REFERENCE BOOK 67-12

MASTER TECHNICIANS SERVICE CONFERENCE

AN INTRODUCTION TO THE CAP SYSTEM

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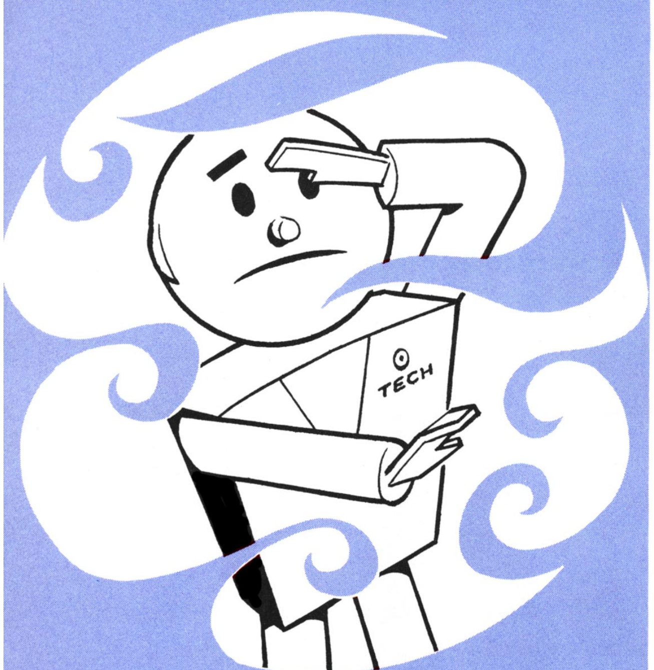
It all started with smog



In the past several years a great deal has been said and written on the subject of air pollution and smog. After a great deal of research into this complex subject, the State of California passed laws aimed at reducing the automobile's contribution to the smog problem. More recently, Federal laws to limit smog-producing engine exhaust and crankcase emissions have been enacted. Starting with the introduction of the 1968 models, all automobiles sold in the United States and many of those sold in Canada will be equipped with engine emission control devices.

Tech figures that it isn't his job to debate the relative merits of the law. Rather, it is high time for him to help every technician who will be servicing the 1968 models learn all he can about cars with this emission control equipment. So, in this session Tech will tell you a bit about smog and a lot about what Chrysler engineers have done to reduce engine emissions to acceptable limits.

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Just in case you didn't know, "CAP" has become the nickname for Chrysler's "Cleaner Air System." I'm sure you'll agree that it is much less of a tongue twister than the formal moniker. Since it is a nice easy name to remember and to use, we'll just refer to it as CAP or as the CAP System.

THE REAL PROBLEM ISN'T SMOG!

Before we get into the CAP System, let's get a few basic facts about SMOG and air pollution straight. To begin with, SMOG is only the end result of a specific and rather uncommon type of air pollution that occurs in a relatively few locations. Air pollution is a much more general and common problem which affects many areas. In other words, in most locations the problem isn't SMOG but rather it is air pollution. And, the new Federal laws affecting engine design were enacted primarily to control air pollution.

WHAT IS SMOG?

Smog results from the action of sunlight on hydrocarbons and oxides of nitrogen. Both of these invisible gases are present in very small amounts in the normal automobile engine exhaust. In the atmosphere when sunlight is present, they react to form the eye-irritating haze know as Photochemical Smog. In other words, smog is not smoke, it is not fog and it isn't a simple combination of the two. It is the peculiar end product of a complex photochemical reaction.

HYDROCARBONS AND CARBON MONOXIDE

Smog does not constitute a serious problem except for cities on the West Coast of the United States. However, excessive amounts of hydrocarbons and carbon monoxide are in themselves undesirable. CAP is designed to reduce engine emissions of these materials to acceptable legal limits. That means both crankcase and exhaust emissions must be controlled. Let's consider the problem of controlling crankcase emissions first.

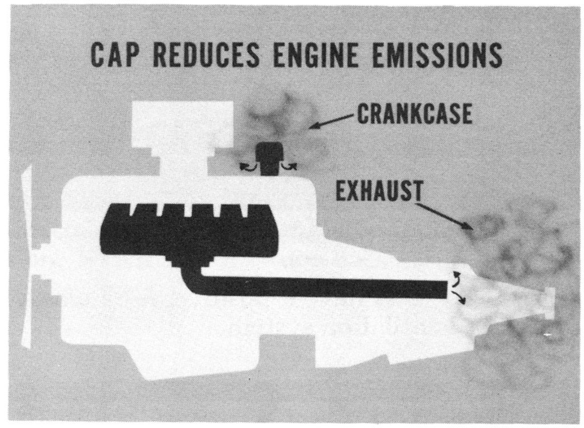

Fig. 1—CAP controls crankcase and exhaust emissions

THE ROAD DRAFT TUBE HAD TO GO

Until a few years ago a road draft tube was used to vent blow-by gases from the crankcase. This was a simple and effective way of relieving crankcase pressure and unwanted crankcase fumes. The old road draft tube was particularly effective when the car was moving. Pressure was reduced at the road-end of the tube so that a steady stream of ventilating air was drawn through the crankcase. However, crankcase fumes contain a lot of hydrocarbons so in the interest of reducing air pollution, the road draft tube had to go.

POSITIVE VENTILATION, OPEN AND CLOSED TYPES

Several years ago the draft tube was replaced by a tube which was connected into the base of the carburetor below the throttle blade. This arrangement provides *positive crankcase ventilation.* Intake manifold vacuum acting on the vent tube pulls fresh air in through the oil filler cap to sweep fumes out of the crankcase. These crankcase gases are drawn into the cylinders where they are burned and the by-products expelled with the exhaust gases.

CAP-equipped cars go one step further. The oil filler cap is connected to the air cleaner instead of being open to the atmosphere. In other

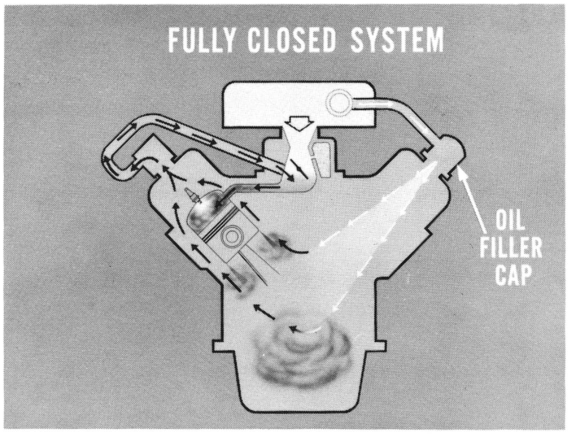

Fig. 2—CAP crankcase ventilation system

words, CAP cars have a positive, *fully closed,* crankcase ventilation system.

