The Automobile

USER'S GUIDE

WITH 196 PRACTICAL SUGGESTIONS

9TH EDITION
REVISED

How to save gasoline, tires and repair bills ★ How to prolong the life of your car and keep it looking new ★ For owners of all makes and year models ★ For the expert as well as for the beginner ★ Read and keep for future reference, or else pass along to a friend ★ Do not throw away.

CONTAINS NO ADVERTISING

(except on page 65)

...Self Quiz...

☑ SEE HOW MANY YOU CAN ANSWER

COMPLETE INDEX ON PAGE 64

THE AUTOMOBILE USER'S GUIDE

with 196 practical suggestions on how to get the most out of your car and make it last longer.

12,000,000 COPIES
have been distributed
prior to this edition.

Customer Research Staff

GENERAL MOTORS
DETROIT 2 MICHIGAN

PRINTED IN U. S. A.

A FREE COPY *of this book will be sent to anyone who may request it and irrespective of the make or model that he or she may own* **BUT—**

Please make good use of it!

READ
and
KEEP ★

★or else pass along to a friend. Don't throw away!

To Owners of *All* Makes of Cars:

THE AUTOMOBILE USER'S GUIDE was first brought out as a war-time measure shortly following Pearl Harbor with the idea of helping motorists "get the most out of their automobiles" and keep them in the best possible running condition during the time when the manufacture of new cars was discontinued, and shortages of gasoline, rubber and other materials threatened to cripple an important segment of America's transportation facilities.

The book met with unusual popularity and by the close of the war 8,000,000 copies had been distributed—which indicates the importance of car conservation in the minds of the motoring public.

It is naturally taking time to catch up with the car shortage—and in the meantime, the big majority of cars in use are at least six years old. So the need for taking extra good care of the cars we have continues to be of vital importance to every motorist.

It is for that reason that we are bringing out this revised edition which will not only help you to make your present car last longer, but contains many suggestions that apply to the post-war models.

The Automobile User's Guide was developed in co-operation with General Motors Engineers, Proving Ground Experts, Research Technicians, Manufacturing Executives and Service Specialists—and is designed to answer those questions most frequently raised by the thousands of motorists—*owners of all makes of cars*—who, over a period

of years, have responded to our various consumer research surveys on problems of design, maintenance and practical operation.

While it is designed to serve the needs of ALL car owners, *irrespective of the make or model*—it should be borne in mind that, because of wide variations in the design of different products, this general manual cannot be considered as a substitute for the instruction book which came with your car.

On the other hand, it contains quite a lot of supplementary information that is not included in the typical automobile instruction book.

It may be that none of the things mentioned are entirely new to you, but perhaps seeing them in print will recall to your mind some things that you had forgotten—or maybe neglected.

At any rate, just as an expert golfer takes lessons once in a while to make sure that he is not getting into any bad habits and in the hope that he may learn something new—just so, it is our feeling that even the most expert motorist may find it worth-while to read this book through and keep it for future reference—or else pass it along to a friend.

CUSTOMER RESEARCH STAFF
GENERAL MOTORS—DETROIT

Complete Index on Page 64

"More Miles per Gallon"

ONE OF THE QUESTIONS most frequently raised by motorists responding to our surveys is "*How can I get more miles per gallon of gasoline?*" and much of the material in the following pages was collected with the idea of publishing a booklet on that subject alone.

An adequate answer to that question, however, gets into almost every phase of care and operation and, incidentally, practically everything that helps you save gasoline will also help you to save on oil, on tires and on repair bills.

Just to emphasize this point, we are listing on the next page some typical examples of things that have a direct or indirect bearing on your gasoline consumption.

Some of these items are relatively unimportant while others have a tremendous bearing on the miles you get per gallon.

The list, although not entirely complete, is suggestive of the "economy pointers" that are developed in this book.

But these pointers are of little value unless you can remember them and the best way to remember them is to learn the reasons back of them. Some of these reasons are extremely interesting and you don't have to be technically minded in order to understand the principles involved.

If you have enough mechanical aptitude to drive an automobile, then you should have no trouble understanding everything in this book and a thorough reading of it will, we believe, increase your motoring satisfaction and make you a safer and more efficient driver.

It will make your motoring more trouble-free and more economical.

It will save you money on gasoline and repair bills, and *it will help prolong the life of your car.*

20 THINGS THAT AFFECT GAS ECONOMY

Depending on your CAR ★

1. ENGINE LUBRICATION—A poorly lubricated engine uses up too much of its own power . . . *See Page 21*

2. CHASSIS LUBRICATION—Power required to overcome friction reduces power at rear wheels . *See Page 15*

3. ELECTRICAL SYSTEM—Condition of battery, distributor points, electrical connections, etc., affect engine efficiency and gas economy. *See Page 23*

4. SPARK PLUGS—Badly worn or dirty plugs may waste as much as one gallon of gasoline in ten!
. . . . *See Page 23*

5. LEAKY FUEL LINES—An occasional check-up of fuel lines and connections may prevent needless waste
. . . . *See Page 27*

6. DIRT IN CARBURETOR—Prevents proper mixture of fuel and air for efficient combustion, resulting in fewer miles per gallon . . . *See Page 25*

7. SPARK ADJUSTMENT—Must be properly set for the particular type of gasoline you are using . *See Page 24*

8. COOLING SYSTEM—Correct engine temperature is essential to good mileage . . . . . *See Page 28*

9. UNDERINFLATED TIRES—Soft tires make car harder to move and increase the wear . . *See Page 34*

10. SLIPPING CLUTCH—Dissipates power before it gets to rear wheels
. . . . *See Page 42*

Depending on YOU

1. "SHOWOFF" ACCELERATION and speeding—may increase your gas consumption as much as 50% and also shortens tire life
. . . . *See Page 43*

2. LOW GEAR DRIVING—means more engine revolutions per mile and fewer miles per gallon . *See Page 42*

3. OVERUSE OF STARTER—Pumps gasoline through engine without making use of it and also impairs lubrication . . . . . *See Page 40*

4. EXCESSIVE CHOKING—May waste enough fuel to run your car several blocks . . . *See Page 41*

5. "PUMPING" the accelerator pedal is hard on engine and wastes fuel
. . . . *See Page 43*

6. SUDDEN STOPPING—wastes momentum that has cost you money to build up . . . . . *See Page 44*

7. "STOP & GO" DRIVING requires more gas than steady driving
. . . . *See Page 44*

8. CHOICE OF ROADS—Driving on unimproved roads uses up more gasoline . . . . . *See Page 52*

9. LEAVING BRAKES ON—Make sure the parking brake is "OFF" before starting the car in motion
. . . . *See Page 45*

10. DRIVING AGAINST WIND—takes extra power—hence extra gas per mile. *But, of course, you can't do very much about this.*

★ ***Which depends mainly on how you take care of it.***

Let Your Instruments Help You

"I keep six honest serving-men;
(They taught me all I knew)
Their names are *What* and *Why* and *When*
And *How* and *Where* and *Who*."

