXTET

ENGINE SPECIFICATIONS  
AND CHASSIS DETAILS





*All operating accessories are conveniently grouped on the right side of the National Sextet engine*



*The left side is as bare and clean as a freshly calcimined wall, with covers concealing the valve mechanism*

## *The Finest Engine and Chassis that National Has Ever Built*

**P**OWER in abundance, combined with mechanical excellence throughout engine and chassis, has always been conspicuously characteristic of National motor cars. In the new National Sextet, however, the National engineers have transcended all their previous achievements, extending over two decades of pioneering and development.

They have perfected, after two years of tireless test and continual improvement, a car that outranks any National they have ever built, not excepting the thoroughbreds of steel that proved their championship mettle in the white heat of speedway and road racing competition.

The engine of the new National Sextet, in fact, marks a distinct advance in the science of motor manufacture.

And measured by the standards that determine the true worth of any engine—power and economy, slow speed performance and instantaneous pick-up, resistance to wear and its corollary, freedom from trouble, and, finally, absence of noise and vibration—the Sextet establishes a level of motor excellence exceptionally high.

### *The Engine is a Six*

First of all, the new National engine is a six.

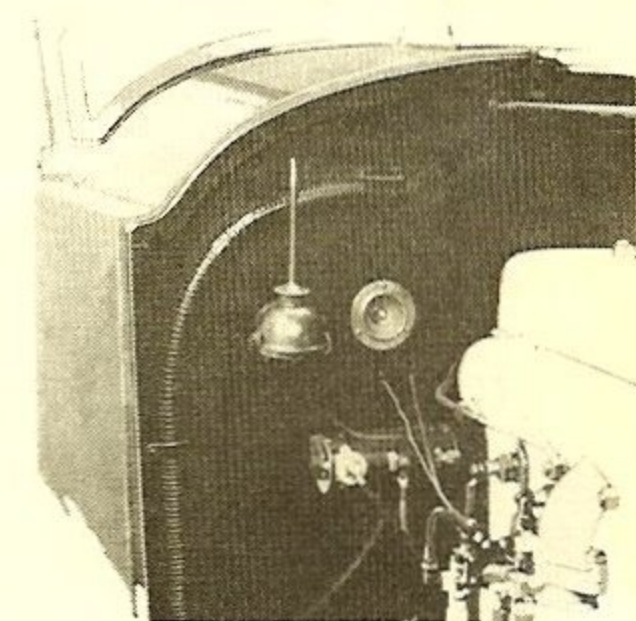
The adoption of the six-cylinder principle for the Sextet was logical. Twenty years' experience in the building of all types of engines, from four to twelve cylinders, all of them on a par with and, in a majority of instances, markedly superior to corresponding types of other manufacture, emphasized this generally accepted fact:

The six-cylinder engine is the most practical type and the nearest approach to the ideal, combining, as it does, the maximum of advantages with a minimum of disadvantages.

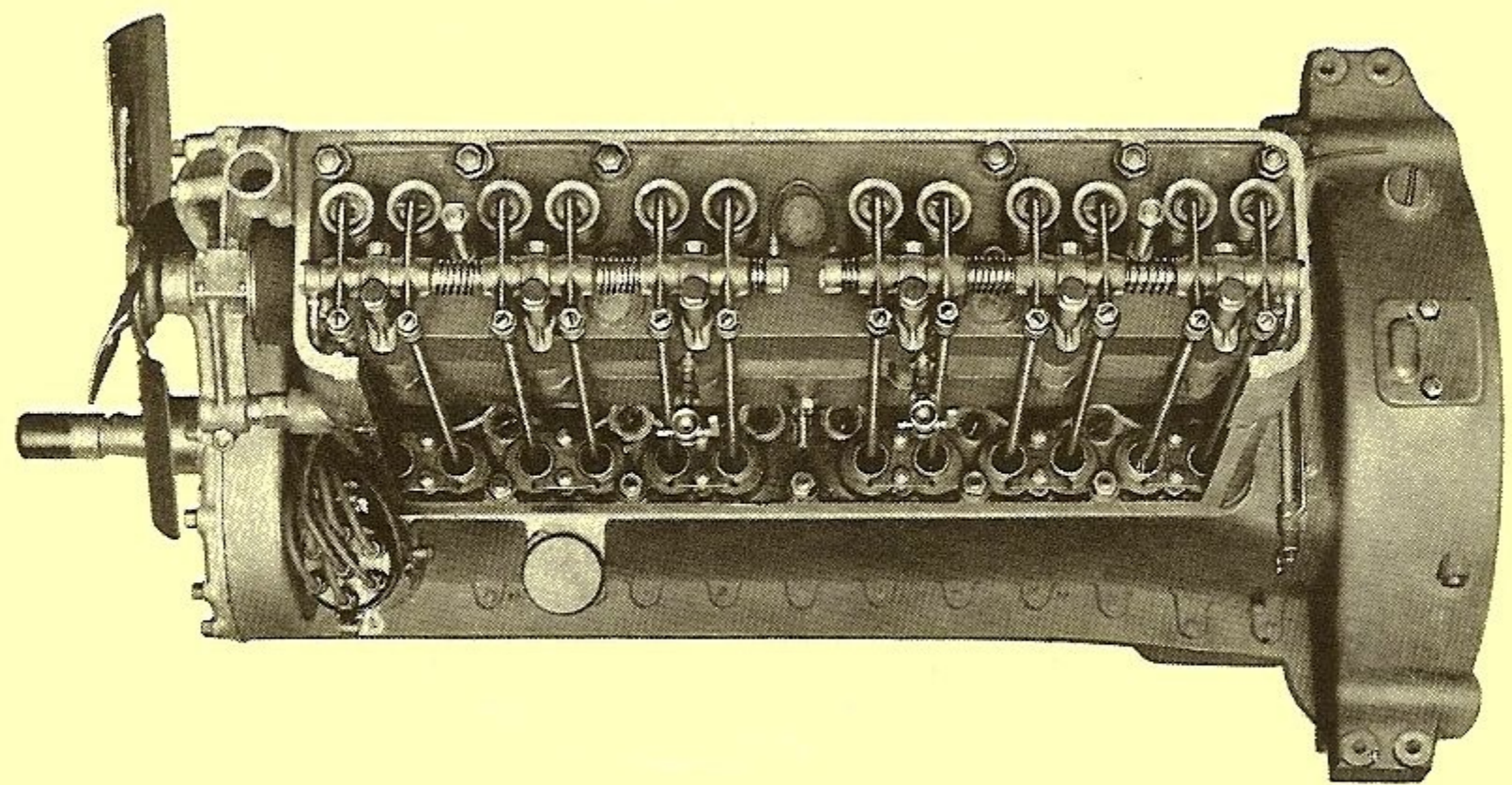
It is universally recognized that the six-cylinder engine gives a complete continuity of power impulses and the uninterrupted flow of power that are impossible of attainment with a four.

And it is equally as patent that with the achievement of this continuous power, each cylinder that is added means nothing more than the addition of so much mechanism, which results in an infinitely greater complexity of construction and an increased opportunity for wear, with little, if any, off-setting gain in performance.

Proving the soundness of such a conclusion by exhaustive investigation and test as well



*A motor light, under the hood, illuminates all working parts of the engine*



*The overhead-valve mechanism is permanently quiet, because of its positive lubrication through the hollow rocker arm shaft, and is easily inspected and adjusted*

as by practical experience, the National engineers, two years ago, determined to develop and perfect the latent possibilities of the six in a motor that would set a new standard of achievement in the field of engine manufacture.