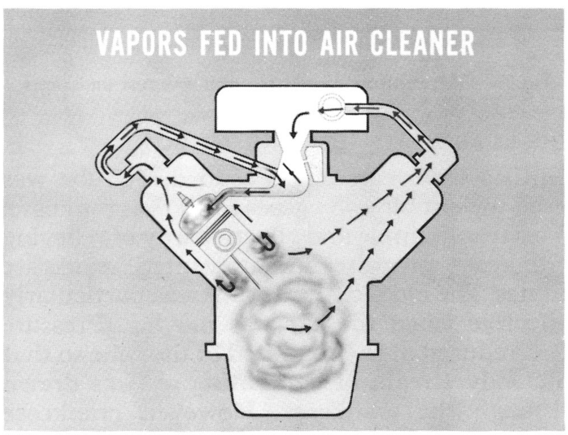

Fig. 3—Excess vapors are vented to the air cleaner

This fully closed crankcase vent system prevents crankcase vapors from escaping into the atmosphere under all conditions. Even in the case of a plugged crankcase vent valve or excessive blow-by, crankcase vapors are vented into the air cleaner and burned in the engine.

THE NATURE OF THE EXHAUST EMISSION PROBLEM

The fully closed crankcase ventilation system provides a 100% solution to the crankcase vapor control problem. Controlling engine exhaust emissions is a bit more difficult. Even without CAP our engines are both clean and efficient under most normal operating conditions. A typical late-model car, in normal city driving emits only 500 to 1,000 parts per *million* of unburned hydrocarbons. Taking the top figure of 1,000 parts per million, that means that not more than about 1/10 of one percent of the exhaust gas is unburned or unused gasoline. The new Federal law requires that this be reduced to 275 parts per million which figures out to be something less than 1/35 of one percent unburned gasoline in the exhaust. This should give you some idea of the nature of the problem.

CARBON MONOXIDE IS PART OF THE PROBLEM

That same typical passenger car in city driving conditions may emit as much as 3% to 6% carbon monoxide. The new Federal law requires that carbon monoxide emissions be reduced to not more than 1.5% of the exhaust.

Essentially, both the hydrocarbons and carbon monoxide emissions are caused by incomplete combustion of the air/fuel mixture in the cylinders. The CAP approach to emission control is to design engines to produce more complete combustion inside the cylinders.

CONDITIONS CAUSING HIGH EMISSIONS

Once you understand why certain operating conditions produce relatively high exhaust emission you'll find it easier to understand how CAP works. On the non-CAP cars, unwanted exhaust emissions are highest at low engine speed and when decelerating. For the average owner this means undesirable emissions aren't a problem except during a very small part of total driving time. But let's see why these particular driving conditions cause relatively high emissions.

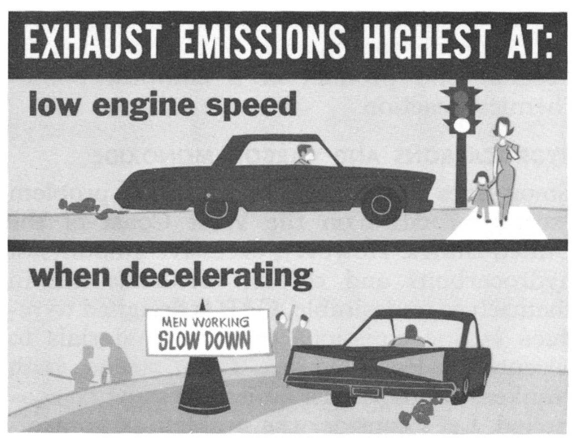

Fig. 4—Idle and deceleration cause highest emissions

SLOWING DOWN SPEEDS UP EMISSIONS

When decelerating, the throttle is in the idle position but the rear wheels try to drive the engine at road speed which is much faster than actual engine idle speed. On each intake stroke the piston works like a vacuum pump and tries to pull in a full charge of air/fuel mixture into the cylinder. However, the nearly closed throttle valve limits the amount of mixture drawn into the cylinder. As a result, the density of the mixture is greatly reduced and the fuel particles are not packed tightly enough together to ignite easily or to burn uniformly and completely.

To make combustion matters worse, the exhaust valve opens before the completion of the power stroke. This results in some exhaust gas being drawn in on the power stroke. This dilutes the mixture sufficiently to interfere with complete combustion. As a result, unburned and partly burned fuel goes out the exhaust.

SMOOTH IDLE AND RICH MIXTURES

On non-CAP cars, a relatively rich idle mixture is used in order to obtain the smoothest possible idle operation at the lowest practical idle speed. From the standpoint of efficiency and economy, these idling characteristics are a luxury. However, the average driver spends so little time operating his car at idle that the rich-mixture compromise was not significantly uneconomical. From the standpoint of emission, a rich idle mixture does result in more hydrocarbons and monoxide in the exhaust.

WHAT CAP IS AND HOW IT WORKS

There have been some basic misconceptions about CAP so let's set the record straight on that score. The CAP solution to emissions consists primarily of modified carburetion and ignition timing, plus some basic engine design refinements.

CAP CARBURETION AND TIMING IS DIFFERENT

The specially calibrated CAP carburetor delivers a leaner idle mixture than non-CAP cars. There are no significant changes in the calibration of the other carburetor circuits. The basic timing of CAP engines has been altered to provide retarded ignition at idle speed. Although the CAP distributor is essentially the same as a conventional distributor, the mechanical and vacuum advance curves are specially calibrated for CAP ignition requirements. In addition, on some models, a vacuum control valve is used to provide maximum vacuum advance during deceleration. It does this by controlling the vacuum applied to the distributor vacuum advance unit.

INSIDE THE VACUUM CONTROL VALVE

The vacuum control valve is connected to the distributor advance unit, the carburetor vacuum port and the intake manifold. But to understand how it works we better take a close look inside the valve.

