FORDOWN
Incorporating NEWSABOUT FORDS and FORDIST
For Ford Dealers and Owners

Vol 12 MARCH, 1920 No. 6

Utility of Overhead-Valve Cylinder Heads

By
Murray Fahnestock

In the summer of 1917, orders from Headquarters, sent the Technical Editor on a tour in his Ford, to make a personal inspection of all the Ford speedsters and racers that could be found Talks with the owners of these Ford racing cars, and rides and inspections of the cars themselves, left no doubt, in the mind of the writer, as to the increase in speed and power secured by the use of these 16-valve cylinder heads

But, these racing Fords used heavy, castor oil for lubrication They were fitted with large carburetors, and almost invariably with some form of special, or high-tension ignition And these racing car engines were usually quite difficult to start, and did not generally run smoothly and sweetly at low speeds

And, while all the evidence tended to prove that a 16-valve cylinder head racer simply out-classed an engine not so fitted, still the utility of these early 16-valve heads, for touring car use, with the regular Ford carburetor and ignition system, was still open to question

So, one of the old-style, Type A, 16-valve cylinder heads was secured from the Laurel Motors Corporation, and fitted to an August, 1914 Ford roadster, motor number 554,792 This attempt, to "put new wine in old bottles" led to many interesting experiences, and some tribulations, which can be avoided by those who are wise enough to profit by the experience of others

Experiences With Type A Head

In fairness, to the makers of the Roof cylinder head, we must bear in mind, throughout this story, that these first tests were made with the Type A head, which was not nearly as good as their Type B cylinder head, which they now manufacture

Now the chief fault, for touring car use, of these old-style heads, was that they were liable to air leaks, into the inlet manifold And these air leaks so weakened the mixture that the engine would not run smoothly and evenly, at speeds of less than 20 miles an hour, unless the carburetor was adjusted to furnish such a rich mixture that it would smother the engine when the throttle was opened

On our particular Ford, this trouble was aggravated by the fact that an old cylinder block was used, and there was much leakage around the stems of the push rods operating the valves When these 16-valve cylinder heads are used, the rocker arms are operated by push rods, which run up through the old valve guides, and clear through the top of the cylinder head

Now, in the old style, Type A cylinder head, the inlet manifold was connected to all six ports, in the side of the cylinder block For this reason, any leakage, around either inlet or exhaust valve guides, of the old cylinder block, caused air leaks Thus there were 8 air leaks into the inlet manifold, from the worn valve guides, of this old cylinder block

Also, as the push rods operating the rocker arms, extended through the inlet manifold, passages in the cylinder head, any leaks, at these points, also allowed air to enter and weaken the mixture—thus giving 8 more possible chances of air leaks With 8 air leaks above, and with 8 air leaks below—giving 16 air leaks into the incoming mixture, is it any wonder that the mixture was so weakened that misfiring occurred, and the motor ran badly, at low throttle openings

Auxiliary-Valve Head

Another 16-valve cylinder head has recently been patented, though not yet placed on the market This uses the regular 8 valves, of the Ford cylinder head, and mounts another set, of 8 overhead valves, in the cylinder head

These eight auxiliary valves, are actuated by a chain driven, auxiliary cam shaft, of the overhead type The regular Ford fan is retained The overhead cam shaft is driven by a chain running on sprockets on the front ends of the cam shaft and of the crank shaft

8-Valve Cylinder Heads

In order to get the advantages, of overhead valves, and to permit the use of valves of larger size, such valve-in-head types as the Rajo have been developed These 8-valve cylinder heads are not fundamentally a speed proposition, but are designed more to obtain power and economy, with maximum efficiency

Overhead valves, such as have been a feature of the Buick engine for many years, are said, by the Chief Engineer of the Fiat Company, to give 20 per cent more power, than the side-by-side valve arrangement used in the Ford engine

This is partly due to the fact that, with the overhead valves, there is less wall surface, exposed to the heat of the explosion, and so less heat and power is lost This would make this type of cylinder head easier to keep cool, than the conventional Ford cylinder head, for, if less heat is lost to the cooling water, then the radiator will have less heat to get rid of

The chief objection, to the overhead valves, is that they are apt to have more play, and be more noisy than valves located in the side of the cylinder block This is a **theoretical** objection, which need not exist in **practice**

As we well know, it is not possible to adjust the valve tappet clearance of the Ford engine, without removing the cylinder head, and also taking out the valve This is a tedious, cut-and-dry process—so it is generally neglected After the average Ford engine has been in use for some time, the valve tappet clearance is usually—just what it happens to be!

Some of the valves have too much clearance, and are noisy Some of the valves have too little clearance—and leak Result, of either too much or too little clearance, is that the motor lacks power, and is noisy

One of the very practical advantages, of the overhead valve cylinder heads, of both the 8-valve and 16-valve types, is the ease with which the valve tappet clearance can be adjusted After loosening the locknut, a turn of the adjusting screw makes the clearance just right—without fiddling or fussing

By thus keeping the clearance reduced to a minimum, in spite of the inevitable wear, the overhead valve head will probably be at least as silent, and maybe more so, than the standard Ford valve arrangement At least it is easier for the car owner to keep it silent, if he wishes to

The valves, used in these overheads, are larger than the Ford valves, being 1⅝ inch clear diameter, and giving almost double the exhaust and intake valve area opening of the usual Ford valves Valve opening depends on the length of the strip-of-opening, around the rim of the valve Thus, a slight increase, in valve diameter, means a considerable increase in rim circumference, and effective area of opening These valves are made of tungsten steel, which does not pit or warp easily

The exhaust manifold is constructed with a by-pass and flexible pipe, which conveys hot exhaust gases to a hot-spot jacket on the inlet manifold, and so heats the incoming fuel vapor, before it reaches the cylinders This exhaust manifold has over twice the exhaust area of the usual Ford exhaust manifold, and the exhaust is carried out through a flexible metallic tubing, of 2¼ inch size, and 54 inches long

The rocker arms are drop-forgings, case-hardened The push rods, and the rocker arm pins, are of hardened tool steel, to reduce wear The valve springs have a compression of 38 pounds The regular size Ford carburetor is used

The regular, touring car type, of 8-valve head has a compression of about 60 pounds, with a valve lift of ¼ inch, and valves of 1⅝ inch size

A racing type, of 8-valve head, is made having a compression of 75 to 80 pounds, and having 1⅞ inch diameter valves, of 11/32 inch lift This head is to be used with a 1¼ inch carburetor