—KIPLING

The modern aviator can run a modern plane from one end of the country to the other depending wholly on his instruments.

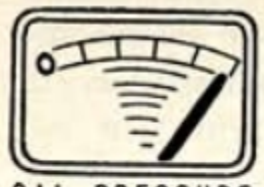
You can't do that with an automobile, but it does emphasize the importance of letting the dash instruments help you.

If you have ever run out of gas, or if you've ever been stopped for speeding—you know how much trouble and embarrassment can be saved by watching the gasoline gauge and the speedometer. And while it may seem to some that the other instruments have been added merely for decorative effect, each of them is designed to serve a very definite purpose—and a thorough understanding of their functions can help prevent trouble and expensive repairs.

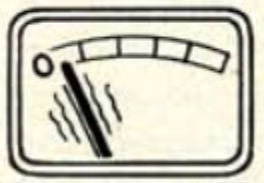
These gauges might be compared to a doctor's instruments for making a medical examination. The "symptoms" that they reveal will often point the way to the ounce of prevention which, if taken care of promptly, may avoid the need for a pound of cure later on.

A brief review of these miscellaneous instruments and dash controls seems to be the most logical way to start our book.

» OIL GAUGE. This gauge shows the pressure of the oil circulating to the moving parts of the engine. Oil pressure is an important thing to watch—comparable, one might say, to the blood pressure in the human. Normal oil pressures differ with various makes of cars, but with a little observation the driver can determine the average pressure for his particular car. Extra high pressure right after starting, particularly in cold weather, usually means that the oil is "stiff with the cold," and speeding the engine under these conditions should be avoided, as the cold oil must be given time to circulate. Otherwise damage to the engine is likely to result.



Always keep to a moderate speed until the oil pressure shows normal. If the pressure shows unduly high *even after the engine is warmed up*, it usually means that you are using an oil that is too heavy—or that there may be an obstruction in the oil line. *See page 21.*



On the other hand, if the oil gauge shows little or no pressure at ordinary driving speeds, stop and investigate at once.★ Trouble may be due to any of the following:

Oil level in crankcase *too low*,

Oil *too thin* as a result of "crankcase dilution", *See page 19.*

Oil pump *out of order*,

An *internal leak* in the oil system may be sidetracking the oil flow.

If the pressure is erratic—jumpy and irregular—have it checked up at the earliest opportunity.

If it's necessary to drive to a service station, ***proceed slowly.***

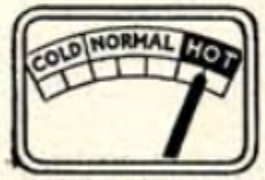
★ In some cars "zero" pressure is normal at idling speeds. However, as the engine speeds up, the gauge should register increasing pressure.

» HEAT INDICATOR. This is simply a form of thermometer which tells you the temperature of the liquid in the cooling system. An undue rise in the temperature of an automobile engine indicates that something is wrong in somewhat the same sense as does a fever in the human body.

"Normal" operating temperature varies among different cars, and is dependent to some extent on the outside air temperature as well as on driving conditions. For example, having to drive very slowly in heavy traffic or on bad roads, driving in mountains, etc., is apt to cause the engine to get hotter than usual.

Whenever the temperature gauge indicates that the engine is "running hot," it is a danger signal which should be investigated as promptly as possible. If it is necessary to continue driving to reach a service station, proceed *slowly*.

Aside from operating or traffic conditions such as those mentioned above, overheating may be due to:



INSUFFICIENT LIQUID in cooling system, resulting from a leak, or excessive loss by evaporation,

FAN BELT, loose or broken,

WATER PUMP failure,

FROZEN RADIATOR which prevents circulation of liquid, causing engine to overheat,

OBSTRUCTION in water passages of radiator or cylinder block, interfering with circulation of liquid,

OBSTRUCTION in front of radiator, or accumulation of insects on the radiator core, cutting off flow of air,

THERMOSTAT out of order, or some internal trouble with *engine itself*—such as inadequate lubrication.

» CAUTION. Since adding cold water when the engine is overheated may crack or damage the cylinder head or cylinder block, you should let the engine cool off for a while before adding water. *Be very careful when it comes to removing the radiator cap.* If it's removed too soon,

escaping steam or boiling water may spurt out, scald your hands and damage the finish of the car. *Refill slowly—and with the engine running at a fair rate of speed, so as to keep the water circulating.*

» AMMETER—or "*CHARGE & DISCHARGE*" indicator. The primary purpose of this instrument is to help you safeguard the storage battery. It shows whether the battery is being charged or discharged at any particular moment. When the generator is storing energy in the battery faster than you are taking it out, the indicator will register on the "PLUS" or "CHARGING" side When you are using up more energy than is being replaced, the indicator will register on the "MINUS" or "DISCHARGE" side.

When the ignition is turned off and no electrical equipment is being used, the pointer should be directly in the center, *at zero.* (If it's not, a short in the wiring is indicated and should be investigated at once, although there's a possibility that the instrument itself may be at fault.)

As soon as the ignition is turned on, the pointer should show "discharge." Then after the engine has been started and brought to a fair rate of speed, the pointer should move over to the "charge" (or plus) side. The speed at which maximum charge is obtained differs with various makes of cars, but almost all of them should show best charging rate at somewhere under 35 miles per hour.

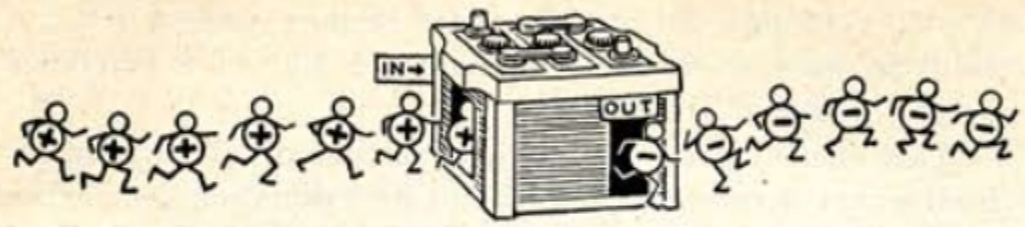
If ever the indicator should fail to move over to the plus side *even after the car attains a good rate of speed*, here are the most likely causes:—

Too many electrical accessories in use at once,

Generator stopped, due to loose or broken belt, or

Generator out of order, due to dirty commutator, faulty brushes, short circuit, broken wiring, or

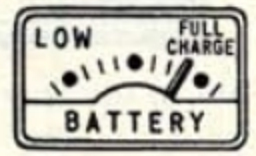
Voltage Regulator or "cut-out" out of order.