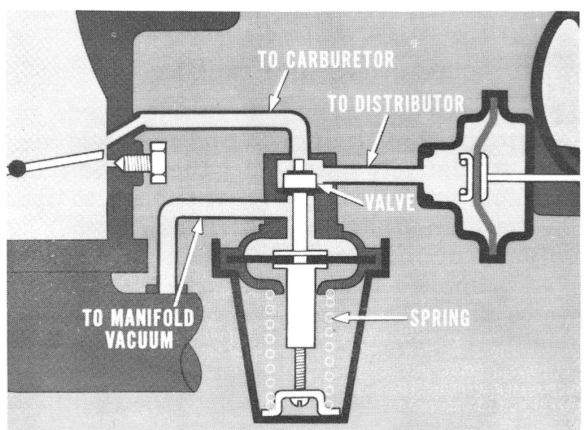

Fig. 5—Inside the vacuum control valve

The chamber on one side of the valve is connected to both the carburetor vacuum port and the distributor vacuum advance unit. The chamber on the other side of the vacuum valve is connected to the intake manifold. A spring normally holds the valve in a closed position.

However, strong manifold vacuum, acting on the valve's diaphragm, can overcome the spring force and open the valve. Let's see how the valve works under various operating conditions.

THE VACUUM VALVE AT ENGINE IDLE

At engine idle speed, the vacuum valve does not affect timing because intake manifold vacuum is not strong enough to open the valve. The only vacuum force acting on the distributor advance unit is reduced pressure supplied by the carburetor port. At idle, vacuum from the carburetor port is not great enough to move the distributor diaphragm and advance the ignition timing.

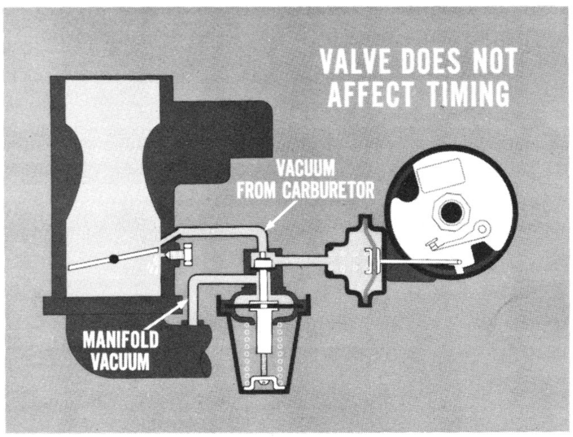

Fig. 6—At idle, vacuum does not open valve

WHEN ACCELERATING AND CRUISING

During acceleration and at cruising speeds, the carburetor throttle is open and manifold vacuum is relatively low. Under these conditions, manifold vacuum is not great enough to open the vacuum control valve. That means that only vacuum from the carburetor vacuum port is applied to the distributor vacuum advance unit. Since carburetor port vacuum is relatively high during acceleration and at cruising speeds, normal ignition advance is provided . . . just as it is in a conventional ignition system.

WHEN DECELERATING, THE STORY'S DIFFERENT

During deceleration the throttle is closed. The carburetor vacuum port is above the throttle and vacuum from this source is not great enough to provide vacuum advance at the distributor. However, manifold vacuum is now at or near maximum so it opens the vacuum valve.

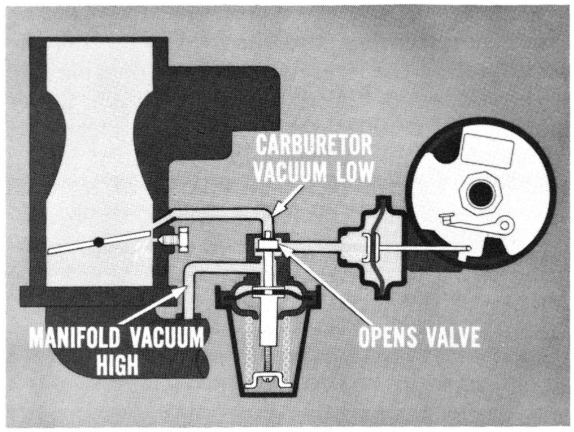

Fig. 7—High manifold vacuum opens valve

When the vacuum valve opens, intake manifold vacuum acts on the distributor vacuum advance unit. This provides maximum vacuum advance during deceleration. Of course this is quite different from non-CAP cars where there is little or no vacuum advance during deceleration.

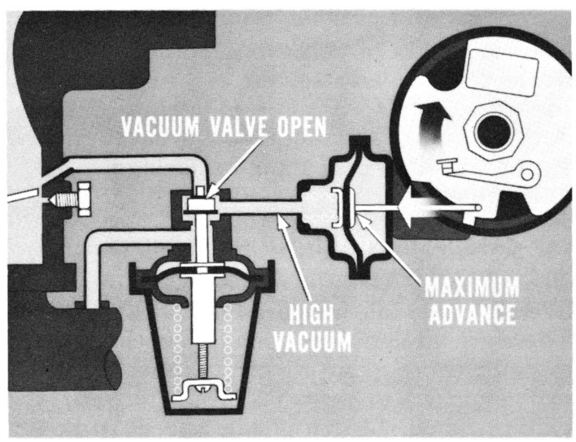

Fig. 8—Manifold vacuum controls ignition advance

Because the ignition timing is greatly advanced on CAP cars during deceleration, combustion starts much earlier, allowing more time for complete combustion. As a result, exhaust emissions are reduced to an acceptable level.

TORQUEFLITE REDUCES EXHAUST EMISSIONS

Equipping a car with a TorqueFlite transmission automatically reduces hydrocarbon emissions to an acceptable level. We better hurry and explain that claim before you jump to the conclusion that our thinker has jumped a cog or two.

A torque converter is designed to multiply torque when the engine is accelerating and driving the rear wheels. It is also much more efficient when the engine is driving the wheels than it is when the wheels are trying to drive the engine. As a result, the torque converter lets the engine slow down much more rapidly during deceleration with a TorqueFlite-equipped car than it does with a manual transmission car.

Because the torque converter lets the engine drop back to idle speed quite rapidly when decelerating, hydrocarbon emissions do not exceed acceptable limits on TorqueFlite cars. Because of this, the vacuum control valve will be eliminated on 1968 models equipped with TorqueFlite but will still be used on manual transmission cars. You may run into a few isolated exceptions to this. For example, a vacuum control valve will still be used on hemi-powered cars equipped with TorqueFlite.

AND A LOT OF OTHER LITTLE THINGS

There is a lot more to clean exhaust than recalibrated carburetors, recalibrated distributors and vacuum control valve. Many refinements and design improvements have been made in combustion chambers, manifold heat control, engine operating temperature control, the induction system and fuel mixture distribution. Over the past several years many improvements have been made that add up to better and more efficient combustion in our engine and a lower level of undesirable exhaust emissions.