Their work is now completed, and the new National Sextet offers concrete and incontrovertible proof of the correctness of their judgment and vision.

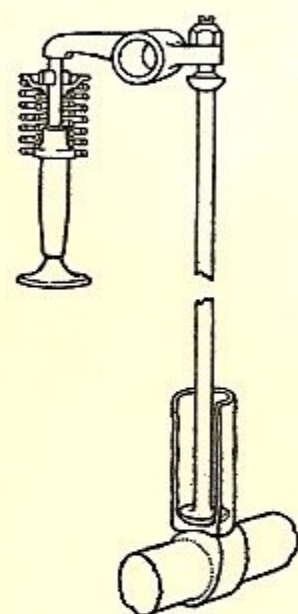
### *A Remarkable Achievement*

The new National Sextet is a revelation in power and performance. With a bore and stroke of only  $3\frac{1}{2}$  by  $5\frac{1}{4}$  inches and a theoretical rating of but 29.4 horsepower, the engine actually develops 71 horsepower at 2600 revolutions per minute.

Further evidence of the amazing efficiency of the Sextet engine can be had by comparing it with the engine of the preceding National model, which had identical bore and stroke measurements yet developed 57.8 percent less horsepower than its more competent successor.

Continuing the comparison, the engine of the Sextet shows a greater economy of fuel and a marked improvement in every detail of performance in actual and arduous service.

How this remarkable result has been achieved is a question that follows naturally and inevitably. The answer is found



*Automatically lubricated ball and socket joints at both ends of the push rods eliminate noise and wear*

in three fundamental and basic reasons, augmented by a host of minor refinements and improvements, as follows:

1—Advanced overhead-valve construction, embodying a new system of gas vaporization especially designed for the handling of low grade gasoline, and utilizing to the utmost every available atom of fuel.

2—Elimination of power waste by the  
 (a) Reduction of friction through an improved system of lubrication;  
 (b) Lessening of the inertia of moving parts by a reduction in weight, which has its compensation in the use of the finest materials;  
 (c) Elimination of all binding action at the bearings, due to shaft distortion, by the use of an extremely stiff and heavy crankshaft, accurately balanced.

3—Extremely fine and close workmanship, insuring perfect balance between all reciprocating parts, and an accurate fit and perfect alignment of all members, thus eliminating both direct power and friction losses throughout the engine.

There follows, as natural consequences of these three most salient structural features of the National Sextet engine, those other attributes that contribute to exceptional efficiency of performance.

To stress by repetition, these attributes are slow speed performance and instantaneous pick-up, reliable, unfailing operation and great resistance to wear, and the absence of vibration and noise, the latter being especially notable because of its accomplishment in an engine of overhead-valve design.

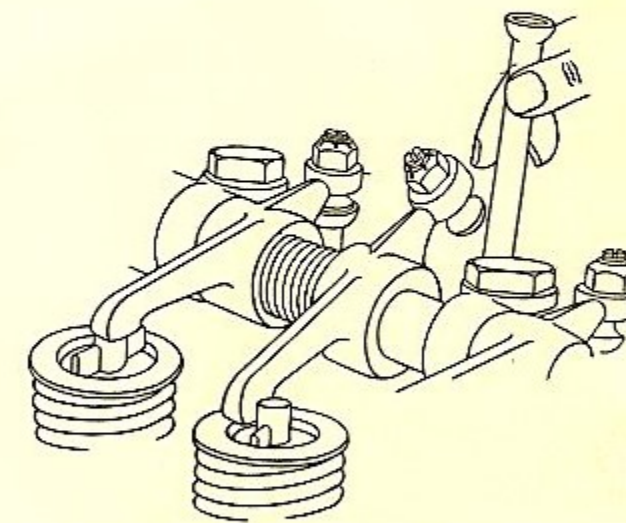
In analyzing the structural factors that make the National Sextet engine the tremendously competent unit that it is, it seems best to consider them in their natural order. The first is:

### *The Overhead-Valve System*

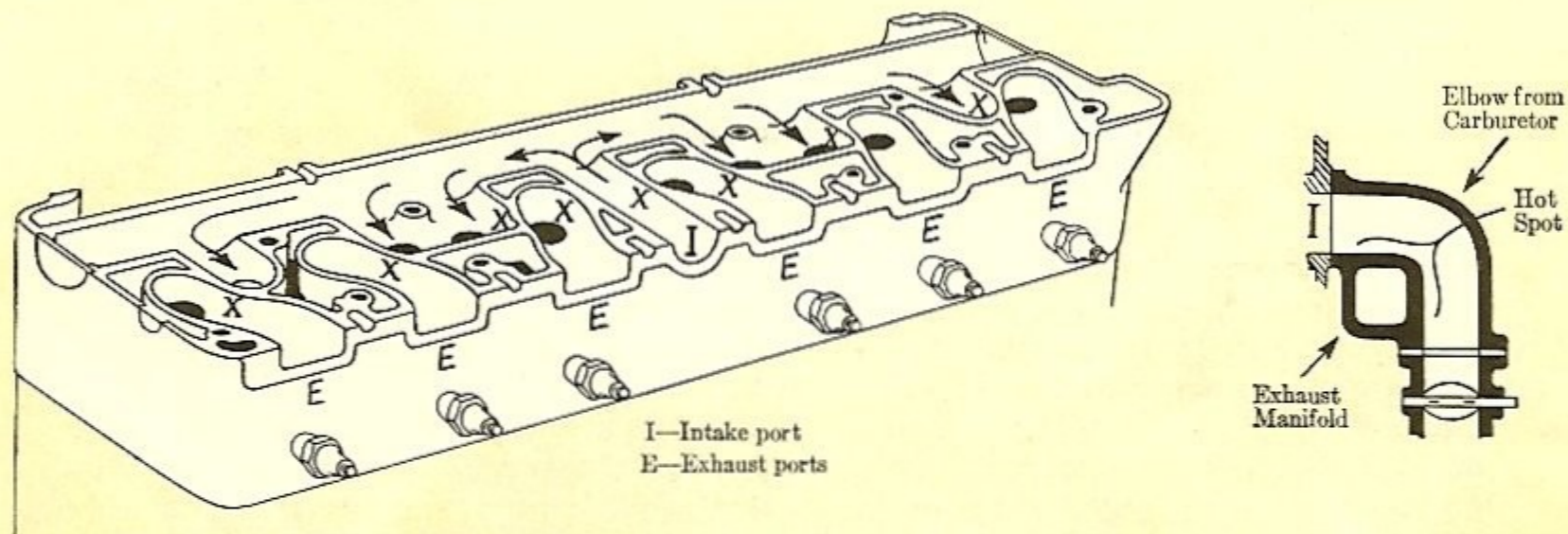
In addition to the advantages inherent in the overhead-valve type of construction, such as quick intake and exhaust, complete scavenging, and direct action of the exploding gases on the piston, with no side pockets to dissipate energy, the National Sextet engine incorporates a number of distinct improvements and refinements that contribute materially to its great power output and efficient operation, which is permanently satisfactory and trouble free.

The valves, for example, are extra large, the  $1\frac{3}{8}$ -inch openings insuring a fresh, clean charge and the complete expulsion of burned gases. Being built of special warp-proof alloy steel, the valves hold their shape permanently and retain compression despite their generous size. Double valve springs are used, giving quiet and hair-trigger action at all engine speeds.