Most cars built within the past few years are equipped with voltage regulator and generator control devices to protect the condition of the battery and the generator. On cars having this equipment, if the battery is fully charged the ammeter will show a relatively low charging rate under ordinary driving conditions. But as long as the needle stays on the "plus" side most of the time, and only shows discharge for short intervals, as when the engine is idling, you know that the charging circuit is in good order.

» SIGNAL LIGHT. On some cars, instead of an ammeter, there is a signal light which comes on when the battery is being discharged, and goes out when it is being charged. The principle of its operation is the same as that of the dial described on the opposite page, except that a light is used instead of a pointer. The light itself and the circuit should be checked occasionally to be sure they are in good order.

» BATTERY CONDITION GAUGE. Instead of an ammeter, certain cars have a gauge that shows the degree of charge in the battery. While this enables you to keep track of the general condition of the battery, it does not tell you whether it is being charged or discharged at any particular moment.



» CARE OF BATTERY. None of these instruments can relieve you of the necessity of having your battery checked at regular intervals. Distilled water should be added about once a week in hot weather and twice a month in the winter.

Even though it may not be necessary to check the battery quite so often in cold weather, it's especially important to keep it

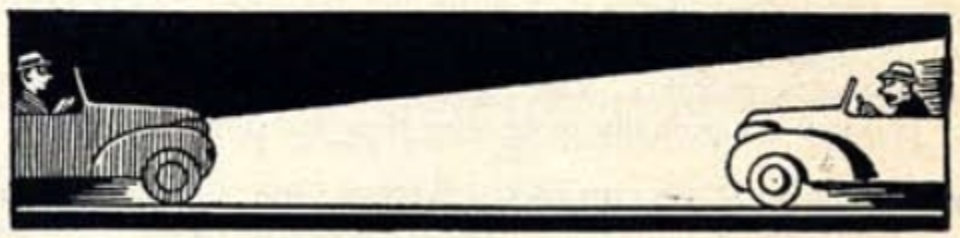
in good condition during the winter because starting requirements are more severe and if the battery is allowed to run down there is danger of its freezing.

This check should be made regardless of the amount of driving that is done, because the water evaporates even when the car is standing idle. If your driving is limited to occasional short runs which may not allow the generator to charge the battery sufficiently, it is advisable to use the electrical accessories as little as possible, and it may be necessary to have the battery recharged occasionally at a battery service station.

If your car is not going to be used for a long period, it is wise to have the battery taken to a battery station for storage.

CAUTION—The charging rate of the generator should *not* be increased beyond the maximum specified by the manufacturer.

» BEAM INDICATOR. This indicator is found on many cars —including all those equipped with Sealed Beam Headlights.



When the upper or "Country Driving" beam is on, a red light on the instrument panel warns you that your lights are "up" where they will dazzle the eyes of drivers coming from the opposite direction. By pressing the foot switch located at the left of the floor board on most cars, the beam is "dipped" to the "Passing" position and the red light goes out.

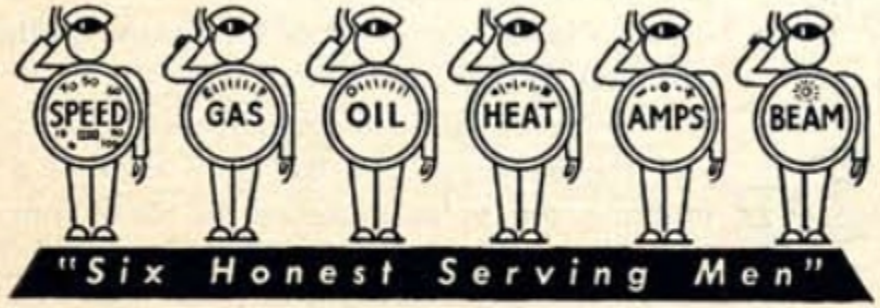
And while we're on the subject of headlights, don't overlook the need of having them checked once in a while to see that they're properly aimed. A very small variation in aiming—even only one degree—will cause the beam to be about five feet out of line at a distance of 300 feet down the road. This amount of error is enough to throw the full intensity of the beam right in the eyes of an oncoming driver, even when the "passing" beam is used.

Aside from that, if the beam is not illuminating the road exactly as it should, you are not getting the full benefit of your lights and your own safety is in jeopardy.

103 *versus* 6

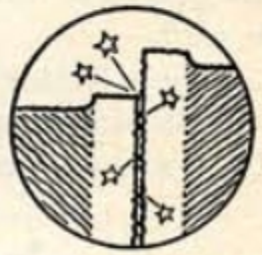
Getting back to the aviation comparison—the transport pilot must keep track of over 100 different instruments, whereas the motorist driving an average automobile has only six instruments to watch. But remember, these six instruments are there for a purpose. They are there to keep you posted on the functioning of vital units—to forewarn you of any impending trouble—to help you get the most out of your car with the least effort and the least expense!

Cultivate the habit of glancing at the dials regularly and soon it will become second nature with you.



Age Is Not a Measure of Car Life

AGE IS NOT A MEASURE of a car's usefulness—nor is mileage either—*except in a broad, general way.* The useful life of your car depends on the kind of care you give it—especially as regards lubrication.★



Metal surfaces, never mind how carefully machined, ground, honed and polished—in other words, no matter how smooth they may seem—are full of minute irregularities. Examine any highly polished piece of steel under a powerful microscope and it will be seen to have many saw-tooth irregularities. Press two such surfaces together without using any oil—rub them back and forth—and these irregularities become entangled with one another, resulting in friction and excessive wear.

But separate the surfaces with a thin film of oil and this can no longer happen. They really never touch one another when properly lubricated. Thin films of oil separate the bearing surface from the surface of the shaft—the piston from the cylinder wall—the gear teeth from the other gear teeth against which they press.

We might say that the lubricant becomes a structural part of the mechanism—very much like the ball bearings in the wheels. If we think of oil as being composed of tiny round globules, this analogy becomes very clear.

Since good lubricants are cheaper than repairs and replacements, you can save yourself a lot of money and greatly prolong the life of your car by keeping it well lubricated at all times. This will also enhance the comfort, pleasure, dependability and safety of your motoring.