SERVICING CAP-EQUIPPED CARS

Maintaining a CAP-equipped car is primarily a matter of performing the ignition and carburetion services that should be performed on any car to insure efficient engine operation. The main difference between service on a CAP car and a non-CAP car is in the ignition and carburetion specifications and in the testing of the vacuum control valve. No unusual special tools are required. However, a timing light, a combustion analyzer and a vacuum gauge are required to insure ignition and carburetion adjustments that will meet legal emission standards. Although it is not considered absolutely essential, an increasing number of technicians consider an oscilloscope most valuable for ignition evaluation and diagnosis.

The information that follows is not intended as a replacement for the Service Manuals and published CAP specifications. Rather, it is an instructional explanation of the essential services that must be performed in order to properly maintain a CAP car.

IGNITION AND ELECTRICAL SERVICES

Good ignition performance and *exact* ignition timing are particularly important on CAP-equipped cars. The following ignition service suggestions are based on past experience on current CAP cars.

SERVICE THOSE SPARK PLUGS

Spark plugs must be cleaned and inspected at least once a year or every 12,000 miles. If the

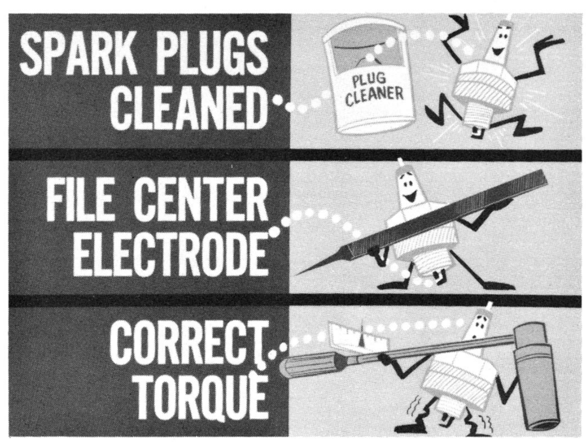

Fig. 9—Spark plug condition is very important

center electrode is worn, it should be filed square and flat and the gap carefully adjusted to .035". When installing plugs, don't guess about torque . . . use a torque wrench. Correct torque is very important since incorrect torque can result in poor ignition performance.

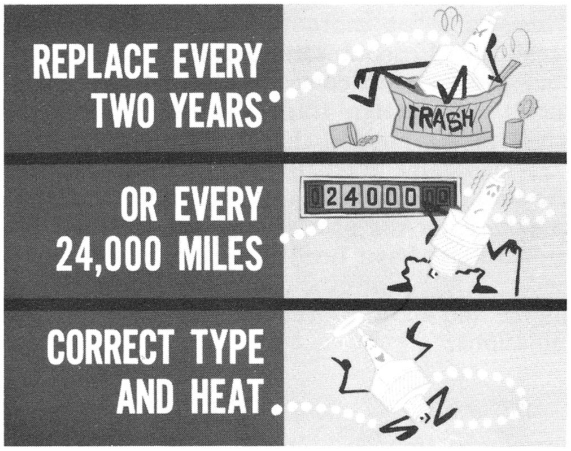

Fig. 10—Use correct plug type and heat range

Spark plugs must be replaced every two years or at 24,000 miles, whichever comes first. It is very important to use the correct plug type and the specified heat range. Incorrect spark plugs will upset both performance and exhaust emissions.

IGNITION POINTS AND DWELL

Good ignition point alignment is very,very important to both point life and ignition performance. Modern point sets are pretty much self-aligning but alignment can be thrown off during installation so watch it! The best way to be sure of correct ignition point gap is to use a dial indicator. After installing or adjusting points, it is a good idea to double-check yourself by hooking up a dwell meter and making sure dwell is within specifications. Of course, checking out dwell is a *must* on dual breaker distributors.

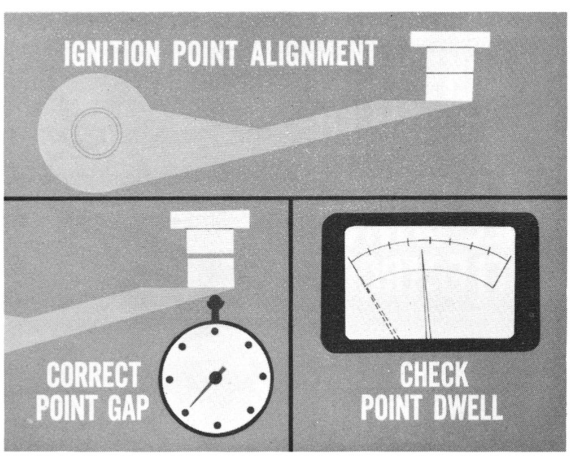

Fig. 11—Ignition point service is important, too

IGNITION CABLE INSULATION AND RESISTANCE

If you run into ignition trouble, it is impossible to overemphasize the importance of checking the secondary ignition cables and circuits. Whether or not you have ignition troubles, it is recommended that you test ignition cable insulation and resistance once every three years. Just remember, you can't tell a thing about insulation leaks, carbon tracking or resistance by simply looking at the cables, cap and connectors.

You can use a grounded test probe to test the insulation of the secondary ignition cables. Disconnect the spark plug cable from the spark plug and make sure the end of the cable is insulated from ground. Start the engine and run the test probe along the entire length of the spark plug cable. If the insulation is faulty, you'll get a spark jump from cable to probe. The secondary ignition coil cable can be checked in the same manner by simply disconnecting one spark plug cable.

You can use an ohmmeter to check secondary cable resistance. When checking ignition cables, remove the distributor cap but leave the cables attached. Connect the ohmmeter to measure resistance from the spark plug end of the cable to the corresponding electrode inside the distributor cap. This checks out both cable and connector resistance. Resistance should not exceed 30,000 ohms. If resistance is higher than that, remove the cable and test it. If cable resistance is greater than 30,000 ohms, replace the cable.

IGNITION TIMING PRECAUTIONS

From what has already been said about CAP I'm sure you realize the importance of setting ignition timing *exactly* to specifications. If you aren't careful about small but important details, you may wind up with incorrect timing.