Regular Ford Cylinder H

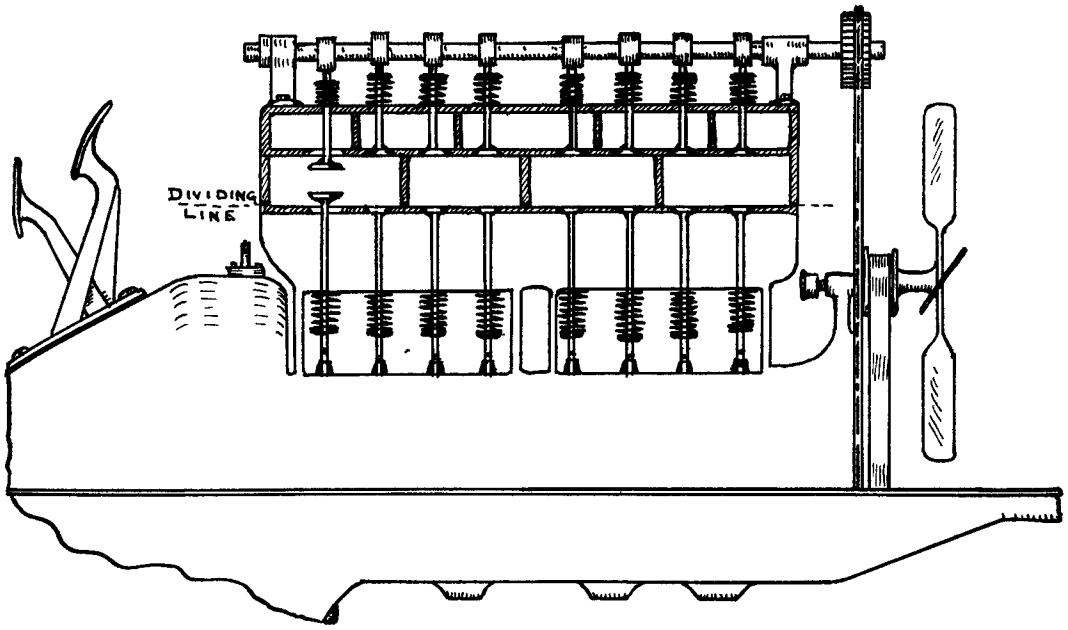
As fuel has become steadily worse, the Ford Motor Company has frequently changed the Ford cylinder head, in order to give a lower compression The lower compression gives better results, with low-grade fuel That is why it is so hard to keep some of the early type Fords from knocking, on present available fuels

Among the different, regular Ford cylinder heads, we might mention

1910 cylinder head—high compression
1911-1912 cylinder head—slightly less compression
1915 cylinder head, compression slightly less
1918 cylinder head, compression much lower Also, this is the **high** type of cylinder head, with much greater water jacket space, giving better cooling And requiring the ¾ inch longer cylinder head bolts, to fasten it to the cylinder block

Special Cylinder Head

The Green, Power-Plus cylinder head, holds about a half-gallon more cooling water than the regular Ford cylinder head, which it replaces The water jacket surrounds the spark plugs completely The largest part of the combustion chamber is located directly over the valves, and the inside of the head is smooth The spark plugs are located in the center line of the cylinders, this tending to give quicker combustion



Cross Section of 16-Valve Head

set to give a slight over-lap, for high-speed work That is, the inlet valves begin to open, before the exhaust valves have entirely closed, thus losing no time at all in getting to work As a special cam shaft is used, it is specially timed for high-speed work

The combustion chamber is almost entirely machined, and may be varied in depth, to give a compression of from 70 to 90 pounds gauge pressure

Double Ignition

One of the features, of the Craig-Hunt, 16-valve head, is the use of two spark plugs for each cylinder The idea being that of burning a candle at both ends, by means of which the candle burns twice as quickly

By firing the mixture, from both sides at the same time, quicker combustion will be obtained, and there will be a higher pressure available in the cylinders for kicking the pistons around, and developing maximum power

Regular Ford spark plugs, of the ½ inch, Champion X type are used

Manifold Design

A glance, at the inlet manifold, shows that special attention has been given to the problem of securing equal gas distribution to all four cylinders It will be noticed that the branches, to the front and rear pairs of cylinders, are of the same length, and that these branches divide equally, between the cylinders of each pair

For use on a half-mile dirt track, or for speedster use, a carburetor of the 1¼ inch size is recommended For board track racing, where the highest attainable speed is desired, a carburetor of the 1½ inch size is recommended

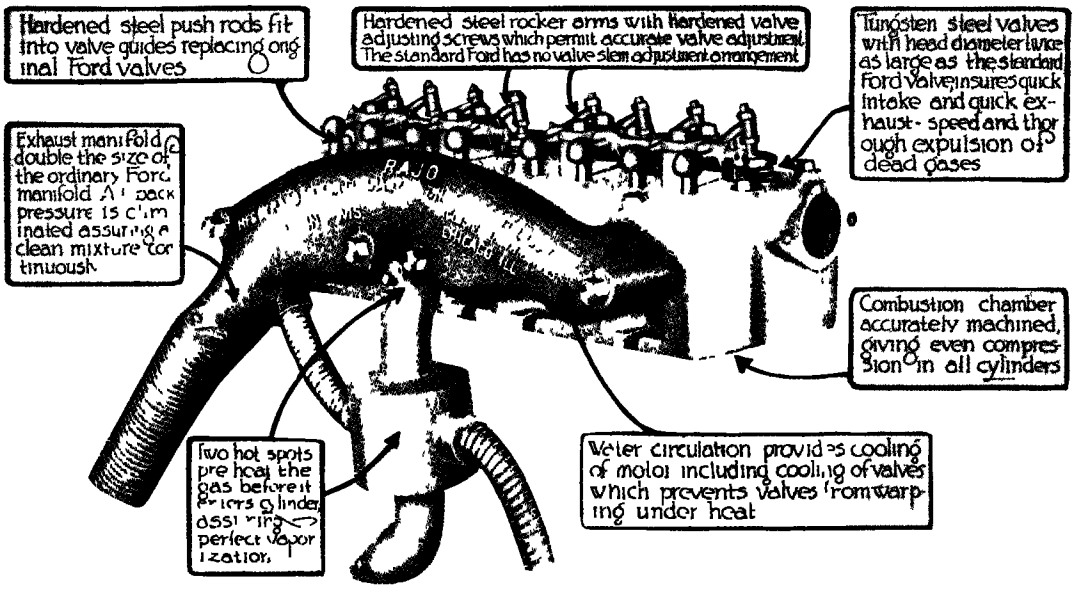
Now, the Ford carburetor is of the ¾ inch size, and a 1½ inch carburetor is not twice, but rather, it is 4 times as large! While carburetors are measured by the diameter of their bore, their capacity, to deliver a fuel charge to the cylinders, is in proportion to their area Consequently, a 1½ inch carburetor will deliver 4 times the volume, of the standard Ford carburetor, of the ¾ inch size