★ Incidentally, much of this chapter applies in a general way to the maintenance of *any* mechanical equipment, such as your *washing machine, refrigerator, oil burner, vacuum cleaner, farm equipment, etc.*

» CHASSIS LUBRICATION.★ The lubrication of the chassis should receive careful attention at regular intervals, because these parts are subject to dust, dirt, rain, etc., and the only protection is the lubricant between the surfaces. There are many miscellaneous items which, if not properly lubricated, will become worn or corroded to the point of being hazardous, and when this condition is reached, expensive repairs or replacements are necessary.

For most cars the recommendation is: *Lubricate the chassis every 1000 miles, or once a month, whichever comes first.* Some of the newer cars, however, may be lubricated at 2000 mile intervals, or every two months—whichever comes first. If you're in any doubt as to how often your own car should be lubricated, consult the instruction book for your model, or ask your dealer.

» TRANSMISSION & REAR AXLE. The lubricant level in the transmission and rear axle should be checked several times a year. *See lubrication chart for your own make and model.*

Nearly all late model cars have *Hypoid Gears* in the rear axle and *Helical Gears* with *Synchronizing Cones* in the transmission. To insure long life and satisfactory operation of these parts, certain definite types of oil must be used. In some cases the lubricant should be drained and replaced at specified mileages or in the Spring and Fall. On some of the newer cars it isn't necessary to make seasonal changes because the axles and transmissions are designed so that the same grade of lubricant may be used the year round—but the level should be checked periodically. The lubrication chart for your car will tell you definitely the type of lubricant to use and how often it should be changed.

★ Because of its extreme importance, a special section is devoted to crankcase lubrication. *See page 18.*

» FRONT WHEEL BEARINGS. At least once a year (or every 10,000 to 15,000 miles), the front wheel bearings should be inspected to make sure they are properly greased. (Some cars, however, are equipped with front wheel bearings which don't need any attention except when the wheels are removed incident to having the brakes relined.)

Care must be taken not to use too much lubricant on the front wheel bearings because it may work past the seals and get into the brakes. When brake linings become saturated with oil or grease, it is usually necessary to have them replaced.

This brings up a point that is worth remembering:

—while the most common cause of damage is from *lack of lubrication*, there is such a thing as *overdoing it.* It is important not only to use the *RIGHT KIND* of lubricant, but also the *RIGHT AMOUNT* of lubricant.

In addition to the front wheel bearings, too much oil on electrical apparatus, such as the generator, starter and distributor may work into the wrong places and cause trouble.

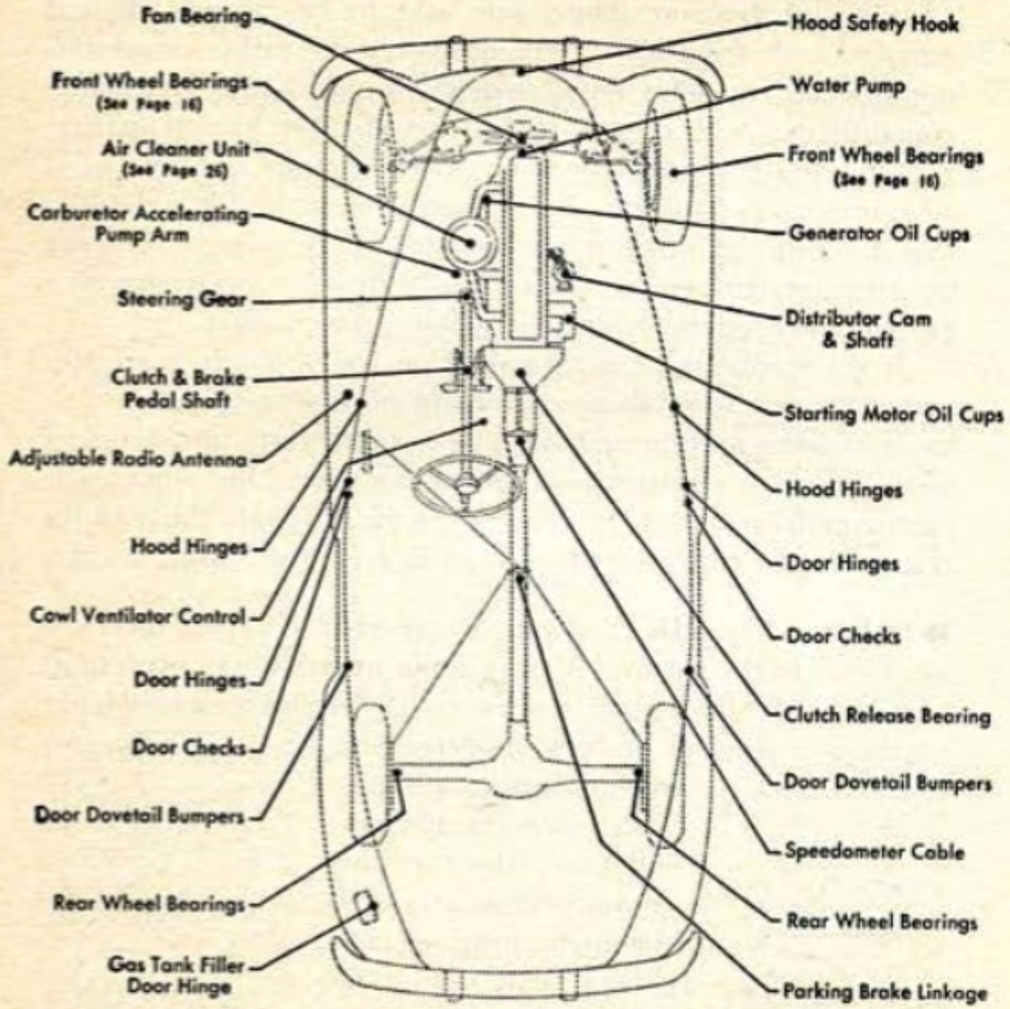
Care should be taken to keep any kind of lubricant from getting on the tires, because oil and grease will cause them to deteriorate. (If oil or grease should get on the tires it should be immediately removed with soap and water.)

DOING A GOOD JOB of lubricating a car is no simple matter. It requires a knowledge of what kind of oil to use and where to use it. Thoroughness is of utmost importance, and to emphasize that point we are including a chart on the next page which is based on a survey among experienced car owners and practical service men.

Please understand that this chart covers only a few more or less typical items suggestive of the KIND of things that are most apt to be overlooked. It is not applicable to every car and is in no sense a substitute for the complete lubrication chart furnished by the manufacturer who built your car.

Examples of items that are

LIKELY TO BE OVERLOOKED IN LUBRICATION*



★ As a matter of fact the safest and simplest way to handle the entire lubrication question, without the need for going into all the detailed instructions for various parts of the car, is to always have this work done by the dealer whose mechanics have been trained to properly service your particular make and model.