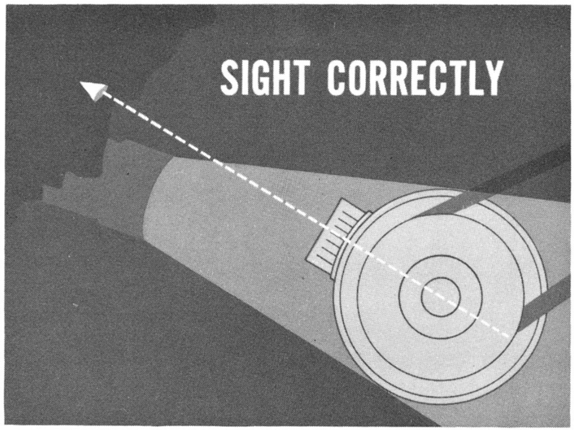

Fig. 12—Eye aligned radially with crankshaft pulley

For example, to set ignition timing correctly you must sight straight at the timing mark. Lining your eye up radially with the timing tab and the crankshaft pulley is more important than lining the timing light up. Looking at the timing mark from a bad angle can give you a false reading. The accompanying illustration explains what we're talking about better than words.

The distributor vacuum advance line must be disconnected from the distributor and plugged before checking and/or adjusting timing. Unless this is done, you may get some unwanted vacuum advance and inadvertently set timing somewhere on the advance curve instead of at the no-advance base setting.

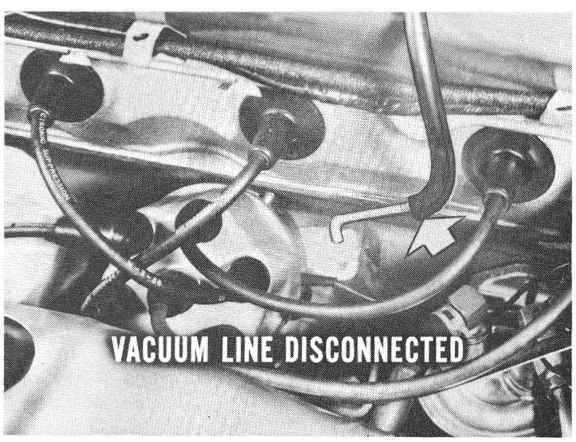

Fig. 13—Disconnect and plug the vacuum advance line

Disconnecting and plugging the vacuum advance line is especially important on CAP cars. CAP idle speeds are generally higher and the throttle is right at the edge of the carburetor vacuum port and may be providing vacuum to the distributor at idle speed. Secondly, even a slight leak past the vacuum control valve would allow manifold vacuum to act on the distributor vacuum advance unit. So play it safe and plug it!

Here is another precaution. When setting timing, engine speed must not be higher than specified. If idle is too fast, you'll get some centrifugal advance causing you to set basic timing later than specified.

IGNITION PRIMARY CIRCUITS

On new and fairly late model cars, it is seldom necessary to go over the primary or 12-volt side of the ignition system unless you are trying to locate the cause of a specific ignition complaint. However, it is good insurance to make a few quick checks and inspections. For example, the condition and specific gravity of the battery should be checked periodically. The battery cables, particularly the condition and tightness of the terminals, is worth a quick inspection. The same thing goes for the condition of the primary wires and the tightness of the primary ignition circuit connections. A little looseness or corrosion at a primary terminal can result in a serious reduction in secondary voltage delivered to the spark plugs.

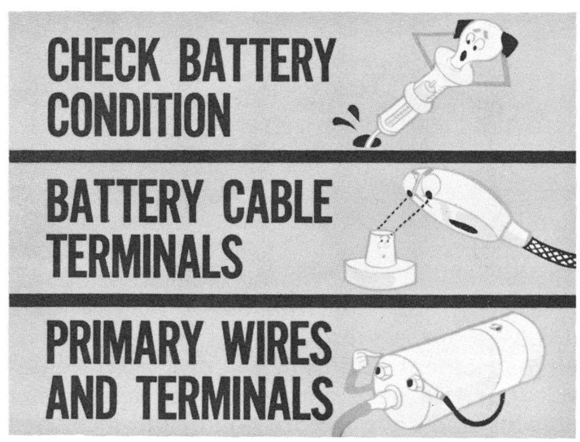

Fig. 14—Basic electrical system inspections

CARBURETOR ADJUSTMENT AND RELATED SERVICE

Periodic inspection, evaluation and adjustment of the carburetor, air cleaner and crankcase vent system is essential on all cars. On CAP-equipped cars, idle mixture adjustment is quite critical and adjusting procedures are somewhat different than non-CAP cars. Specific step-by-step idle mixture and idle speed adjustment details vary depending on the engine and carburetor you happen to be servicing. These details are found in your Service Manual so we will confine our discussion here to important highlights and precautions.

CHOKE AND THROTTLE LINKAGE

Before you touch an idle mixture or idle speed adjusting screw, be sure and cover the elementary mechanical items that affect carburetor performance. Make sure the choke linkage and the choke shaft operate freely.

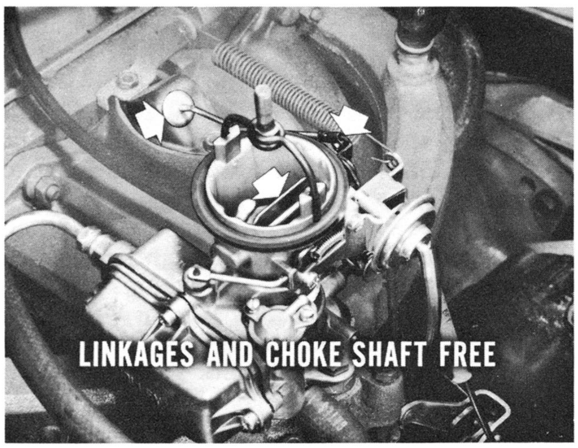

Fig. 15—Choke and linkage must operate freely

KEEP THAT AIR CLEANER CLEAN

The carburetor air cleaner element should be inspected every six months and replaced every two years. To service an air cleaner, remove the outer wrapper and wash it in kerosene or a similar solvent. To clean the element, use compressed air to blow the dirt out. Keep the nozzle about two inches away from the inside of the element and blow the dirt from the inside out. Be sure and clean the air cleaner housing and cover before you install a cleaned or new element.

If the air cleaner is not equipped with the outer wrapper it should be cleaned at every oil change and replaced every year. In the case of an oil-bath air cleaner, the oil level should be checked every six months and the air cleaner should be thoroughly cleaned and the oil replaced once a year.