An aluminum inlet manifold is furnished with the Craig-Hunt cylinder head But no exhaust manifold is furnished, as most speedster builders use some special form of exhaust fitting, and can easily have a manifold built to suit their own individual requirements

There are 8 cams, on the overhead cam shaft, and each cam operates a rocker arm which actuates two valves There are individual adjustments, on the ends of the rocker arms, which make contact with the valve stems, by means of which the adjustment for valve tappet clarance, can be individually made, for each valve This tends to ensure quieter action, and more accurate valve timing

The placing of the valves, at an angle of 20 degrees, has the advantages of giving the gases a good start in the direction that they should go, thus making easy the induction and exit of the gases

The same chain, which drives the cam shaft, also offers opportunities for driving magnetos and other accessories—in the same manner that one chain is used to drive the cam shaft, generator, and other devices, on many high-priced, other-than-Ford automobiles



which was designed for testing aviation motors—even the energetic, 16-valve Ford engine could not spin the heavy armature, of this electric testing generator, at a sufficient speed to show the maximum power, which the 16-valve equipped cylinder head was capable of developing

But, as the power curve, of the 16-valve, large-carburetor Ford, still slopes upward, after passing the 30 horse power mark, it seems possible that this 16-valve head may develop a maximum out-put of considerably over 30 horse power—though no official tests are available to either prove or disprove this

Craig-Hunt, Peugot-Type Head

The Craig-Hunt, Peugot-type cylinder head, is designed for racing and speed car use, and is not recommended for touring cars and trucks As this cylinder head uses 1½ inch valves, it is evident that the valve opening area is doubled, and thus great power and speed can be obtained

The valves are seated at an angle of 20 degrees from the vertical, thus giving a more nearly spherical and more efficient combustion chamber space, and reducing the amount of heat lost through the walls to the cooling water

While regular Ford valves can be used, the makers do not recommend this practice, as the valve heads might break at high speeds The area of the ports is somewhat greater than the area of the valve openings, so that there is no constriction, at this point The compression ratio is about 5-to-one, as the combustion chamber forms about 20 per cent of the cylinder volume

The valve springs are held in place by nuts and cotter pins, on the valve stem By using this method, equal spring tension can be obtained, and stronger springs can be used

One of the novelties of design, of this 16-valve cylinder head, is the use of the chain driven, overhead cam shaft This eliminates the use of the regular Ford cam shaft, unless the Ford cam shaft is retained for use with the timer, or as an idler gear in driving the high-tension magneto—so generally used in speed cars

In the earlier, Craig-Hunt heads, the overhead cam shaft ran open, and exposed to dust and dirt But, on the present models, this overhead cam shaft is enclosed in an aluminum housing, which is held in place by ten cap screws, on the top of the cylinder head

The cam shaft runs on light ball bearings And each cam dips in the oil contained in the cam shaft housing—thus giving perfect and continual lubrication of the cams, cam rollers on the rocker arms, and of the rocker arms themselves

The cam shaft is driven by a high-speed, Diamond roller chain And, as roller chains give good satisfaction on motorcycles, where they run within a few inches of the muddy roads, and transmit up to 10 and 15 horse power, without undue noise, the chain drive should give long wear and quiet running, when only required to transmit the less than ½ horsepower that is necessary to actuate the cam shaft of a 16-valve cylinder head

The chain is driven by a sprocket on the crank shaft, which replaces the usual fan pulley on the crank shaft No fan is used, with this 16-valve cylinder head, as owing to the small area of the wall space of the cylinder head, but little heat is lost into the cooling water Consequently the water of the cooling system is easily kept at normal temperature by the radiator—without the help of the fan At high speeds, a fan has practically no effect on the amount of air drawn through the radiator

The cams, of the roller-follower type, are

Intake Side—Craig-Hunt 16-Valve Racing Head

of the cylinder head has the advantage that this tends to keep the spark plugs clean Both oil and soot are burned off the plugs, as rapidly as formed

Most of us have noticed, when scraping carbon from a Ford engine, that quite frequently the carbon has been completely burned off the heads of the exhaust valves, while the heads of the inlet valves are often covered with a heavy, oily incrustation of carbon

Locating the spark plugs on the exhaust side of the cylinder head, does not seem to have interfered with the smooth running of the engine at slow speed The incoming gases, from the inlet valves, flow right across to the spark plugs

Also, with the **overhead** inlet valves, the distance from the edge of the inlet valves to the spark plug points is less than 2½ inches

Magneto and Single-Spark Ignition

The speed and power, of the standard Ford engine, are restricted in several ways One is by the small size of the regular valves, another is by the lag, and lack of accuracy of the Ford ignition system

This ignition becomes increasing inefficient at higher speeds, and was never designed for high speed work In order to get full value, from the 16-valve cylinder head, it thus stands to reason that some form of high-tension magneto, or some form of special ignition system, such as the Philbrin, or Atwater-Kent is of value Strengthening one leg of a man enables him to run faster But strengthening both legs lets him run faster still

Compression

As the doubled valves, of a 16-valve cylinder head, admit more gas to the cylinders, it stands to reason that the compression pressure will be higher, when the throttle is wide open At normal throttle openings, the compression will be practically the same, for the same car speeds

The compression, of one of these 16-valve cylinder heads, is about 78 pounds per square inch And the ratio, between the compression space, and the volume of the cylinder, when the piston is at the bottom of its stroke, is about five-to-one

This 78 pounds compression, is when the racing type, of 1¼ inch carburetor, is used When the standard, ¾ inch carburetor is used, this smaller carburetor does not admit so much gas to the cylinders—especially at high speeds—and so the compression is considerably less, under normal running conditions

The compression can be raised, by cutting off a little metal from the bottom surface of the cylinder head on a shaper But this is seldom advisable The compression can be lowered, by using two or more cylinder head gaskets The same cylinder head gaskets can be used on both Type A and Type B cylinder heads, though special gaskets, with the smaller openings ,are really preferable for the Type B cylinder heads