The rocker arms are drop forgings of unusual fineness and light weight. They are mounted on two hollow shafts through which oil is forced,



*Bearing surfaces are easily inspected and push rods removed by slipping the rocker arms to one side*



X—Common walls between intake and exhaust passages

*Exceptional efficiency in the handling of low grade fuels has been attained by casting the intake manifold integral with the cylinder head and locating a hot spot at the point where the gas enters the intake system*

under pressure, direct to the rocker arm bearings. This positive system of rocker arm lubrication, perfected in the National Sextet, eliminates the wear and consequent noise that is common to conventional types of overhead-valve, design, and assures silent and easy performance over long periods of running with minimum necessity for adjustment.

An additional refinement is the use of spring spacers between the rocker arms to hold them securely in place. This construction permits the slipping of the rocker arms to one side for ready inspection of the bearing surfaces.

The fingers of the rocker arms are of unequal length in the proportion of 3 to 2, increasing the lifting effect of the cams on the valves and enabling the use of cams of less height than would otherwise be required. This, in turn, makes for quieter and less abrupt cam action, an additional contribution to engine silence.

The push rods are unique in that they are automatically lubricated, and can be readily removed without the use of tools or disturbing any other part of the valve mechanism. At the top, the push rods are cupped to receive a ball at the end of the rocker arm, while at the bottom, they are spherical in contour and slip into valve tappets that have the form of hollow inverted steel pistons, effecting a ball and socket joint. Complete and thorough lubrication is provided by the pools of oil that gather in these recesses from the oil vapor surrounding the valve mechanism.

The entire valve mechanism is enclosed in dust-tight and sound-proof steel housings, which shut out dirt and grit and give the engine an extremely neat and clean appearance. Should adjustment eventually become necessary, the valve covers are readily removable, affording quick access to the screw adjustment on top of the rocker arms.

## The Manifold Construction

Exceptional efficiency in the handling of low grade fuels is attained in the National Sextet through an advanced pre-heating system that was developed and perfected only after two years of patient experiment and exacting test.

In an attempt to secure more complete vaporization, anybody can apply heat to fuel through such commonly known devices as the hot spot and the exhaust stove. But to apply this heat in just the right amount for maximum power and operating economy is quite another matter. If too much heat is applied, the gas is unduly thinned, resulting in a loss of power. And if too little heat is applied, the gas will not burn properly, power is wasted, carbon deposits form, and unburned fuel seeps past the pistons into the crankcase oil supply, causing lubrication trouble.

The success of the National engineers in the solution of this complicated problem of correct pre-heating is best attested by the remarkable power developed by the Sextet engine when run on low grade gasoline. This power is attained with silky smoothness and without fuel troubles of even the most minor kind.

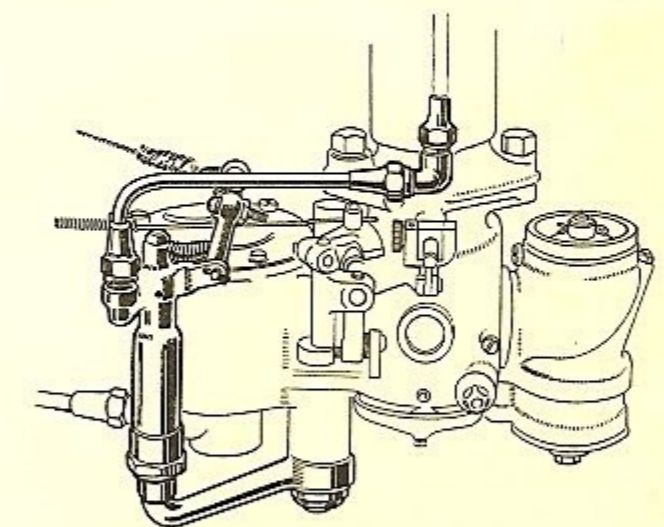
In the engine of the National Sextet, the intake manifold is cast integral with the detachable cylinder head, being hot water jacketed on all sides and entirely surrounded by heat. In addition, the short external elbow, connecting the manifold to the carburetor, is combined with the exhaust so that a hot spot of exactly correct size is formed at the point where the gases enter the intake system. These two features, combined with a hot water jacket around the bowl of the carburetor, unite to produce perfect vaporization of low grade fuels without robbing them of their strength, giving the resultant explosion the snap and pep of high test gasoline.

For starting in extremely cold weather, the National Sextet has an additional convenience in the form of an electric heater, attached to the carburetor. This device, which is controlled by a primer button on the dash, warms a small charge of fuel before the gas enters the intake pipe. Motorists who have experienced the annoyance and delay of starting on a zero morning will appreciate this novel refinement.