"Oil Is Cheaper Than Metal"

YOU MAY HAVE HEARD it argued that motor oil does not wear out and therefore should not have to be drained off and replaced with fresh oil. That, however, is a rather dangerous doctrine, because oil is bound to deteriorate with use. It becomes contaminated with dust, dirt, water and other foreign matter.

Or, even if it could be kept perfectly clean and free from such impurities, it seems that sooner or later the little globules that make up the lubricant get pounded out of shape or tortured by excessive temperatures until finally they are no longer able to do a good job of keeping the metal surfaces apart.

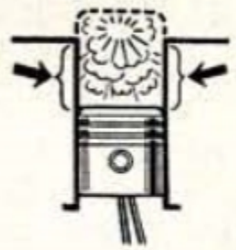
If the engine were never called on for heavy duty service, and if the car were always driven in normal temperatures, at modest speeds and through air which is free from dust, it might be unnecessary to change oil for a long time. But since such ideal conditions rarely, if ever, exist—the only safe thing to do is to drain the crankcase and put in fresh oil from time to time.

» DUST AND DIRT. Even on paved city streets there's a lot of dust in the air, and it's just about impossible to prevent at least some of it from getting into the oil. Air cleaners, which are standard equipment on most modern cars, are a big help; but some dust manages to get in despite such safeguards and if you drive over dusty or sandy roads, it is advisable to drain the oil much oftener than would normally be necessary.

» WATER. Short runs in cold weather, such as city driving, do not permit thorough warming up of the engine, and water may accumulate in the crankcase. You can't burn gasoline (or hardly anything else, for that matter) without creating water vapor or steam.

Before your engine warms up, the water vapor or steam will condense and get down into the crankcase and be "churned up" with the oil. This wouldn't be so bad if it were just *plain, pure water*, but it usually contains sulphurous acid which is very harmful to the highly finished engine parts.

» CRANKCASE VENTILATION—one of the most important and perhaps one of the least appreciated features of modern engine design—greatly reduces the condensation of water in the crankcase by dispelling the gaseous vapors before they have a chance to do any harm. They cannot be entirely eliminated, however, and so if most of your driving is on short runs, it is advisable to change the oil more often than would otherwise be necessary.



» CARBON. Since it's necessary to lubricate the inside walls of the cylinders, up next to the combustion chamber, it is impossible to keep the products of burning fuel from getting mixed with the oil.

» GASOLINE. Certain portions of unburnt gasoline may leak past the pistons and get mixed with the oil. This condition—"crankcase dilution"—is aggravated by the use of inferior gasolines; also by loose or worn pistons and rings; and by improper use of the hand choke. *See Page 41.*

» "SLUDGE." Low-temperature sludge is a thick substance that results when water and other "foreign" materials are *beaten* into the crankcase oil by the moving parts of the engine. It often forms as a result of short-run, slow-speed driving, especially in cold, wet weather.

It tends to clog the oil passages, thus interfering with the lubrication of vital engine parts, and if the piston ring slots become clogged with sludge,

much oil will be trapped in the cylinders and wasted by burning up instead of flowing back down to the crankcase.

To prevent such trouble, make sure the radiator thermostat is operating properly so that the engine does not run "cold"; see that the crankcase ventilation system is not obstructed; and have the oil changed oftener when your car is driven mostly on short runs during cold weather.

The presence of sludge can be determined by removing a valve cover and inspecting the interior of the engine. Also, excessive oil consumption may indicate that the piston ring slots are plugged, as mentioned above.

The only time-tried method of removing sludge from an engine is to take off the oil pan and other parts necessary to permit manual cleaning of the engine interior. Pistons must be removed and ring grooves cleaned of sludge if the engine is to be restored to normal oil consumption and operating efficiency.

» HIGH TEMPERATURE SLUDGE, which is also harmful, is sometimes formed as a result of driving for long periods at high engine temperatures. It is not likely to be encountered by the average motorist, but if your car is driven a great deal under severe operating conditions, you should use a "premium" oil, available from most oil companies.

» OIL CONSUMPTION. A lot of high-speed driving increases the amount of oil that's used, and even with normal driving it's perfectly natural for a car to consume a small amount of oil between changes. This shouldn't cause you any concern as long as it doesn't become excessive.

It's unnecessary to keep the oil level in the crankcase right up to the "full" mark. No harm is done if it gets down as much as a quart. But it should never be allowed to get *too* low because sufficient oil is necessary, not only to keep the engine working properly, but also to help keep the bearings cool.

» OIL FILTERS are standard equipment on some makes of cars and can be installed, if desired, on those that don't have them. While these filters help to remove grit, dirt and other

foreign matter from the oil, they cannot keep the oil perfectly clean. Nor can they prevent oil dilution. So, even though your engine may be equipped with an oil filter, it is still necessary to change the oil. When the filtering element becomes clogged with dirt, etc., it should be replaced with a new one. *A dirty filter is no better than none at all.*

» DRAINING THE CRANKCASE. The engine should be warmed up to a normal operating temperature before draining the crankcase. The benefit of changing oil is lost, to a large extent, if the crankcase is drained when the engine is cold, because cold oil will not flow so readily, and impurities are less likely to be removed.

» LIGHT OIL vs. HEAVY. Some motorists have an idea that light oils are too "thin" to properly lubricate an automobile engine and that heavier oils provide safer lubrication. Actually, the reverse is nearer the truth. Before oil can lubricate, it must first be able to flow to the bearings, piston rings, etc., and if too heavy or "thick" it cannot readily flow between the closely fitted moving parts.

Any slight saving that might be gained through the use of an oil that is too heavy for your engine is false economy and would be more than offset by the following:

1. **Undue wear on vital engine parts, resulting from failure of the oil to flow to all the places where it is needed.**
2. **It will make the car hard to start in cold weather and will tend to run down the storage battery.**
3. **Gasoline consumption is likely to be higher because of greater friction between moving parts—*especially on short runs when the engine doesn't have a chance to fully warm up.***

Motor car manufacturers supply the car owner and the oil companies with charts showing the grade of oil (such as 10W, 20W, 20, etc.) which should be used in each make and model at various atmospheric temperatures.

This numbering system, which was developed by the Society of Automotive Engineers, scientifically classifies lubricants in terms of viscosity or fluidity (simply a rating of how easily oils flow at certain temperatures). The lower the number, the lighter (more fluid) the oil. These numbers refer only to viscosity and have no reference to any other characteristics or properties.

In climates of extreme variation, where it may be mild one day and down around zero the next, it is clearly out of the question to change oil to suit every temperature change. Car manufacturers generally specify the grade of oil which will allow easy starting at the lowest "EXPECTED TEMPERATURE"—and they usually add—"*when in doubt, use the lighter oil*" (the grade with the lower number). It is especially important to use a light oil if much of your driving consists of short runs of 20 minutes' duration or less.