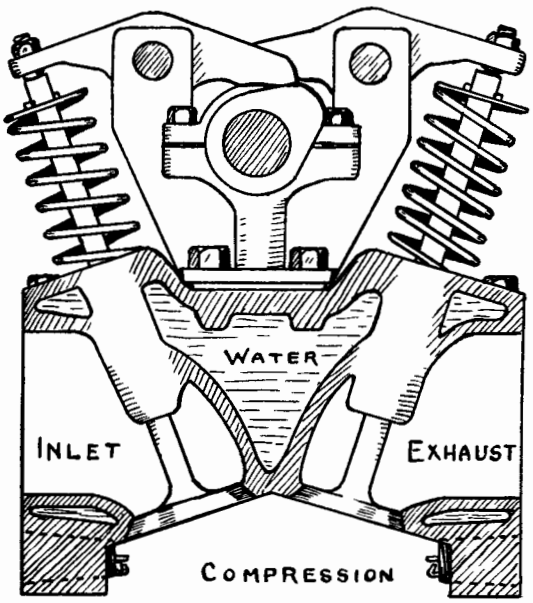
Machined Combustion Chamber

Those of us who have scraped the carbon from the regular Ford cylinder head know how difficult it is to scrape the carbon off the rough, unfinished surface of the casting And, the rough surface of the casting tends to collect the carbon more rapidly, just as a rough, unfinished surface collects dirt more rapidly than a clean polished surface

In the 16-valve cylinder heads, the overhead placing of the valves allows the combustion chamber to be completely machine-finished Thus entirely eliminating any rough, unfinished surfaces, inside the cyl-

inder This reduces the rapidity with which carbon deposits collect, and increases the efficiency of the motor, as less heat is lost through radiation to the cooling water

Another advantage, of a machine-combustion space, is that it enables the compression space of all four cylinders to be made exactly equal This insures even compression, and a smoother and more powerful running engine A horse runs better, with all four legs of the same length



Craig-Hunt 16-Valve

With the old-style, Type A cylinder heads, it is probable that some of the trouble, with smooth running at slow speeds, was due to the use of the old valve ports in the regular Ford cylinder block The ledges, under the edges of these old valve ports in the cylinder block, caught and condensed, some of the gasoline vapor And this caused uneven running at slow speeds, and choking, when the throttle was opened suddenly This trouble has been entirely eliminated, on the new Type B heads, by encolsing all the ports in the cylinder head

The valve stem guides, of the new Type B heads, are more detachable Thus they can be easily renewed, if they should ever become worn, and air leaks exist, around the stems of the inlet valves

Any air leaks can also be eliminated by using Ford valves, with the 1/64 inch oversize stems, and reaming out the worn guides to this size

It is a clever feature, of the 16-valve design, that Ford valves and parts can be used The valves, of the 16-valve head, are of 1¼ inch diameter They can be cut down from the standard Ford valves, of the usual 1⅜ inch size, as the valve stems are of the same size Also, the Ford valve spring washer and cotter pin can be used

As to the valve springs of the 16-valve head, these can be made from the regular Ford valve springs, by grinding about two coils, or turns, from the regular Ford valve springs By grinding down a Ford valve re-seating tool, to 1¼ inch diameter, this tool can be used for re-seating the valves of the 16-valve cylinder head

In connection with the doubled valves, it is interesting to consider that two carburetors might be used to advantage with this 16-valve head, using one carburetor for each pair of cylinders

Those who have been so fortunate as to have examined the Liberty aviation engine, have noticed that it was necessary to furnish this engine with four carburetors, in order to enable the Liberty Motor to develop its full speed and power

On the Type A cylinder heads, a priming cup, for the injection of gasoline for easier starting, can be placed on the inlet manifold But, the Type B cylinder head, is already provided with a couple of priming cups, on the top of the cylinder head These two priming cups connect directly with the branches of the inlet manifold, inside of the cylinder head And any heat at all, remaining in the engine, is thus available for the quick vaporization of the gasoline, and the easy starting of the engine

One owner, of a 16-valve engine, is now using a drop-forged fly-wheel, as he managed to burst the regular fly-wheel of his Ford engine by racing the engine as fast as it would go, without any load to steady the engine This particular engine had special ignition, light pistons, etc

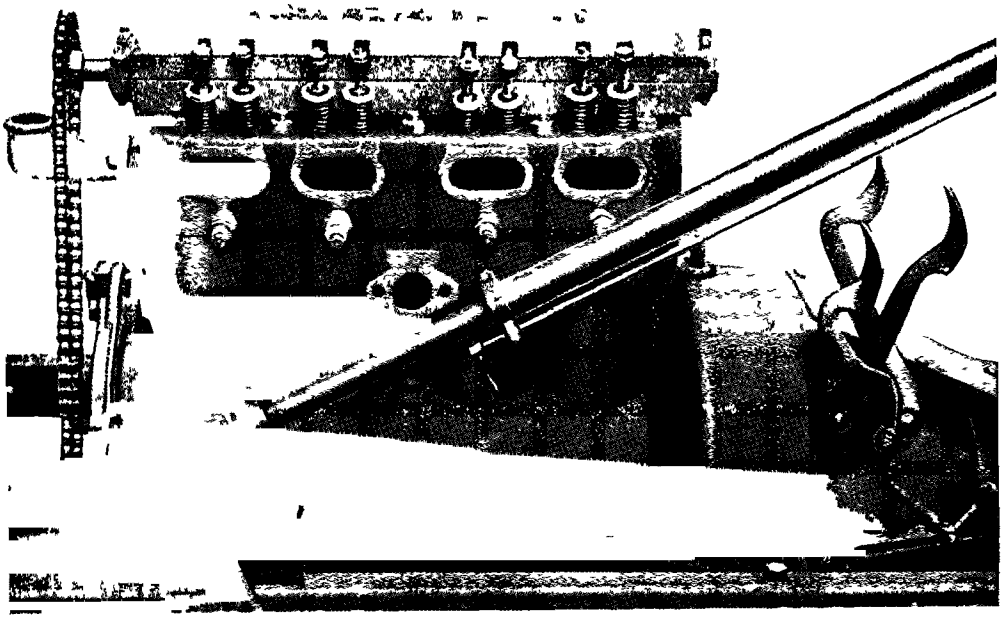
Manifold Arrangements

The inlet manifold is of the Y-type, and its most noteworthy detail is the placing of the exhaust manifold in close contact with the Y-fork of the inlet manifold, thus giving a 'hot-spot' heating arrangement, with some of the heating effect of a combined inlet-and-exhaust manifold

The exhaust manifold is of special design there being 8 ports in the top of the cylinder head, and the manifold fitting over these ports For track racing, one can fit straight tubes, from these exhaust ports and extending straight up through the top of the hood For road racing, one can face the opening in the exhaust manifold towards the left-hand side of the hood, and have one large exhaust pipe, extending along the outside of the car