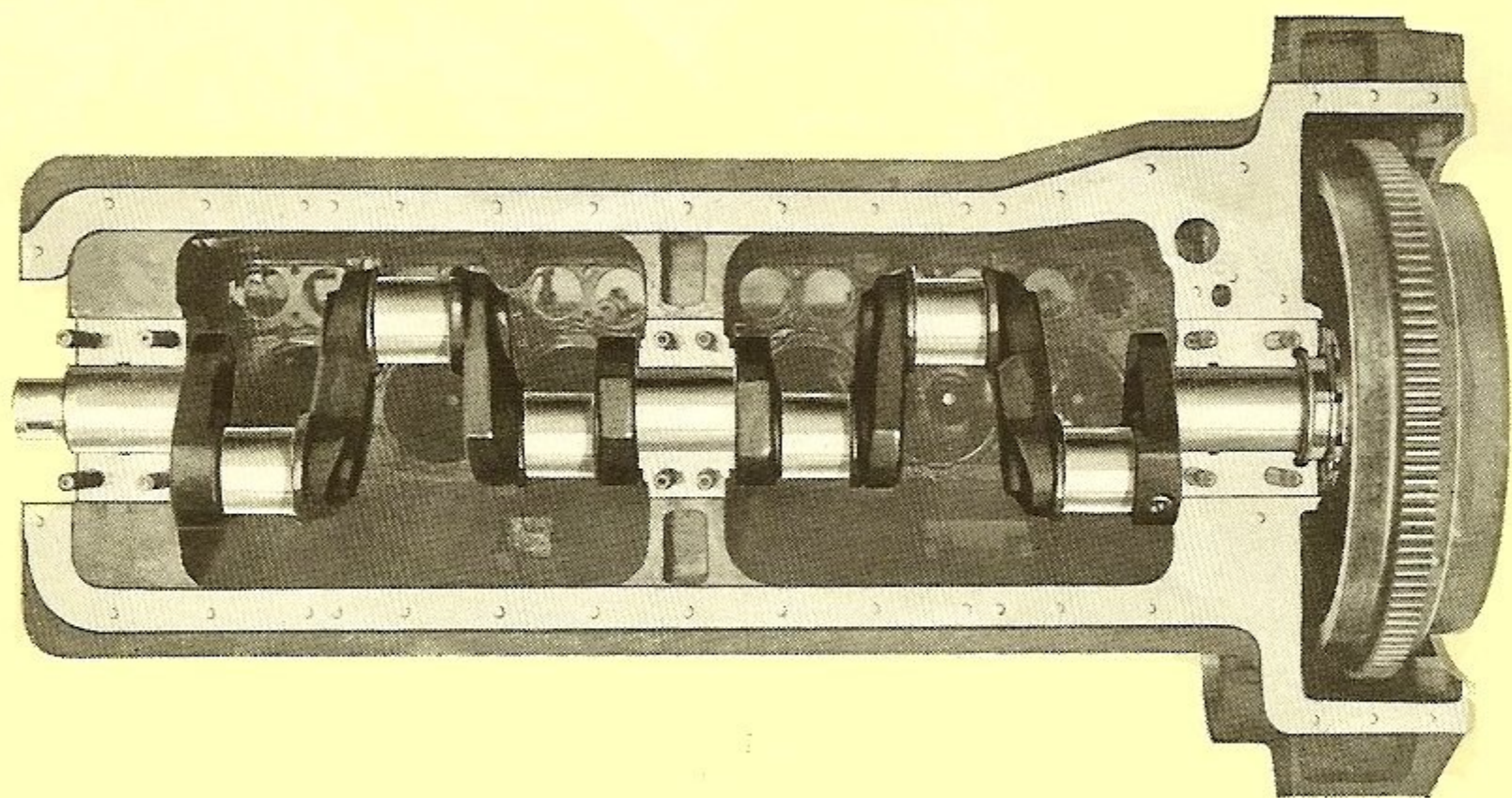
## The Operating Mechanism

Lightweight reciprocating parts, which lessen internal resistance and the consequent waste of power, contribute materially to the exceptional performance of the Sextet engine. In the construction of these reciprocating parts, however, mere weight reduction was not alone sought, only those materials being chosen that would assure sustained excellence of performance over a period of years and at all engine speeds and engine temperatures.

The pistons, for example, are close-fitting castings of fine grained semi-steel, a material that is notable for its ability to withstand wear, as



*An electric heater, attached to the carburetor, facilitates starting in zero weather*



*The National Sextet crankshaft is of unusually large diameter and exceptionally stiff, while all bearings are greatly oversize for long engine life*

well as its resistance to heat changes. These pistons weigh less than two pounds each and hold compression at all engine temperatures. They are fitted with three rings, two of which are of pressure-proof construction to prevent the undue seepage of oil along the cylinder walls into the combustion chambers.

The connecting rods are I-beam drop forgings of unusual strength and light weight. They have bronze-backed, nickel-babbit bearings,  $2\frac{1}{2}$  inches in diameter, that embody the greatest possible resistance against wear. Both the pistons and the connecting rods are balanced against each other with milligrammatic exactness to produce maximum smoothness and to eliminate destructive vibration.

This principle of balancing is continued even to the cylinders, the combustion chambers of which are machined all over so that one will hold exactly the same volume of fuel as another.

### *The Sextet Crankshaft*

Tremendous power, exceptionally smooth, is not the only salient characteristic of the National Sextet engine. The motor also is as tough as rawhide, and with ordinary care, its life should be practically limitless, due primarily to the use of greatly oversize parts at all vital points of wear.

The crankshaft is especially noteworthy in this respect. It is unusually heavy and thick, measuring  $2\frac{1}{2}$  inches in diameter, with front, center and rear bearings of bronze-backed nickel babbit that have a length of  $3\frac{3}{32}$ ,  $2\frac{1}{16}$  and

$3\frac{3}{32}$  inches respectively. Actual service of the most arduous kind has demonstrated beyond all question that the wear on bearings of this size is almost imperceptible even over long periods of use.

Moreover, with a crankshaft of such large diameter, there can be no whip and consequent binding action at the bearings, which is another common source of power waste. The shaft is practically self-balancing, being constructed with curved cheeks whose center of gravity is also their center of rotation. Any remaining tendency to whip has been overcome by forging accurate counterweights integral with the crankshaft cheeks, a construction that produces a smooth, even performance at highest engine speeds.

When adjustment finally becomes necessary, it is easily made by removing the lower half of the copper-aluminum alloy crankcase, the crankshaft bearings being accessibly mounted in the upper half for easy take-up.

### *The Lubricating System*

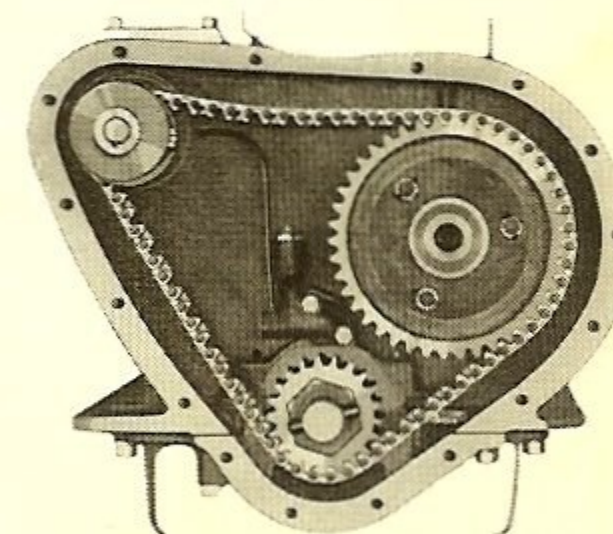
The lubricating system of the National Sextet is a marked improvement over common practice. The flow of oil is complete and continuous under constant pressure to each and every vital point of wear, including the overhead-valve mechanism. This unit of the power-plant heretofore has been neglected, and premature wear has been inevitable through this neglect, with the resultant noise that is regarded as a proverbial fault of the overhead-valve engine.

In the National Sextet, the oil is forced under pressure through the hollow crankshaft not only to all the main and connecting rod bearings, to the camshaft, and the accessory drive shaft, but to the overhead rocker arm shaft as well. The orifices in the crankshaft are unusually large, and carry a generous volume of oil that effectively aids in the dissipation of bearing heat, in addition to providing efficient lubrication.

The pressure is maintained at a fixed point by a regulator at the forward end of the engine, the overflow from the regulator lubricating the timing chain and sprockets. The cylinders and minor parts of the valve assembly are lubricated by the oil mist thrown off by the spinning crankshaft. Oil-tight housings hold this mist prisoner.

### *Other Dominant Features*

The camshaft of the National Sextet, with cams integral, has three large bearings, insuring rigid alignment of the shaft and consequent exactness of valve timing at all engine speeds. Both the camshaft and the accessory drive shaft are driven from the crankshaft by silent chain, a special adjustment being provided for the taking up of slack and the elimination of the noise that sometimes follows wear. This adjustment is possible only where a triangular chain drive, like in the National, is used, and is easily reached through a hand hole in the timing gear cover.



*A special eccentric adjustment takes up all slack in the chain that drives the camshaft and accessory drive shaft*