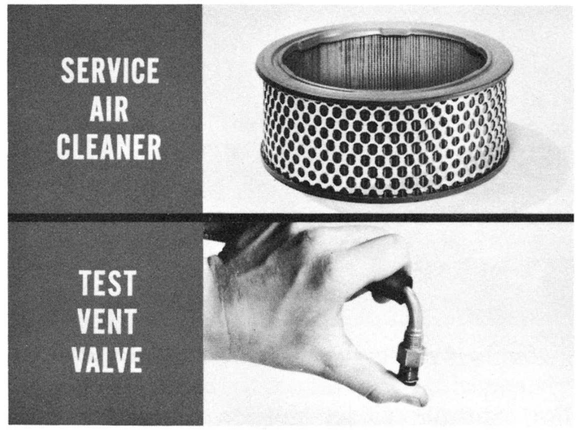

Fig. 16—Service the air cleaner and crankcase vent valve

AND THE CRANKCASE VENT VALVE, TOO

The crankcase vent system should be inspected every six months and the vent valve should be replaced every twelve months. It's easy to test the operation of the valve. Disconnect the vent valve from the valve cover while the engine is running. If the valve is working, a distinct hissing noise will be heard. Also, when a finger is alternately placed over the valve inlet and then removed, a strong vacuum pull will be felt. If the system is not working, make sure the hose, filler cap and carburetor vacuum passage are open. If the valve is plugged, do not attempt to clean it. Install a new valve.

DON'T FORGET MANIFOLD HEAT CONTROL

Another item affecting carburetion performance that is sometimes overlooked is the manifold heat control valve. Make sure it is completely free and operating correctly. It is good insurance to put a couple of drops of manifold heat control valve solvent on the ends of the valve shaft any time you work on an engine. As you probably know, the solvent should be applied when the manifold is cool. If the manifold is hot the solvent will evaporate too rapidly to do much good.

WATCH THESE DETAILS, TOO

Before adjusting engine idle speed on a carburetor equipped with a dashpot, make sure that the dashpot is backed off so that it doesn't contact the throttle lever and hold the throttle open. Idle speed is adjusted with the air cleaner installed, transmission in neutral and on six-cylinder cars, with the headlights on high beam. Whether or not you *adjust* idle speed with air cleaner installed isn't important as long as speed is within specifications when the cleaner is installed. On TorqueFlite cars, put the transmission in "park" and on manual-transmission cars be sure and set the parking brake. The reason for the high-beam headlights on six-cylinder cars is to put an alternator load on the engine to minimize stalling at night.

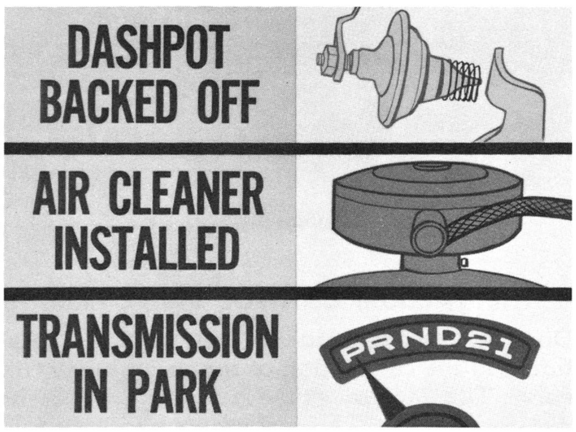

Fig. 17—Idle-speed adjustment conditions

You'll find that engine idle speeds specified for CAP cars are higher than you are accustomed to. The higher idle speed is necessary because of the retarded ignition timing and the leaner idle mixture. Be sure and set idle speed to CAP specifications.

YOU'LL NEED A COMBUSTION ANALYZER

Since you'll need a combustion analyzer to check and adjust air/fuel ratio, you better get yours checked out and make sure you know how to use it. Make sure your analyzer is properly calibrated to measure the leaner mixtures . . . 14.0 to one or higher. Incidentally, the *higher* the meter reading, the *leaner* the mixture. Instructions vary somewhat depending on the particular model you have in your shop. Study the instructions, including the fine print.

IDLE MIXTURE AND THINGS TO COME

The procedure for adjusting idle mixture is not the same for all carburetors so make sure you are familiar with the carburetor you are working on. We won't attempt to give you a step-by-step procedure for the carburetors you'll be servicing. Rather, we will pass on some of the important precautions and considerations that must be observed when adjusting a CAP carburetor. Incidentally, you are going to see some new carburetors with entirely different types of idle-mixture adjustment. So if you run into a carburetor that doesn't seem to have the kind of mixture screw you are accustomed to, don't guess. Get out your 1968 Service Manual and find out how these new adjustments are made.

KEEP THESE IDLE TIPS IN MIND

It is normal procedure to adjust idle mixture and speed before testing or adjusting the vacuum control valve. Since you don't know whether or not the valve is correctly adjusted or if it is leaking, make sure intake manifold vacuum isn't getting to the distributor and upsetting ignition timing. Either remove and plug the manifold vacuum hose or use a spring clamp to pinch it shut. If you use a clamp to close off a hose, make sure it does close it off completely without damaging the hose.

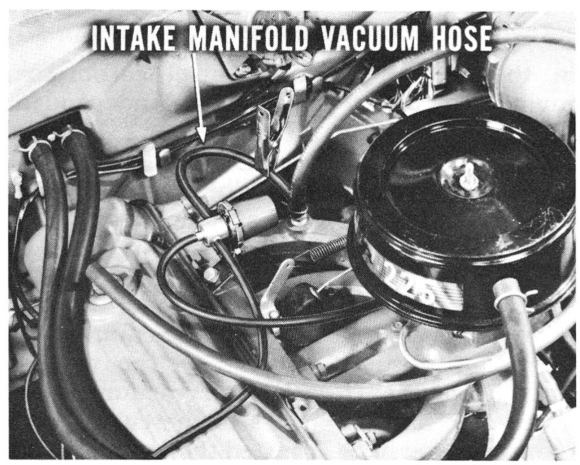

Fig. 18—A clamp can be used to close manifold hose

When adjusting idle mixture, remember that a combustion analyzer is a very sensitive instrument and it takes about ten seconds for the meter to stabilize after *each mixture adjustment*. You will get better results if you don't turn the mixture adjustment more than about 1/16 of a turn between readings.

Fig. 19—Adjust idle mixture from rich to lean

Final idle mixture adjustment must be made by adjusting from rich-to-lean . . . not from lean-to-rich. If you tried to start with the mixture too lean, the idle would be very rough and it would be difficult to keep the engine running at specified engine speed. And, it is very important to maintain specified idle speed when adjusting idle mixture. So keep your eye on the tachometer as well as the combustion meter. If idle speed changes appreciably when adjusting mixture, readjust idle speed before proceeding with mixture adjustment.

In the case of multiple-barrel carburetors having two mixture screws, a final independent adjustment of the mixture screws may be made to improve idle smoothness. Just make sure this final adjustment doesn't put the air/fuel ratio outside of CAP specifications.