For touring car use, the exhaust manifold is reversed, with the opening towards the carburetor side of the engine, and the exhaust is conducted over the top of the cylinder head, and past the inlet manifold, and connected to the regular exhaust pipe of the Ford car and muffler of the Ford car

The large cross piece, of the exhaust manifold, where it fits on the top of the cylinder head, is designed to allow quick and easy expansion of the exhaust gases By the time the exhaust gases have reached the elbow of the exhaust manifold, beside the inlet manifold, the gases have been so completely expanded and are flowing so steadily and evenly, that the elbow offers comparatively little



View of Craig-Hunt Head

obstruction to the flow of the gases Another factor, which aids the flow of the gases around this elbow, is that the inside available area of the exhaust manifold is one by 2¼ inches, at this point

There are water jackets, between the ports of the exhaust manifolds, thus securing more effective cooling

In order to secure more effective vaporization, of the incoming mixture, the incoming manifold is placed in such close proximity to the elbow of the exhaust manifold that a 'hot-spot' is formed, where the raw gasoline is completely vaporized

16-Valve Head Developes Power

The Ford engine is rated at 22 5 horse power—under the usual formula, diameter squared, times number of cylinders, divided by the constant 2 5 But, it does not actually develop this much power under actual tests as a general rule, though exceptional Ford motors will sometimes show the full 22 5 horse power, under favorable conditions

The single, solid black line, on the chart is the curve of power production of the average Ford engine, at different speeds About 300 revolutions per minute is about the lowest speed at which the engine develops any real power And it cannot develop more than 2 horse power, at this speed

Now, 300 revolutions correspond to a car speed of between 7 and 8 miles an hour, so that is 2 horse power will not let the Ford engine pull the car up much of a grade on high gear, unless the car is speeded up so that the engine can show more power

The dotted line, is the power curve of the Roof 16-valve cylinder head—using the regular Ford carburetor It will be noticed that this 16-valve head gives from 2 to 3 more horse power, at all speeds

Measuring the horizontal distance, between the two curves, we find that the 16-valve head gives equivalent power, at speeds of about 200 revolutions per minute less

Now 204 revolutions equal a car speed of 5 miles per hour Thus, with the 16-valve head, the car will develop as much power, at 10 miles an hour, as it otherwise would, at 15 miles an hour And this is a considerable practical difference

One might not think that a difference, of 2 5 horse power, would make so much difference in power But, the reason is that this is extra, or surplus, power, and that is what speeds up the car If one is walking down steps, one will descend much faster—if kicked or shoved from arrears

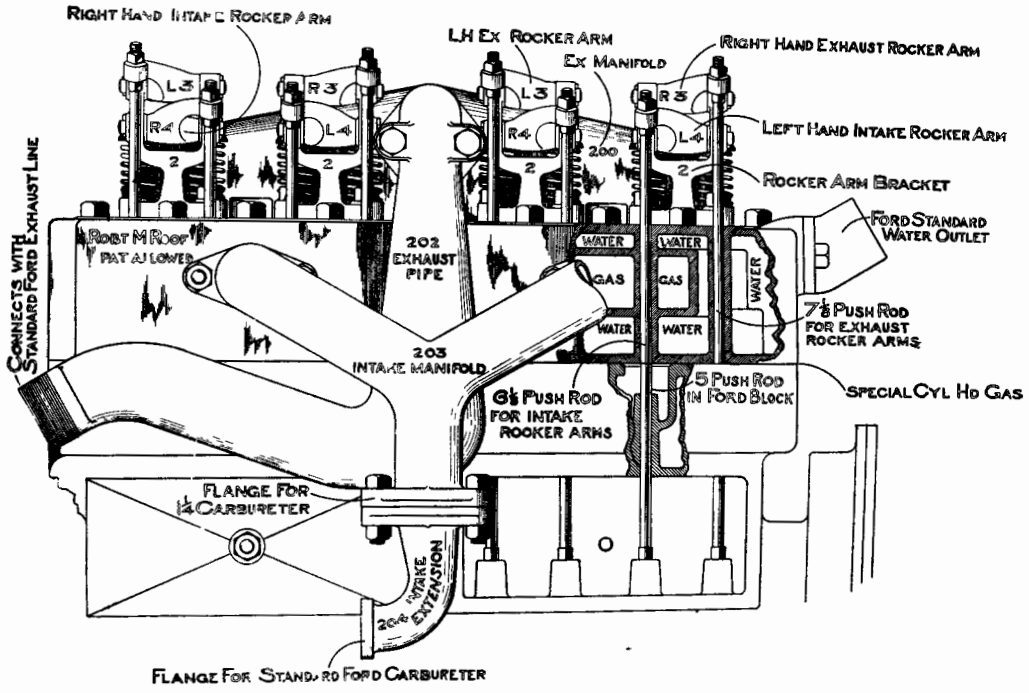
With Racing Curburetor

But, it takes the racing size, of 1¼ inch carburetor to open wide the flood-gates of power and speed And the power produced, is shown by the doubled line on the chart

Even at such comparatively slow speeds, as 1,000 revolutions per minute, which is a car speed of less than 25 miles an hour, the 16-valve head shows an increase of more than 5 horse power, which will make a very large difference in power and hill-climbing ability

At speeds of 1,600 revolutions, or a car speed of about 40 miles an hour, the regular For engine shows about 20 horse power While the 16-valve, large-carburetor Ford engine develops very close to 30 horse power This 10 horse power, added to what one already has, is certainly a tremendous increase in effective power and speed ability

These tests, on the 16-valve head, were made by Mr Roof, at the Government Bureau of Standards And, since these cylinder heads were tested on a very large and heavy electric-dynamometer testing machine—



Roof Type B Head

we mash down an apple dumpling, when we wish it too cool off quickly

With the regular Ford ignition system, and with the regular Ford carburetor (and with counter balances on the crank shaft), we have attained speeds of from 55 to 60 miles an hour, in an open Ford roadster, with the top down This was ample speed to astonish many drivers of larger cars, and gave a get-away on hills that almost seemed to spin the rear wheels

While we are curious to know just what speed they will give without the counter balances, we do think that the combination works well together And as our only available time, for making these tests, is in our off moments and leisure time, we cannot always make our tests as complete as we would like to

Before installing the 16-valve cylinder head, we were thoroughly convinced of power and speed to be gained at high speeds We knew that, at high speeds, the small size of the Ford valves was one of the chief factors, limiting the power of the Ford engine What did surprize us, was the increased power and pep of the motor at low engine speeds