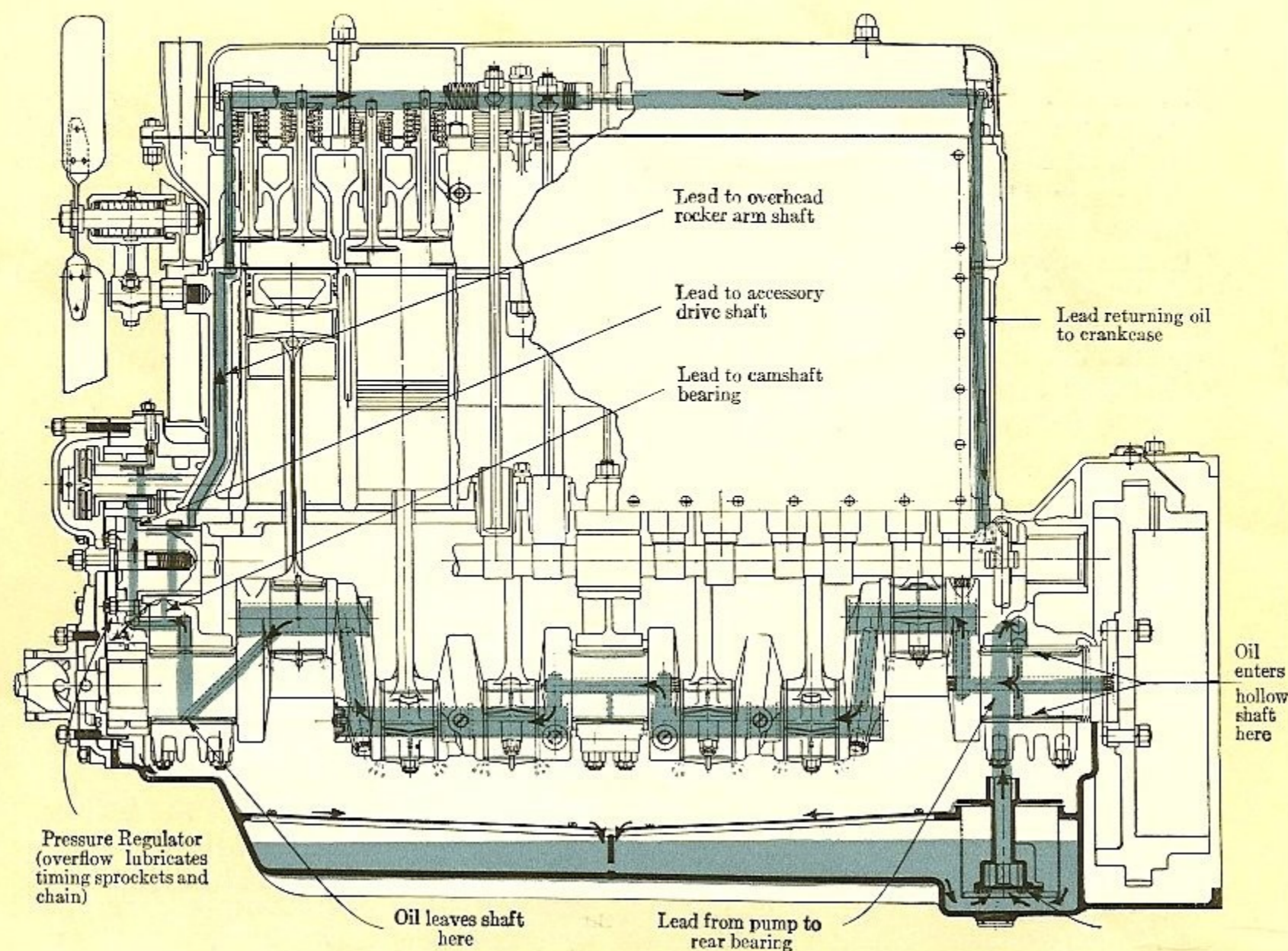


Diagram of the lubricating system of the National Sextet engine, showing the complete circulation of oil through every vital point of wear, including the overhead-valve mechanism

The ignition is by Delco distributor, positively driven by spiral gear from the camshaft, thus assuring perfect co-ordination between spark and valve timing.

Starting and lighting have their source in a Westinghouse single-wire, 6-volt system. The starting motor and generator are independent of one another, and the battery is accessibly suspended from the frame underneath the front floor boards. This is the simplest and least complicated system that has yet been devised, with chances of getting out of order reduced to the minimum.

The cooling is positive and equal to every emergency, being effected by means of a centrifugal pump and a special four-blade, pressed steel fan of unusual efficiency. The Fedders hexagon radiator has individual cells that are removable in the event of damage through accident.

The carburetor is a Rayfield, fed by a Stewart vacuum tank of the largest size. The gasoline tank of 18 gallons capacity is mounted behind an enveloping cross member at the rear of the frame to protect it from collision. It is concealed by a sheet steel apron, in which is a slide-cover opening that reveals the

capacity gauge on the tank. The filler cap is accessibly located on the right, near the curb.

If you have ever run out of gasoline on a road where several miles separated you from the nearest garage or filling station, you will put not a little value on the emergency reservoir that is built into the gas tank of the National Sextet. This reservoir gives a reserve supply of 1½ gallons when the main tank is empty, and is controlled by a valve on the heel board of the rear seat. The emergency tank, incidentally, is automatically the first to be filled, so it requires no special thought or attention.

### Accessibility

In time, even an engine as finely built and as thoroughly lubricated as is the motor of the National Sextet requires overhaul, and when that time comes, accessibility becomes an essential factor in reducing upkeep costs, saving, as it does, many hours of labor in the work of inspection, adjustment and repair.

The Sextet engine has been designed and constructed with a view to ready accessibility, in order that its original state of efficiency may be maintained over a long period of years with the minimum trouble and the least expense.

The cylinder head, for example, is detachable for easy access to all valves and combustion chambers. The entire valve mechanism is exposed when the pressed steel covers are removed. And the main and connecting rod bearings are readily reached by removing the lower half of the crankcase.

All the accessories of the National engine, such as manifolds, spark plugs, carburetor, water pump, starting motor and generator, are accessibly and conveniently grouped on the right side of the engine, leaving the left side as bare and clean as a freshly calcimined wall.

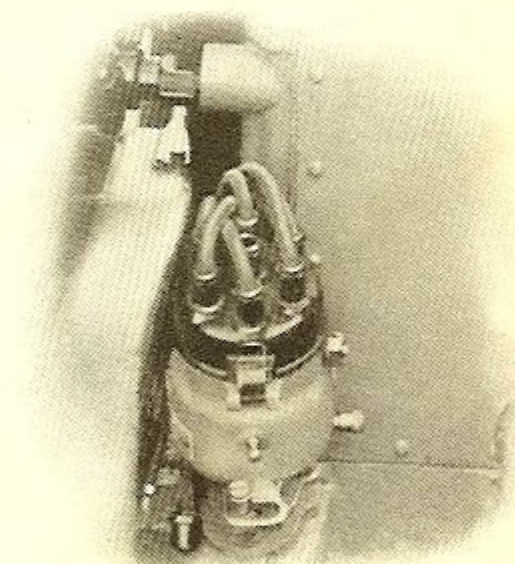
A motor light, mounted on the reverse side of the dash underneath the hood, enables easy inspection and adjustment at night.