CARBURETOR VACUUM MUST BE RIGHT

Before testing or adjusting the vacuum control valve you must make sure that vacuum at the carburetor vacuum port above the throttle blade is correct. If carburetor vacuum is between zero and six inches of mercury, you'll know that you have adjusted the air/fuel ratio, ignition timing and idle speed correctly. If carburetor vacuum is outside of these limits, you have slipped up some place and better recheck your adjustments.

If you are using a dual-vacuum gauge, connect one gauge into the carburetor vacuum hose and close off both the distributor and the manifold hose. If you are using a single gauge, you can save time by connecting it into the distributor hose so that you won't have to move it for the next test. Take your carburetor vacuum reading with engine warmed up and running at specified idle speed.

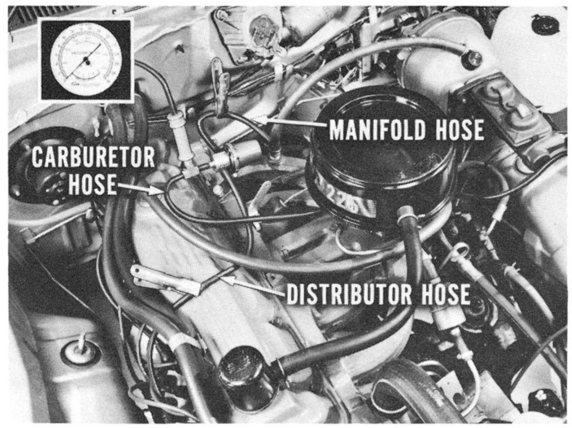

Fig. 20—Carburetor vacuum test connections

— THE VACUUM CONTROL VALVE TESTS —

One test hook-up is used to test both the opertion and the calibration of the vacuum control valve. The vacuum gauge is connected into the distributor hose. The carburetor and manifold vacuum hoses are connected normally and are *not* clamped shut.

Fig. 21—Vacuum control valve test connections

TEST VACUUM VALVE OPENING

You will remember that during deceleration high-manifold vacuum should open the vacuum control valve. To see if it does, simply speed the engine up to about 2,000 r.p.m. Then, release the throttle and let the engine drop back to idle speed. If the vacuum gauge climbs up to about fifteen, you'll know the valve is opening as it should. However, this test does not tell you whether the valve is properly adjusted.

TEST VACUUM VALVE CALIBRATION

The adjustment of the spring in the vacuum control valve determines how long the valve will be held open by manifold vacuum. When you release the throttle to let the engine return to idle from the 2,000 r.p.m. speed, vacuum will quickly reach its maximum of about 15 inches of mercury. If the valve is staying open long enough, the vacuum gauge will hold this high reading for at least one second. If vacuum drops immediately, the valve is closing faster than it should.

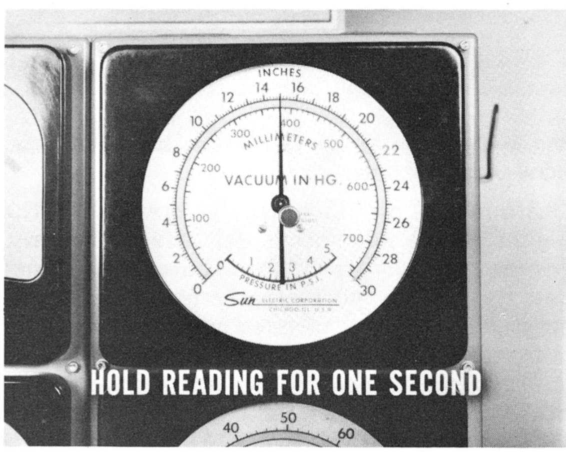

Fig. 22—Vacuum control valve open long enough

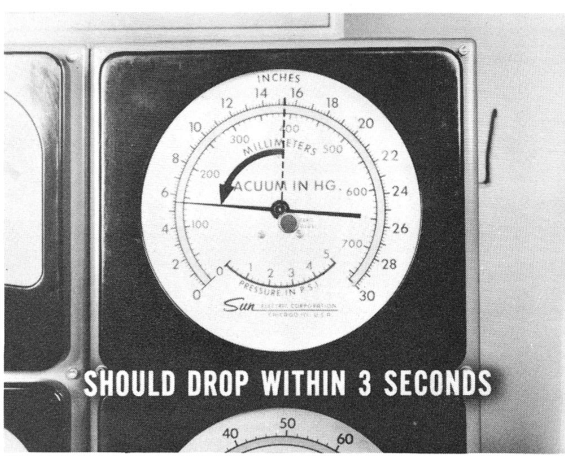

Fig. 23—Vacuum should drop below six inches of mercury

How fast should the valve close? The vacuum should drop below six inches of mercury in not more than three seconds. If it does, the valve is closing soon enough. If it drops below six in less than one second or takes more than three seconds to drop below six, the valve must be adjusted.

VACUUM CONTROL VALVE ADJUSTMENT

The vacuum valve adjusting screw is at the spring end of the valve. Remove the valve cover to get at this screw. Here is your guide to valve adjustment:

To Increase Time Valve Is Open: Turn the valve adjusting screw counterclockwise. This reduces the effective closing pressure of the spring and lets the valve stay open longer.

To Decrease Time Valve Is Open: Turn the valve adjusting screw clockwise.

One Turn Equals ½-Inch: One turn of the adjusting screw will change the valve setting approximately ½-inch of mercury. For example, if at the end of three seconds the vacuum reading has only dropped back to seven inches, two clockwise turns of the screw should drop the reading to about six inches in three seconds.

Be sure and retest the valve closing time after you adjust it. If the valve cannot be adjusted to specifications, it must be replaced.

—A FINAL WORD OR TWO TO THE WISE—

Under most operating conditions, a CAP-equipped car will behave, operate and perform just about the same as a non-CAP car. However, CAP cars do have some distinctive operating characteristics that you should understand and be prepared for. The following facts and comments will give you a better idea of what you and your customer can expect.

MANIFOLD VACUUM AT IDLE

One characteristic of a CAP car that takes the unprepared technician by surprise is relatively low vacuum readings at engine idle speed. A CAP car simply doesn't pull as much vacuum at idle as a non-CAP car. That's because on a CAP car the throttle is cracked a bit more and there is more air bleed past the throttle blade. This has the net effect of reducing manifold vacuum at idle speed. So don't jump to the conclusion that there is something wrong with a CAP car if it doesn't pull eighteen or nineteen inches of mercury.