The doubled valves seem to let so much gas into the cylinders that, at slow speeds, the engine has a throb of power, and a 'kick', at each stroke of the piston At higher speeds, the engine almost runs-away-from-itself

Gear Ratios

In our experiments, with 16-valve cylinder heads, we used the regular-ratio gears in the rear axle of the Ford roadster For even board track racing, a 3-to-one ratio is as high as is generally used, for even the lightest racers, with a 16-valve head

We have talked to quite a few builders of racing Fords, and they say that the 3-to-one gears have given them more speed, with a 16-valve head, than the 2¾-to-one gears

For half-mile dirt track racing, about 4-to-one ratio, should be used This gives wonderful accelleration and all the speed that can be used, around the short turns of a half-mile track

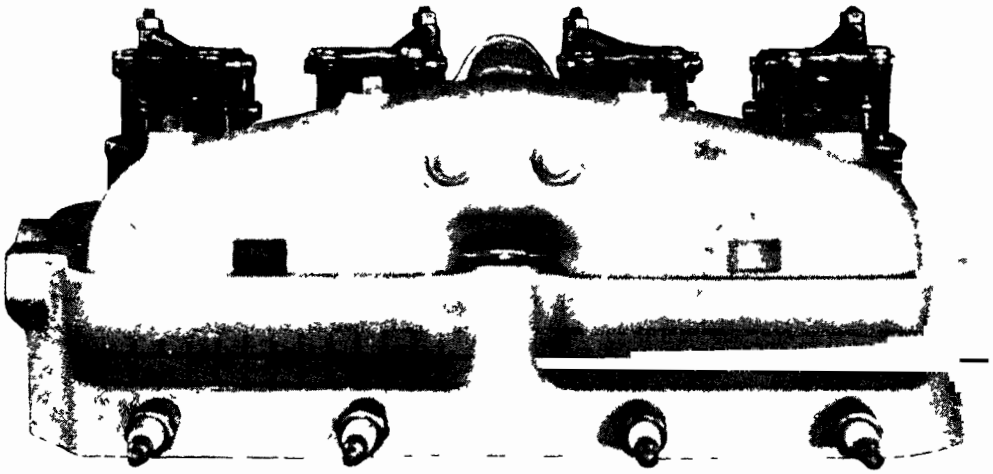
These 16-valve cylinder heads, by letting the gases in and out of the cylinders quickly, enable very high engine speeds to be attained With high engine speeds, a comparatively low gear ratio will give the most available speed on the road or track

In other words, if one has a light Ford racer, which makes its highest speed with say 2¾-to-one gears—and then installs a 16-valve cylinder head, the far higher engine speed, attained with the new cylinder head, makes it probable that best results will be obtained by the use of a 'one-story-lower' gear ratio, being, in ths case, the 3-to-one

Exhaust Connection

On the old-style, Type A cylinder heads, the connection, between the exhaust manifold, on the left-hand side of the cylinder head, and the regular Ford muffler, was made by means of a piece of flexible, metallic tubing This metallic tubing is very convenient for making intricate bends in the exhaust line of a Ford speedster

One of the difficulties, which we encountered, was that the flexible tubing seemed about three inches too short, to reach all the way back to the muffler We have since



Exhaust Manifold and Spark Plugs

learned that, by attaching one end of the flexible tubing to some solid fastening, and giving several hefty jerks to the other end of the tubing, that the tubing can be stretched several inches

Of course, this difficulty can be avoided by moving the muffler a little farther forward, or by changing the muffler over to the left-hand side of the frame, instead of leaving it on the right-hand side

The method we used, was to cut a piece, about a foot long, from an old exhaust pipe, and place this pipe in the front end of the muffler The flexible tubing was then slipped over this extension pipe

This difficulty has been eliminated, on the new Type B cylinder heads, as connections are made whereby the exhaust manifold connects directly to the regular Ford exhause pipe

The question has been asked, as to whether the 16-valve cylinder heads are harder on the main and connecting rod bearings Generally speaking, we would say "No" By this we mean, that there is no more strain and wear on the bearings, with the 16-valve head, than with the regular Ford cylinder head—**at the same car speed and gear ratio**

Of course, if one drives the car at speeds of 50 and 60 miles, much of the time, after installing the 16-valve cylinder heads, then it stands to reason that the bearings will wear more rapidly However, occasional bursts of speed will not make much difference It is prolonged high speeds that cause the most wear

Let us suppose that we drive ten miles, over a certain road in 30 minutes, with a regular cylinder head Then, let us drive over the same road, in the same 30 minutes, with a 16-valve cylinder Obviously, the Ford engine will be developing exactly the same power, and there will be precisely the same wear of the bearings, in each case

Of course, if the drives gets away with the 16-valve head, and passes everything on the road, this will mean more power developed, and more wear on both bearings and tires Extra wear is always the price of extra speed But, most of us feel that the extra speed is worth it!

As a rule, the extra speed and power is held in reserve, to be used in those 'moments of high decision' when someone tries to give us the slip It is the feeling that 'we could, if we would' that is so much more comfortable, than the hopeless despair of 'we would, if we could'

Roof Type B Head

After several years experience, with the Type A cylinder head, which gave splendid racing results, Mr Robt M Roof, Chief Engineer of the Laurel Motors Corporation, devised the Type B cylinder head, to eliminate the difficulties which we have mentioned and to make the 16-valve cylinder head better adapted to use on Ford passenger cars and trucks