### Workmanship

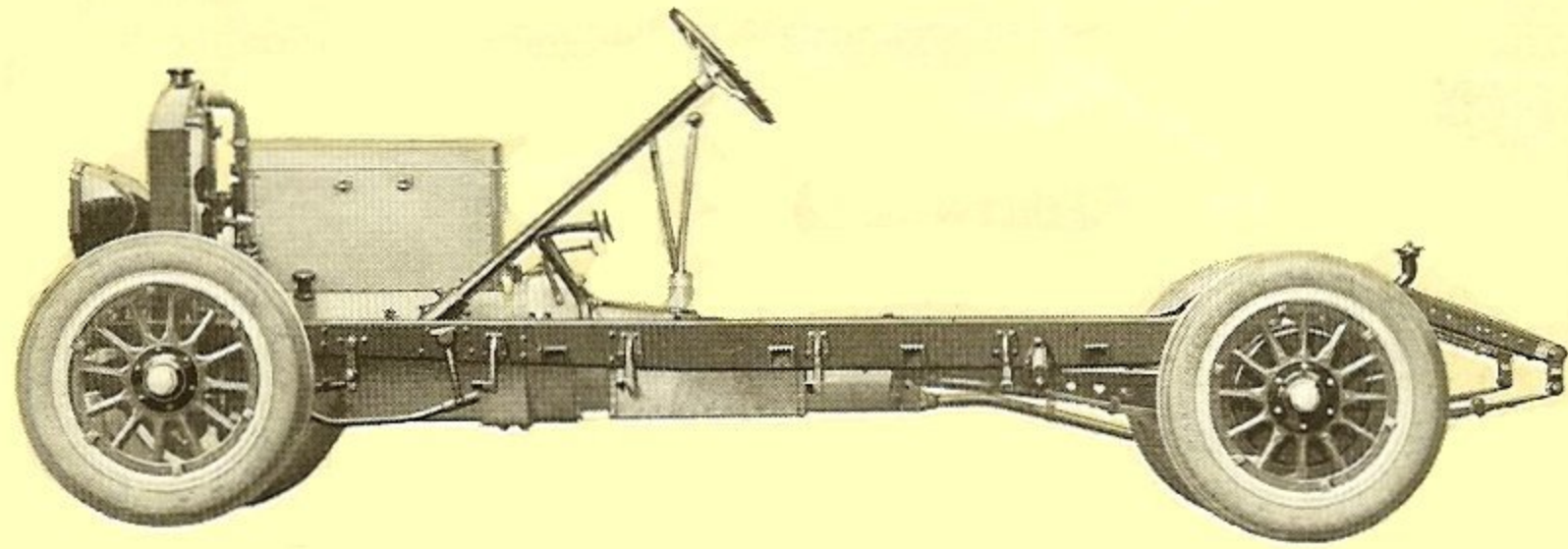
All the major improvements and the many niceties of design that make the National Sextet engine the outstanding engineering achievement that it is could be wisely discounted by half were it not for the rigid adherence to extremely close standards of accuracy that characterizes the engine's production, every operation of which is performed in the National shops.

The relation of fine workmanship to efficient performance is often lost sight of, probably because the intimacy of that relationship is not thoroughly understood. Its importance, however, becomes apparent when the car owner is brought face to face with the realization that every misfit in an engine, no matter how infinitesimal, invites rapid deterioration, and that each misalignment carries excessive friction and loss of power in its wake.

The Sextet engine is built under advanced



The Delco distributor is positively driven by spiral gears from the camshaft



*Salient features of the clean-cut National Sextet chassis are low center of gravity, unusually complete provision for automatic lubrication, and long, flexible springs*

methods of precision manufacture, many of which are exclusively National and unduplicated in other shops. Reciprocating parts are balanced to the fineness of a milligram, and all parts of all units are fitted with utmost closeness and accuracy of alignment. As a result, the Sextet engine utilizes every atom of fuel, destructive vibration is eliminated, and the energy so often wasted through friction is applied to the rear wheels.

### *Performance*

A flood of reserve power is always at the command of the National Sextet driver. Costing nothing when it is not used, as when loafing along at third or half-throttle in ordinary city driving, it is always there for the emergency sprint or pull. And when the accelerator is stirred, the engine responds with a snap that lifts the car out of the crush of metropolitan traffic or crowds the telephone poles closer together on the open road.

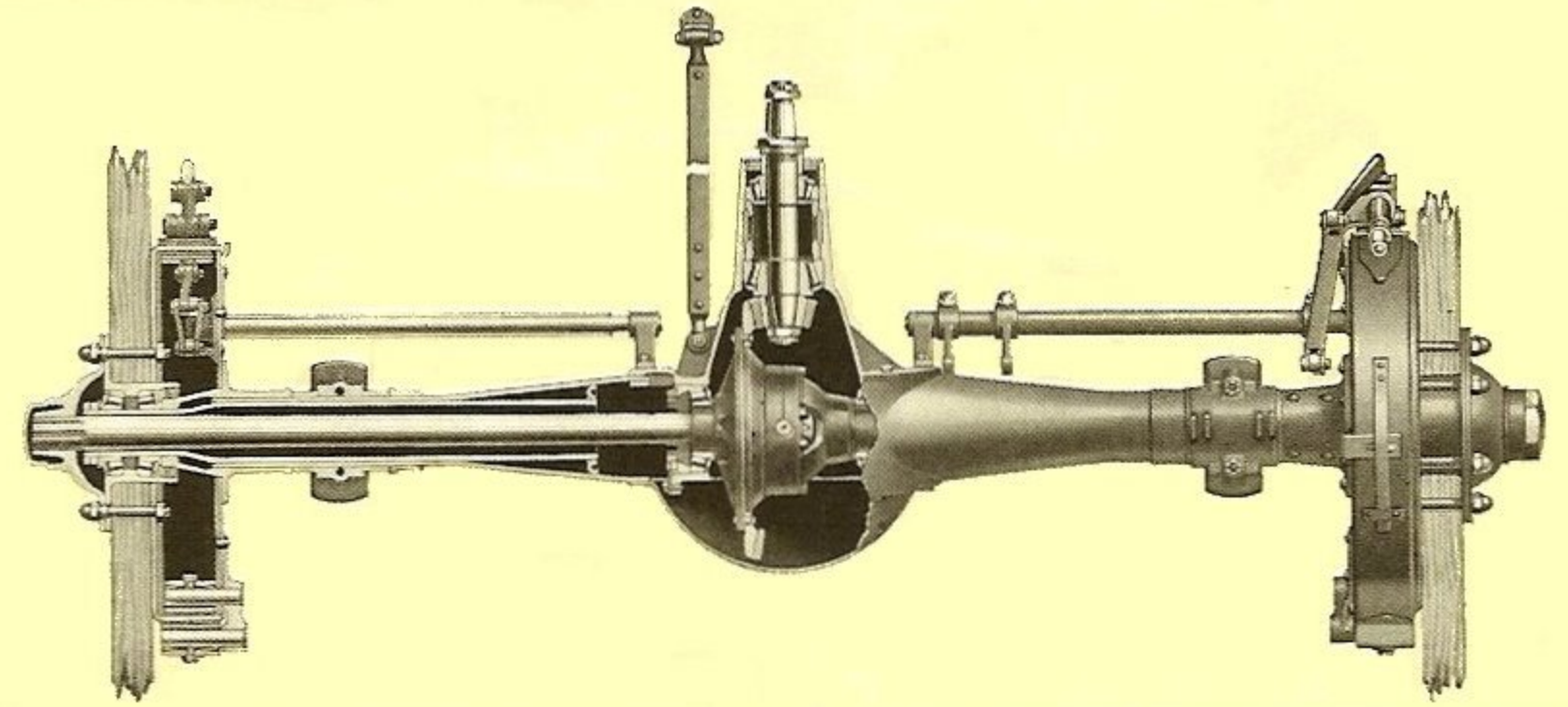
So, with the National Sextet, the driver may hit a 60-mile-an-hour clip or slowly drift along with the tide of congested traffic, yet the car maintains, season after season, the gratifying average of twelve miles to the gallon on the lowest grades of fuel.

In addition to emergency speed, rapid pick-up and ease of handling, this reserve power means lessened engine strain and prolonged engine life. By virtue of that fact, the National Sextet engine, ever running easily and always with something to spare, has an increased capacity for service over a long span of years.

### *The Sextet Chassis*

As the National Sextet engine is distinguished by its abundant and responsive power, so is the National Sextet chassis notable for its rugged and enduring strength.