Let us repeat that the lubricant is really a structural part of the mechanism. To use the wrong oil is just as bad—or, at least, almost as bad—as *putting in a repair part that doesn't fit!* So follow the advice of the engineers who designed your car. Reread your instruction book and consult with your dealer. Remember, *oil is cheaper than metal*, and *engine repairs are expensive.*

It is not very much of an exaggeration to say that—

"A Well Lubricated Part Never Wears Out"

Keeping Your Car "Fit"

NOW AND THEN we hear someone say "*I keep plenty of oil and gas in my car and never have to worry about anything else.*" Perhaps it's true that such a car is running fairly well, but that doesn't mean that it is operating as efficiently as it might. A little care and attention to such hard-working parts as the ignition and carburetion systems can improve the gasoline economy, smoothness, and general "well-being" of any automobile, out of all proportion to the small cost of a periodic check-up and adjustment.

» IGNITION SYSTEM. The entire ignition system, including the battery, must function efficiently if you are to get first-class performance and if gasoline waste is to be prevented.

A weak battery causes slow starting—and the longer it takes to start the engine, the more gasoline is pumped into the cylinders without being used. This excess of raw gasoline washes the lubricating oil off the cylinder walls which contributes to rapid wear of pistons, piston rings and cylinders. *See Starting Hints on page 40.*

To keep the ignition system in good condition, the distributor points should be adjusted and the timing reset about twice a year—preferably in Spring and Fall—and if you do a lot of driving, it's a good idea to have them checked oftener.

» SPARK PLUGS. It's surprising how a little thing like a spark plug can have so much effect on the performance of your engine, and yet tests by the University of Michigan Engineering Research Department showed that bad plugs may often waste as much as one gallon of gasoline in ten. In addition, they cause hard starting and reduce engine power.

Experienced drivers make it a point to have their spark plugs cleaned and adjusted about every 5,000 miles. Such regular inspection and cleaning will make it possible to discover badly worn plugs before they cost you too much money in wasted gasoline.

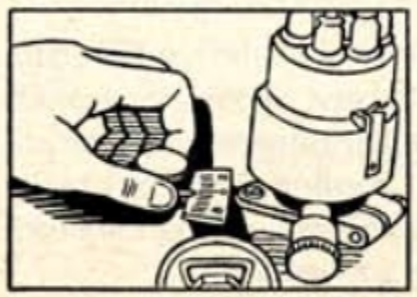
Clean "plugs" give better performance.

When new spark plugs are needed, be sure you get the right size and type to suit your particular car. There is more to it than merely getting a plug of the right *thread size*. The correct gap is important, and the plug should have the correct *temperature characteristic*. A plug that gets too hot for your engine will burn its points out rapidly, and may cause uneven engine operation or knocking due to pre-ignition. On the other hand, a plug that is "too cool" is likely to become coated with soot or fouled with oil and this will cause your engine to "miss."

The simplest and most satisfactory way to dispose of the spark plug problem is to go to your dealer. If the plugs merely need cleaning, or regapping, he will attend to it for a very modest charge. If any of them need to be replaced, he will do his best to supply the ones that will work most efficiently in your own particular car, taking into consideration any special operating conditions which you may normally encounter.

» SPARK ADJUSTMENT. Many cars are equipped with an adjustable spark control device known under various trade names, such as "*Octane Selector*" or "*Gaselector*." This is usually given the correct setting by the manufacturer or the dealer, for the type of gasoline that is to be used.

However, when changing from one grade of gasoline to another, be sure that the Selector setting is changed to suit the octane number rating of the new fuel. For example, if you have been using "regular" gas, and change to premium or Ethyl gas, the full benefits from the change cannot be obtained unless the proper spark adjustment is made.



The instructions of the manufacturer should always be followed. As a general rule, it is most economical to have the setting as close to the "*advance*" end of the scale as possible without causing a "*spark knock*" or "*ping*" at ordinary rates of acceleration.

Since practically all the gasolines now on the market are of higher octane ratings than those that were available during the war, it would be well to have your dealer check the setting of the *adjustable spark control* to make sure that it is advanced to the proper degree so that you may get full advantage of the better grade of gasoline.

» CARBURETOR. Back in the old days carburetors were provided with various adjustments and some motorists got the habit of "tinkering" with the carburetor whenever the engine wasn't running just right.

Today, however, it is rarely necessary to do anything to the carburetor—*insofar as adjustments are concerned*. On a modern carburetor the only adjustment that is ever likely to need attention is the "*idle adjustment*." This controls the speed and smoothness with which your engine "idles," but it has no effect on the fuel mixture under load. Such things as the *metering rod* and *accelerating pump* take care of that.

Over a long period of time, the carburetor may lose some of its efficiency, resulting in poor performance, increased gas consumption, frequent stalling, etc. Such things are usually traceable to:

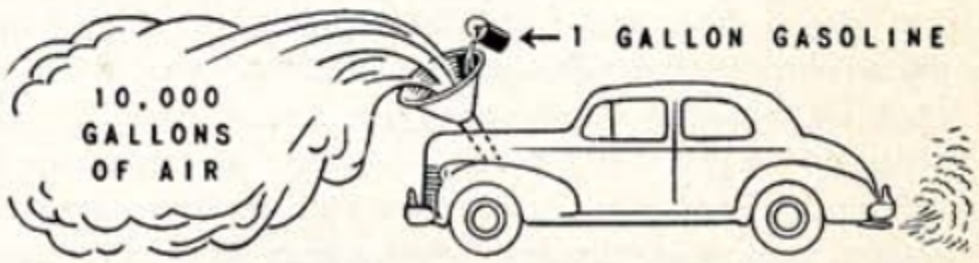
(a) ***worn or damaged parts,***
(b) ***linkage getting out of adjustment,*** **or**
(c) ***jets clogged with dirt, or water in gasoline.***

Since carburetors of today are so scientifically designed, so accurately fitted together and adjusted to such close measurements, it is best to allow only experienced mechanics to make adjustments or repairs. If corrections must be made, be sure the work is done by service people who thoroughly understand your make of carburetor.

» AUTOMATIC CHOKE. If your car is equipped with an automatic choke, it may be advisable to have it inspected and adjusted twice a year—for Winter and Summer driving, although on the newer cars no seasonal adjustment is required.