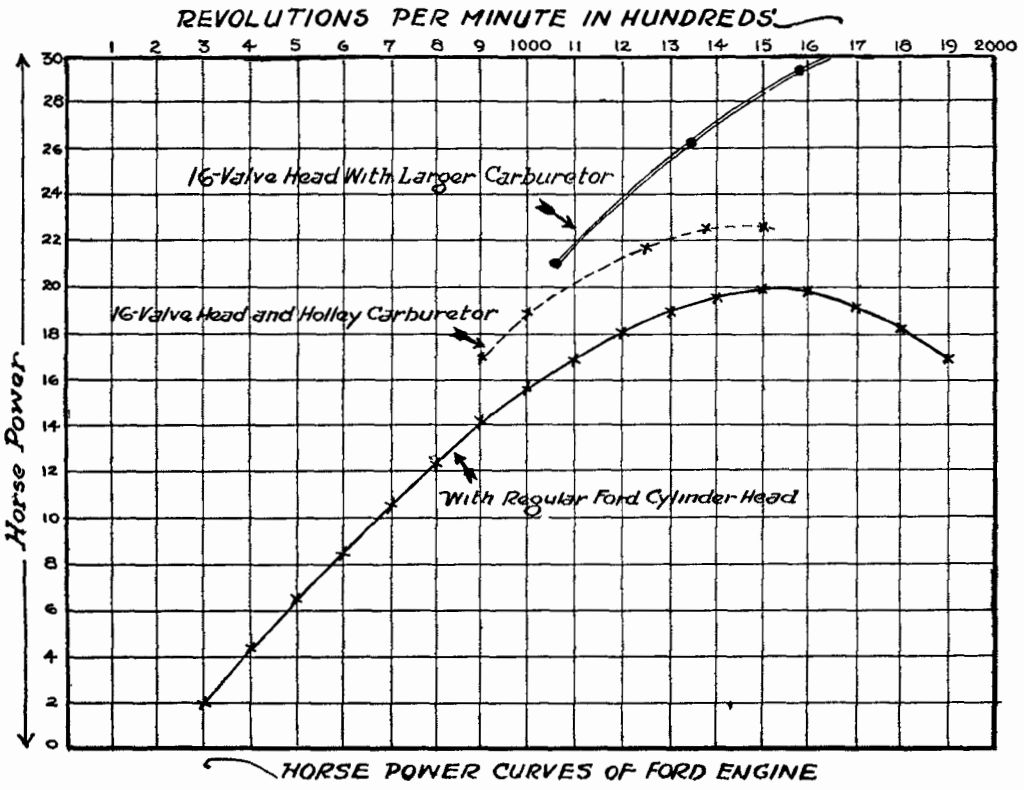
The air leaks, around the push rod guides of the earlier Type A heads, have been permanently eliminated by running these push rods through solid metal cores No matter how loosely these rods now wear in their guides, no air can possibly get into the manifolds And so the engine should run smoothly and nicely at slow speeds—as, in fact, it does

This long push rod guide, extending the entire thickness of the 16-valve cylinder head, supports the push rod, and prevents buckling and bending

Also, when the push rod does not extend through either exhaust or inlet manifolds there is no chance of washing off the oil with the gasoline or burning it off with the hot exhaust gases As a result of this, the lubrication of these push rods is easily taken care of

In connection with the push rods, we might mention that long use, caused the lower ends of the upper push rods to smear over a little —and then they tended to stick in the guides We eliminated this by grinding a bevel edge, around the end of the push rods, where they made contact with the lower push rods

This minor trouble can also be eliminated,



by cutting the lower push rods shorter, so that they do not extend up into the cylinder block head guide, even when raised to their highest postion This will necessitate the use of longer push rods in the cylinder heads Using one-piece push rods, of drill rod steel will also eliminate this possible source of trouble entirely

Lubrication

For the lubrication of the push rods, and of the rocker arms and valve stems of the 16-valve cylinder heads, the use of castor oil is advised Ordinary oil becomes thin and watery when heated, and quickly runs away But, after two or three applications, of the more tenacious castor oil, this oil sticks in place, and keeps the parts well lubricated and quiet running

Ben Lawell, of Columbus, whose excellent racer has been described in our magazine, uses a mixture of 2/3 Mobiloil B, and 1/3 castor oil, for the lubrication of the engine of his Ford speedster

Often, an extra supply of this oil is carried in a tank, with a hand operated pump, under the cowl dash, with the pump within reach of the driver

Another stunt, for the lubrication of racing motors, is to use two oil feed pipes, instead of only one When fitted with larger oil scoops, or funnels, these catch more oil, and tend to ensure adequate lubrication, at even the highest speeds

For the lubrication of a racing motor, Mr Roof informs us that a G B & S oil pump can be used This pump can be actuated by one of the cams, of the cam shaft, and babbitted into position, on the side of the crank case, adjacent to the cam shaft This requires a 1-7/16 inch hole, cut in the side of the crank case

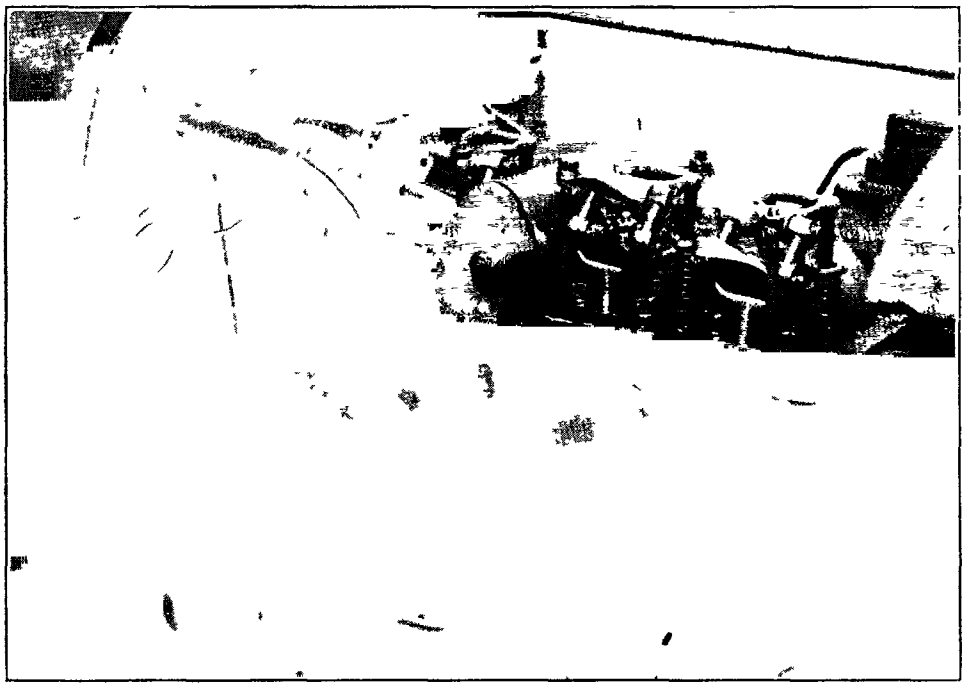
Ignition

On the Roof, Type B 16-valve heads, the spark plugs are now located on left-hand side of the cylinder head In this position, they are very accessible and easily removed or replaced Also, the high-tension cables, leading to the spark plugs, are so entirely removed from the rocker arms, and valve operating mechanism, so that no trouble with short circuits need be experienced