Especially noteworthy is the unusually complete provision that is made for



*The full-floating rear axle, with Timken bearings throughout, has a one-piece pressed steel housing that reduces unsprung weight and increases riding comfort*

automatic lubrication, oil and grease cups having been replaced wherever practical by oilless bushings that require no attention.

The frame is cold-pressed steel of deep-channel section, tapered in front for smaller turning radius. In fact, this big, roomy car, measuring 130 inches from hub to hub, can be turned without gear-shifting maneuver in a forty-foot street. Suspension of the engine on the frame is made at three points, relieving all twisting strain.

The transmission is of the three-speed selective type, running in oil and is mounted in unit with the engine, insuring absolute alignment. It is driven through a single dry-plate clutch that combines soft, velvety action with firm, positive engagement. In addition, the clutch is easily adjusted with an ordinary monkey wrench to take up wear.

The drive shaft transmitting the power from the engine to the rear axle is hollow and of unusually large diameter, combining great strength with light weight. It is fitted at both ends with large internally lubricated universal joints, insuring the free, unimpeded transmission of power regardless of road conditions.

Control levers are centrally located, unusually long, and operated without change of posture. Brake and foot pedals yield easily to pressure and are fitted with corrugated rubber footpads to prevent slipping. Steering is left hand, of the easily operated bronze worm and gear type, with an adjustment to take up end play. A further contribution to operating convenience is a single-cylinder tire pump, mounted on the transmission.

The front axle is a one-piece I-beam drop forging of great strength, with nickel-steel steering knuckles fitted with ball thrust bearings of hardened steel, combining ease in turning with absolute safety.

The rear axle is an advanced type of full floating design, distinguished by a one-piece pressed steel housing that materially reduces unsprung weight and

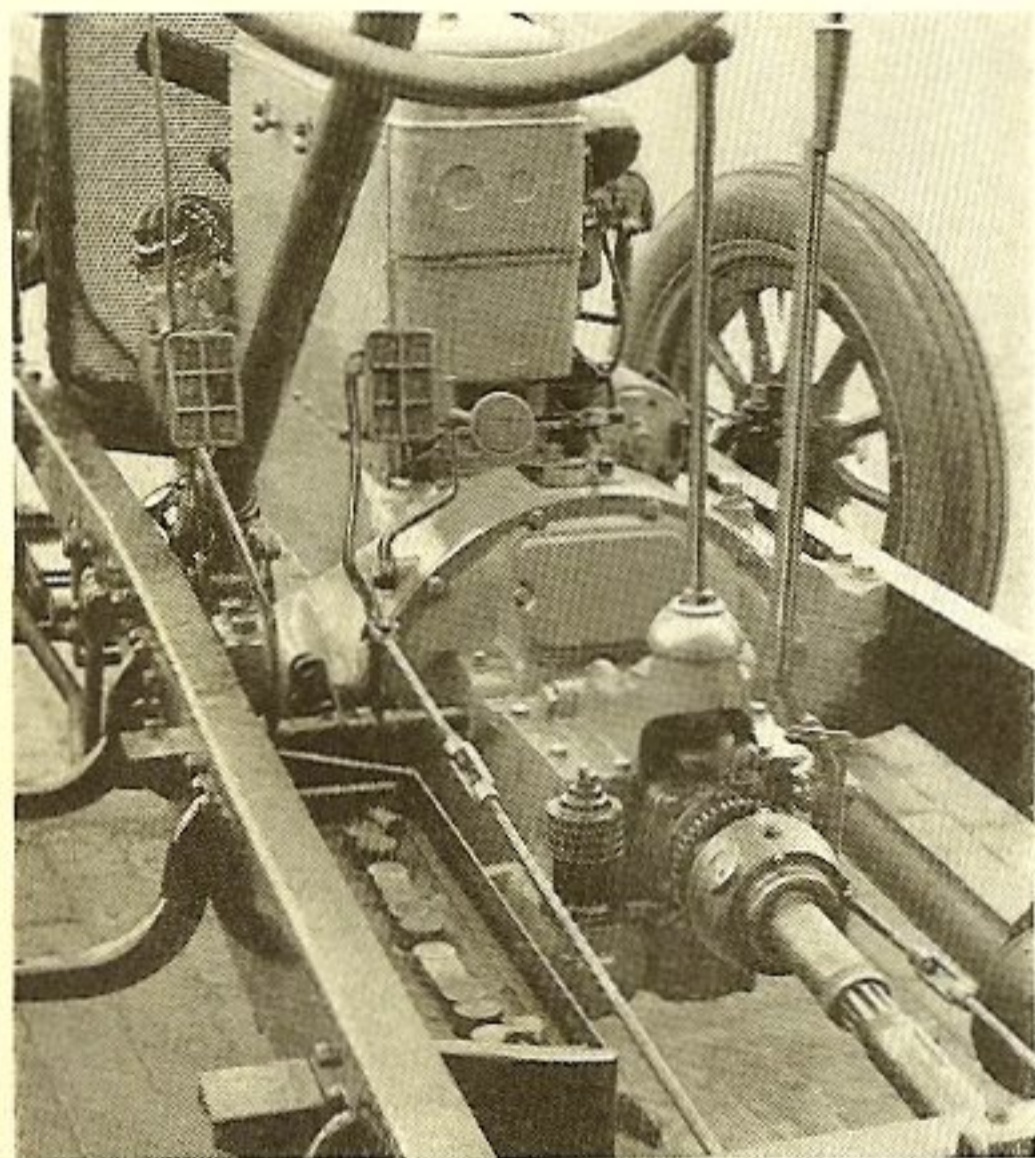
improves riding quality, at the same time giving added strength. The silent spiral-bevel gears that are used are easily adjusted through a removable cover at the rear, insuring quiet operation throughout the life time of the car. Timken bearings are used exclusively in both front and rear axles, and in the wheels.

A distinctive feature of National rear axle construction is the drive, which is through springs in the conventional manner, but with a triangular pressed steel torque arm to take up injurious twisting strain and to prevent disturbance of the brake mechanism.