The automatic choke sometimes gets blamed for such things as difficult starting, jerky performance, or low gasoline mileage when the REAL trouble may lie elsewhere. Worn or dirty spark plugs, loose connections, burnt or badly worn distributor points, dirt in carburetor jets, grounded condenser or a weak coil—may all contribute to difficult starting, loss of power and poor performance. So, before tinkering with the automatic choke, the electrical and carburetion systems should be checked up and any necessary adjustments made. When this is done the difficulty is often found to have been remedied.

» AIR CLEANER. The purpose of an air cleaner is to help prevent dust, dirt and abrasives from being breathed into the engine through the carburetor. *It is interesting to note, in passing, that for every gallon of gasoline that you use, about 10,000 gallons of air pass through your air cleaner!*

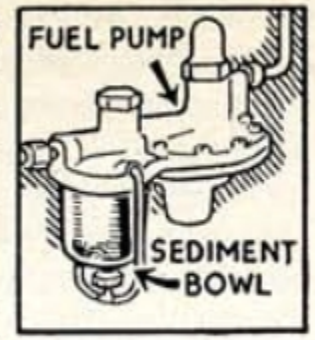


Failure to service and re-oil the air cleaner when it becomes filled with dirt and dust will result in poor gasoline economy and cause hard starting as well as unnecessary wear within the engine. All that's necessary to do is to wash the filter element in gasoline and then re-oil it.★ Some service organizations take care of this as an incident to lubricating your car.

★

If your car has a *heavy duty oil bath air cleaner*, follow the special instructions of the manufacturer.

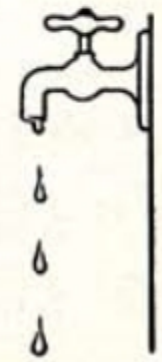
» THE FUEL PUMP delivers gasoline to the carburetor. The diaphragm of the pump might be called the *heart of the power plant*, and if for any reason its operating efficiency becomes impaired, the performance of your car will suffer.



Excess sediment in the fuel pump filtering bowl is likely to cause uncertain engine operation. Water may also accumulate in the bowl over a period of time and in cold weather it may freeze and cause damage. To avoid such difficulties, the bowl and strainer should be removed and cleaned once or twice a year.

If your fuel pump ever needs repairs, the most economical thing to do, generally speaking, is to replace the entire assembly. Many dealers can quickly replace an inoperative pump with a properly rebuilt one, and at no more cost than you would have to pay for repairs.

» FUEL LINES—as well as the fuel pump—should be checked once in a while for leaks. This is not a frequent cause of trouble, but it's good economy to make sure that the entire fuel feed system is in good working order. If gasoline leakage is suspected, the check-up should be made *while the engine is running*, because some types of leaks will not show up except under pressure from the fuel pump.



» VALVE GRINDING—CARBON REMOVAL. Ordinarily these jobs are not necessary except after long periods of use. *Loss of power, missing at low speeds and "rough idle"* are some of the symptoms of valve trouble, but your dealer can determine definitely whether or not the valves are at fault. If your engine develops a pronounced knock or "ping" it may be that carbon needs to be removed. This should be done anyway when the valves are ground.

» COOLING SYSTEM. For good performance and maximum economy, your engine must operate within certain definite temperature limits—*not too hot—not too cold.* It is the function of the cooling system to maintain the correct operating temperature. If not kept in good condition, cooling efficiency drops and gasoline consumption is likely to rise. Most owners make it a point to flush out the entire system twice a year, in the Fall and Spring, incident to the addition or removal of anti-freeze. When this is done, the system should be checked to make sure there aren't any leaks.

Clean water should be used in the radiator—which should be kept filled to the proper level at all times. A small quantity of *rust inhibitor* added to the water will help to prevent formation of rust in the cooling system. Ordinarily, there's no point in doing this except in the summer, because most anti-freeze solutions already contain a rust inhibitor. (Your dealer can advise you on this.)

» ANTI-FREEZE. These preparations, to all intents and purposes, can be classified in two general types:

1. **VOLATILE types, such as alcohol and methanol, which are more apt to evaporate—especially when warm.★**
2. **PERMANENT types, such as ethylene glycol, etc., which do not have to be replenished except in case of leakage.**

Whichever you use depends on your own preference or convenience. *Under no circumstances, however, should you use salt solutions, kerosene, honey, or other makeshift preparations. They're likely to do more harm than good in the long run.*

★

CAUTION. Since alcohol is very harmful to automobile finishes, care should be taken not to spill any. If it should get on the finish, pour on plenty of cold water immediately.

The "volatile" types—alcohol and methanol compounds—are usually cheapest from the standpoint of first cost, but they are more easily lost by evaporation, so when they are used a careful check should be kept on the *amount* and *strength* of the radiator solution.

The "permanent" types have a higher first cost, but do not require much attention, and once the proper amount has been put in the radiator, all that's necessary is to check it occasionally and replace any water that may have evaporated.

If much water needs to be added, the loss may be due to leaks. In this case, adding water without replenishing the anti-freeze may weaken the solution and thus cause danger of freezing. Obviously the first thing to do is to find out the cause of the loss and have it corrected; then, when water is added, have the service man test the strength of the solution.

When using the "permanent" type of anti-freeze, it is especially important to check hose connections, gaskets, water pump packings, etc., because this type has more tendency to seep out through imperfect seals than the other solutions. Moreover, air leaks in a cooling system containing permanent anti-freeze mixtures may cause serious corrosion.

Incidentally it is well to have the engine warmed up to normal operating temperatures when checking the level of either type of solution. This is because the water and anti-freeze contract when cold and will seem to be low—perhaps not even high enough to be visible.

» SEALED COOLING. Some cars have a pressure cap on the radiator which confines pressure within the cooling system. With this design, loss by evaporation is not so much of a problem, and alcohol can be used without the necessity of such frequent checking.

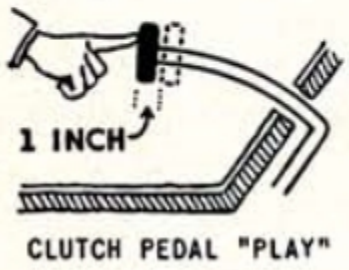
» THERMOSTAT. Except on a few cars equipped with radiator shutters, the circulation of water through the radiator is

controlled by a *thermostat* or *automatic valve* which limits the amount of water circulating through the radiator until a definite temperature has been reached.

When more heat is desired from the car heater, a thermostat which opens at a higher temperature is sometimes used. This may not be practical if alcohol or methanol are used in the cooling system, as evaporation is likely to be too rapid.