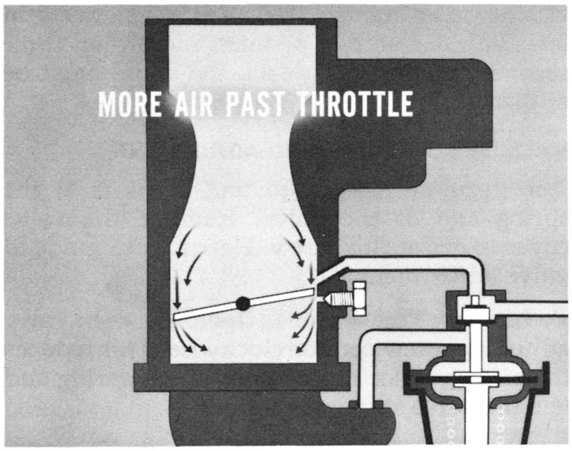

Fig. 24—At idle, manifold vacuum is relatively low

DON'T BLAME THE VACUUM CONTROL VALVE

The new emission control laws don't allow the engine design engineers the luxury of going a bit rich on idle mixture in order to smooth out engine idle. As you know, most all engineering is a compromise and engine design is certainly no exception. The design engineer can provide more power with some loss in economy, or, more economy with some sacrifice in economy. He can produce smooth idle at quite low engine speeds at the expense of exhaust emissions. But, when the rule book puts a limit on exhaust emissions at idle, engine idle speed and smoothness is automatically involved in the compromise.

Fig. 25—Emission control affects engine idle performance

Whatever you do, don't blame the vacuum control valve if idle isn't quite as smooth as it is on comparable non-CAP engines. Since the vacuum control valve opens and affects ignition advance only during deceleration, it does not normally affect engine idle operation in any way.

Fig. 26—Vacuum control valve does not affect idle

HOW ABOUT ECONOMY?

Customers sometimes wonder how much the higher engine idle speeds will affect economy. Others hear that a CAP carburetor is leaner and therefore expect greatly improved economy. Just as in the past, economy is primarily a matter of driving conditions and driving habits. Generally speaking, owners won't notice any economy differences between a CAP car and a comparable non-CAP model. That's because the leaner mixtures tend to offset the higher engine idle speed.

Fig. 27—CAP does not affect fuel economy

LET'S GET STARTED RIGHT!

Take time to look at a 1968 Owner's Manual and you'll find that starting instructions have been changed and generally simplified. Just in case you run into an owner who has a starting problem because *he* hasn't looked at his Owner's Manual, be prepared to explain the simple facts of starting to him.

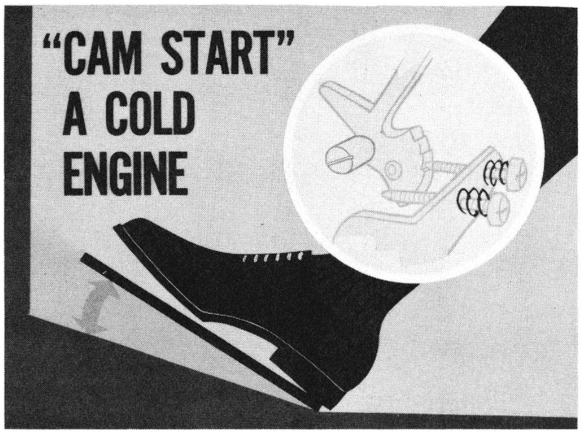

Fig. 28—Fast-idle cam sets best throttle position

Normal Cold Start: With CAP it is important to "Cam Start" a cold engine. That simply means pushing the accelerator all the way down and then releasing it completely before cranking the engine. The choke and fast-idle cam will put the throttle in the best position for easy starting more consistently than the average driver.

Normal Warm Start: After the engine has been warmed up, stopped and then is to be restarted, the best routine is a bit different. Simply hold the accelerator part-way down and crank the engine until it starts without moving or releasing the accelerator. Opening the throttle part-way is recommended because with the engine warm, the choke won't operate the fast-idle cam and provide a partly open throttle as it does when cam-starting a cold engine.

Below Zero Start: When the temperature drops below zero, cranking speed is reduced and the fuel in the starting mixture tends to condense out on the cold intake manifold walls. As an aid to below-zero starting, push the accelerator all the way down and then release it. This allows the choke to close. Then, hold the accelerator part-way open while cranking the engine. The extra throttle opening helps sweep enough air and fuel into the cylinders to aid starting.

Unusual Starting Condition: If the correct starting procedure is not followed, the engine may become "flooded". When this happens, the instructions are the same as for past models. Depress the accelerator fully and hold it down while cranking. Holding the accelerator all the way down allows unrestricted air intake and at the same time operates the carburetor dechoking device.

IT PAYS TO BE FUSSY!

Good warm-up performance is dependent on correct fast-idle speed and choke operation. So, make sure fast-idle, choke, and vacuum kick adjustments are as close to specifications as you can get them. Don't fudge or guess!

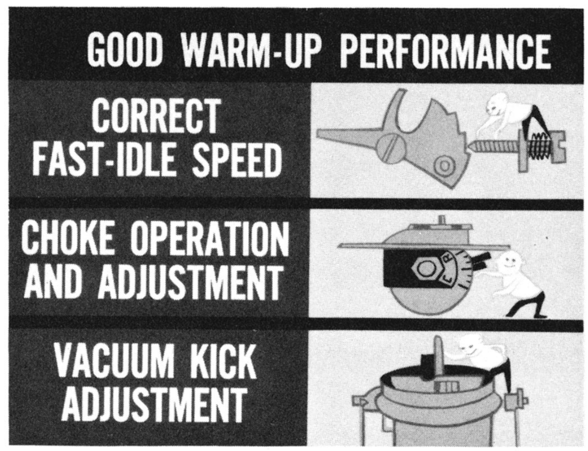

Fig. 29—Adjustments affecting warm-up performance

Make sure the throttle valve is closing properly. A binding linkage or a weak throttle valve return spring is bound to cause trouble.

AND JUST TO CAP IT OFF

Like Tech said in the beginning, maintaining a CAP-equipped car is primarily a matter of performing ignition and carburetion inspections, adjustments and services that should be performed periodically on any car to insure efficient engine operation. Now that you know *what* CAP is, *how* it works and *what* to expect in the way of operating characteristics you should be well prepared to tackle the 1968 CAP-equipped cars that are on their way.

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LITHO IN U.S.A.