Another very important reason, for placing the spark plug at one side, instead of right in the middle of the 4 valves, is that the side position allows the spark plug to be entirely surrounded by a water jacket, thus keeping the spark plug sufficiently cool to prevent cracking and breakage Now it seems quite probable, that the reason the writer had so much trouble with the breakage of the Champion X spark plugs, in the Type A cylinder head, was due to the fact that the spark plug was adjacent to the hot valves, and so did not receive adequate cooling

In changing, from a regular spark plug, to an extension plug, it is sometimes necessary to run down a 1/2 inch pipe size plug tap, in order to cut the threads deeply enough to give the extension plug its proper position

Placing the spark plugs on the exhaust side



Type B Head With Dash Cut Away

after another, and soon made it evident that a special type of spark plug should be used in a racing type Ford engine

The new spark plugs, which we then secured, were of a different type, with a shell extending down into the combustion chamber, and affording the porcelain insulator some measure of protection against the intense heat

If one has a high-tension magneto, or some other form of special ignition system, then one does not have any trouble at all with the interference of the cylinder head, with the coil box But, we wished to ascertain just what a 16-valve cylinder head would do with a Ford ignition system, and a Ford carburetor

Carburetor Fitting

As fitted for use with the Ford carburetor, this 16-valve cylinder head fed the gasoline vapor through all six ports in the side of the cylinder block—instead of through just two ports, as is usual practice Also, the incoming gases entered through two inlet valves for each cylinder, instead of through only one valve per cylinder

However, as we still used the regular Ford, Holley carburetor, this ¾ inch bore carburetor remained the restricting valve, or „gate-way„ still limiting the amount of vapor charge that could be drawn into the cylinders With open throttle, there was a "Whoessh—" sound, very audible from the driver's seat, denoting the inrush of the air through the carburetor, and suggesting that a larger carburetor would give greater power and speed

As a matter of fact, a 1¼ inch carburetor is recommended for use with a 16-valve cylinder head And there is no doubt that this is the proper size carburetor to use, when maximum speed and power are desired As to area, the larger carburetor is nearly 3 times as large as the regular Ford size

With the larger carburetor, the engine may not start quite so easily, and run so slowly idle, or on high gear—that is, unless the larger carburetor has more accurate adjustments than the standard Ford carburetor, and a wider range of control

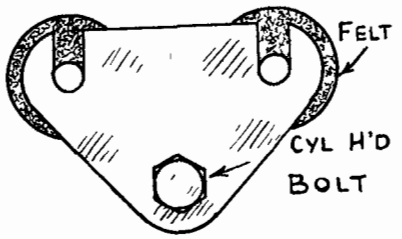
Miles Per Gallon

When we heard the way that the air rushed through the carburetor, when the throttle was wide open, we naturally thought 'Good-by gasoline' But, the speedometer told a different tale For summer use, with a light Ford roadster, in which we demonstrated the highest possible speed to everyone who would let us, the general average seemed to be about 20 miles per gallon With air leaks eliminated, the average should be higher

One of the chief reasons, why the Ford car does not make a hundred miles per gallon of gasoline, is that so much heat is lost through the cylinder walls, and is wasted in heating up the water

Now, with the L-head combustion space, of the regular Ford engine, there is more wall surface, for the same given volume, than there is in the more nearly spherical combustion space of the 16-valve cylinder head A ball or sphere has the least surface, for a given volume of contents That's why

At high speeds, or with wide open throttle, so much gas was admitted to the cylinders that the slight amount of air coming in through these air leaks did not seem to make any difference For this reason, while the



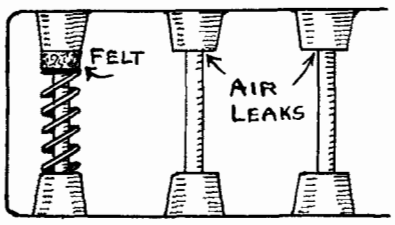
Stops Air Leaks

Type A cylinder head is not well adapted to ordinary touring car use, it does very well indeed on racing cars

For those who now have these cylinder heads, and wish to improve their low-speed performance, we suggest the method of placing felt washers around the push rods, on the top of the cylinder head, and holding these felt washers down around the push rods by means of metal clips fastened by a small, 10-20 machine screw to the cylinder head

There are two ways of eliminating the air leaks around the valve guides One method is to place a felt washer on the push rod, against the end of the valve guide This washer can be held in place by means of a light coiled spring, resting against the tappet guide, and pressing against the washer against the bottom of the valve guide

A more mechanical cure, on old, worn cylinder blocks, is to ream out the valve guide with an oversize stem reamer, and then use push rods that are 1/64 inch larger than the standard size How this question of air



Stops Guide Air Leaks

leaks has been altogether elminated, on the present Type B cylinder heads, will be shown later

Installing Head

To install these overhead valve cylinder heads, it is usually necessary to cut a larger opening in the bottom of the dash, to give the added head room, required by the valve operating mechanism of these multi-valve heads This can be easily done, by means of an ordinary wood saw, after the coil box has been removed

Just where to put the coil box is somewhat of a problem Of course, in a Ford racer or speedster body, the dash is placed a few inches farther to the rear of the engine, and this solves the problem very nicely and easily

The way we solved the problem, was to use a couple of blocks of wood, cut from 2 by 4 inch lumber, nailing these blocks on each side of the opening in the dash, and fastening the coil box to these wooden blocks This brought the coil box about 3 inches farther to the rear, so that it did not interfere with the cylinder head mechanism at all

The present method, used by the Laurel Motors Coporation, consists in a light, pressed steel box This is clamped to the dash, and the coil box is bolted to the bottom of this box This makes a light, neat and tight enclosure, and solves the problem nicely—only moving the coil box back for an inch or so

When the coil box is moved farther to the rear, this means that slightly longer wires will be needed to the spark plugs With the complete cylinder head outfits, this extra plug wiring is also included

Coil Box Support

Wiring Type A Head

On these earlier Type A cylinder heads, the spark plugs projected down, through the middle of the four valves This gave a good position, as regards charge ignition, but, it made the spark plugs rather difficult to get in and out, through the rocker arms

Also, the wires to the spark plugs, were always short-circuiting against the valve springs, until they were given a little extra insulation

The first, clumsy method, was to slip some porcelain insulators, of the tubular form (such as are used in house wiring where the wire goes through a beam) This worked all right

But, a neater solution of this problem was found when some three-inch lengths of flexible loom, were slipped over the spark plug ends of the high-tension cables This wire loom is of the kind used in wiring houses for electric lighting

Spark Plugs

After using the 16-valve cylinder head for a short time, chronic trouble developed with the spark plugs The high compression, and intense heat, developed from the use of these multi-valve heads, cracked one spark plug