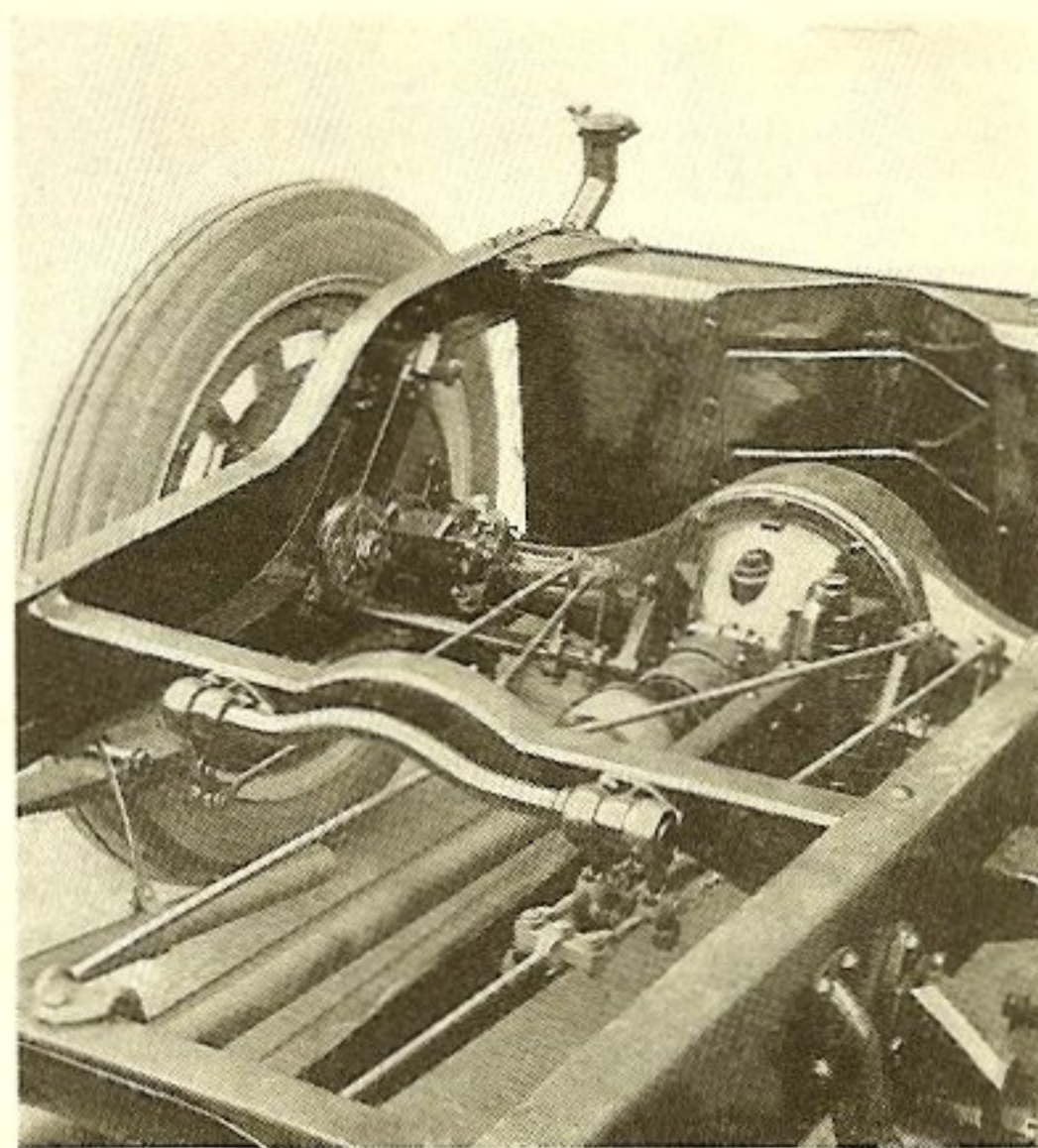
The brakes are of unusually generous size for safety, with wide face and 16-inch drums, mounted on the rear wheels. The service brake is external contracting, operated by a foot pedal, and the emergency brake is internal expanding, operated by an extra long lever.

Unusual riding comfort is provided by the semi-elliptic springs, which are exceptionally long and flexible, with the rear springs underslung to reduce the center of gravity of the car and to eliminate sidesway. The front springs measure 38 inches and the rear springs 60 $\frac{1}{4}$  inches. Their cushioning power is materially augmented by the use of heavy Hartford shock absorbers, front and rear. Grease pockets at the ends of the spring leaves do away with squeaks for all time.

The weight of the National Sextet chassis, equipped with the seven-passenger body and ready for the road, is 3700 pounds. This weight is nicely distributed both for riding comfort, and to insure an unusually high mileage return from the cord tires that are standard equipment.



*Power tire pump and speedometer drive are located at the rear of the transmission*



*Twisting strains are eliminated by a pressed steel torque arm attached to the rear axle*



## Detail Chassis Specifications

- STARTING AND LIGHTING**—Westinghouse 6-volt single wire system, with separate generator and starting motor, simply constructed and free from complication. Starting motor geared direct to fly-wheel by automatic self-disengaging drive.
- BATTERY**—Accessibly suspended on frame under removable front floor boards.
- MOTOR LIGHT**—On reverse side of dash under hood, enabling convenient inspection of engine accessories, all of which are grouped on right hand side.
- CLUTCH**—Single-plate dry-disc type, 12-inch diameter. Simple construction, soft and positive engagement, easily adjusted.
- TRANSMISSION**—Unit with engine, selective type, three speeds forward and reverse. Nickel steel gears running in oil mounted on splined shafts, strongest possible construction. Main shaft mounted on Timken roller bearings; countershaft on large ball bearings.
- DRIVE SHAFT**—Tubular construction, 1¾-inch outside diameter; light and extra strong, with two large internally lubricated universal joints.
- FRONT AXLE**—One-piece, I-beam drop forging, with Timken wheel bearings and nickel steel steering knuckles fitted with ball thrust bearings of hardened steel.
- REAR AXLE**—Full floating type, with one-piece pressed steel housing, reducing unsprung weight and materially improving riding qualities. Fitted with noiseless spiral bevel gears running in oil and mounted on Timken roller bearings. Axle shafts are splined, strongest construction known. Differential and gears easily adjusted through removable axle cover at rear.
- DRIVE**—Through springs, with triangular torsion member to take up twisting strain, distinctive National feature.
- SPRINGS**—Semi-elliptic, silico-manganese steel, extremely long and flexible; front, 38 inches long, 2 inches wide; rear, 60¼ inches long, 2½ inches wide. Rear springs underslung, lowering center of gravity and reducing sidesway. Heavy Hartford shock absorbers front and rear.
- SPRING LUBRICATION**—Grease pockets at ends of leaves and oilless bushings at spring bolts, requiring no attention.
- BRAKES**—On rear wheels, with 16-inch drums, extra large, providing unusual factor of safety. Service brake external contracting 2½ inches wide, operated by foot pedal; emergency brake internal expanding 2¼ inches wide, operated by emergency lever.
- STEERING**—Left hand, bronze worm and gear construction, with adjustment to take up lost motion and end play. Walnut wheel, 18-inch diameter, corrugated inside, with aluminum spider. Horn button on top of steering column.
- CONTROLS**—Emergency brake and transmission levers centrally located, extra long, 23 inches, reached without change of posture. Control pedals fitted with corrugated rubber footpads.
- FRAME**—Cold pressed steel of deep channel section, light and extra strong, tapering toward front end to give short turning radius.
- WHEELS**—Selected hickory, artillery type, with demountable rims and aluminum hub caps.
- TIRES**—Straight side cord, 32 x 4½-inch, front and rear.
- TIRE CARRIER**—Special thief-proof double tire carrier at rear, fitted with Yale padlock. License and tail lamp brackets integral.
- TANK**—At rear of frame, protected by enveloping cross member against collision and concealed by splash apron of 20-gauge steel, with sliding cover revealing capacity gauge on tank. Filler opening at right. Emergency reservoir gives 1½ gallons additional fuel supply when main tank is empty.
- TIRE PUMP**—Mounted on transmission, with connection accessible through handhole in front floor boards covered by removable steel plate.
- SPEEDOMETER DRIVE**—On drive shaft at rear of transmission, transmitted through flexible shaft.
- DIMENSIONS**—Wheelbase, 130 inches, giving ample length for the mounting of spacious seven-passenger bodies. Tread, 56 inches.
- SPEED**—Zero to 60 miles an hour with top raised and full quota of seven passengers.
- FUEL CONSUMPTION**—Twelve miles per gallon. Oil consumption nominal.
- WEIGHT**—With seven-passenger body, ready for the road, 3700 pounds.
- TURNING CIRCLE**—Forty feet.

We reserve the right to make changes in construction and equipment as we see fit at any time, without obligation to make corresponding changes on cars previously sold or shipped.

National Motor Car & Vehicle Corporation  
Twentieth Successful Year Indianapolis