» CLUTCH. (*Skip this if you have Hydra-Matic Drive.*) In recent years clutches and gear shifting mechanisms have been improved and refined to a point where they are practically trouble-free. Any difficulties that should develop can usually be traced to improper driving methods. *Your particular attention is called to page 42 where the use of the clutch is discussed in detail.*

Aside from the way you drive, there's one little thing that's likely to need some attention once in a while. The clutch pedal should be adjusted from time to time so that it has some *free travel* before the clutch actually begins to disengage. In other words, the pressure of one finger should be enough to push the pedal down about an inch before the resistance of the clutch springs is felt. If there is little or no "play" or free travel, the clutch may be slipping somewhat.



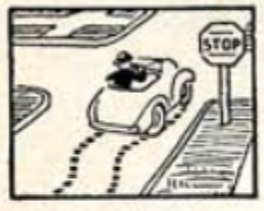
CLUTCH PEDAL "PLAY"

It takes only a few moments for a capable mechanic to make the simple adjustment necessary. Gradual change in the amount of clutch pedal "play" is natural as the result of normal wear, but it should be remembered that *excessive clutch wear may be caused by rough usage.*

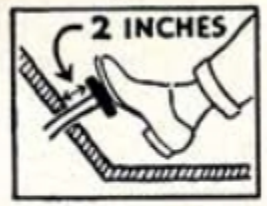
» "JACK RABBIT" starting or letting the clutch pedal up "*with a BANG!*" is not only hard on the clutch itself, but on the entire driving mechanism of the car as well as the tires—*to say nothing of the discomfort to passengers.* *See page 35.*

» BRAKES. In the interest of conserving tires, *smooth stopping* is just as important as *smooth starting* and *smooth running*. From a standpoint of safety, it is highly important that your car can be stopped quickly and surely. Of almost equal importance, it must keep to its course when the brakes are applied and *not twist or swerve to one side or the other.*

Since brakes wear so gradually, we sometimes fail to realize that they need adjusting until some emergency stop calls it to our attention. *Don't wait for that.* Brakes should never be left unadjusted so long that it becomes possible to push the pedal almost all the way to the floorboard. When the brake pedal can be pushed to less than two inches from the floorboard, or if your brakes "take the steering out of your hands," it's high time to have them checked and adjusted.



NEEDS ATTENTION



NEEDS ATTENTION

The principle of hydraulic brakes is that *equal pressure is transmitted to each wheel.* Despite that, however, there may be times when the braking effect is not as even as it should be. A slight amount of grease on the brake linings, for example, may cause the car to pull to one side when the brakes are applied. If oil or grease does get on the linings, it is usually necessary to replace them with new ones.

Low tire pressures, or unequal tire pressures, will sometimes cause uneven braking—which is another reason for checking the tire pressures regularly.

» BRAKE FLUID. The type of hydraulic brake fluid used is very important. Attempting to economize by the use of substitute brake fluids is risky business. The car manufacturer is careful to specify a certain brake fluid with the right composition and

properties for his particular braking system. The wrong fluid may injure the rubber parts of the system and cause leaks, or it may form gum and cause sticking of the cylinders, or form bubbles which may result in failure of brake action.

A warning sign is given by hydraulic brake systems when the fluid is low or when the system is otherwise in need of attention. The driver may notice that the pedal suddenly goes down farther than usual, or it may be necessary to "pump" the pedal to make the brakes work. At the first sign of any such irregularity, have your service man investigate and take care of it.

On the rare chance that your brakes should ever fail completely, make a "mental note" to shift into second gear and use the engine's compression to slow down your car or else use the emergency or parking brake.

» RELINING. The mileage at which brakes need relining cannot be specified because the amount of wear depends on the kinds of brakes in different makes of cars, variations in driving habits, road and traffic conditions, etc. However, when a reliable mechanic tells you that your linings are getting thin, don't wait too long before having them replaced because you'll not only run the risk of an accident, but damage may result from metal-to-metal friction between the brake drums and the brake lining rivets; and when new lining is finally put in, there will be considerable extra cost for repairing the drums.

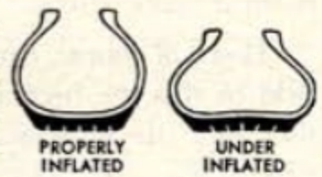
» BREAKING IN. New brakes, like a new engine, will last longer and give better service if they are broken in carefully. This applies not only to a new car but to any car on which new brake linings have been installed. It is particularly important to apply the brakes slowly and easily for the first few hundred miles until the braking surfaces acquire a smooth finish.

» SQUEAKS AND RATTLES. Squeaks mean friction and friction means wear. It's natural for squeaks and rattles to develop in a car, since it's subject to so many jolts, stresses and strains. It is well worth the trouble to have all bolts, nuts and screws tightened up at periodic intervals.

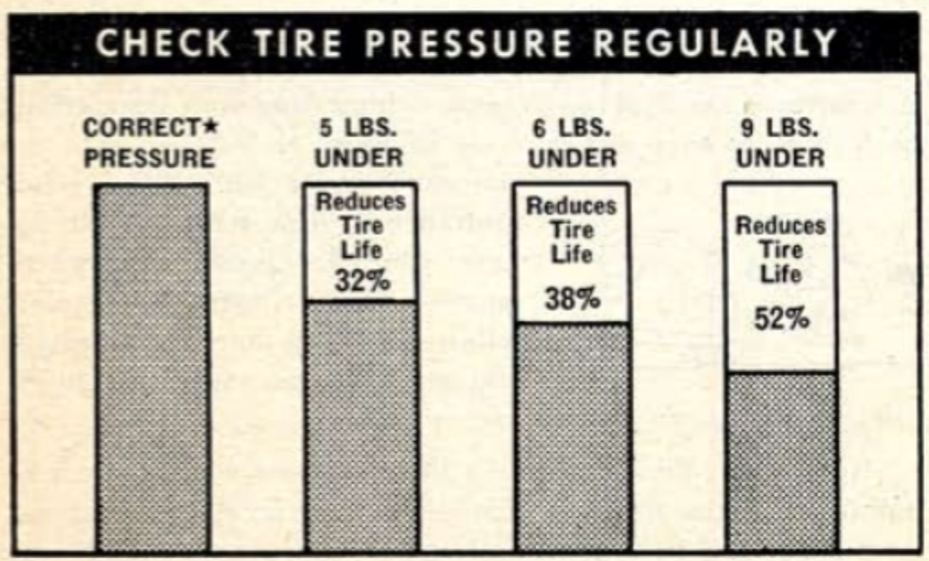
Stretching Your Tire Mileage

BEFORE GETTING INTO a detailed discussion of tire care, here's one suggestion that everyone can follow, which may save a lot of grief:

Develop the habit of always glancing at your tires before getting into the car. Then you won't be in danger of starting out with a flat tire, or driving far on one that is visibly soft. (Sometimes, especially on rough roads, you may not know, from the way the car handles, that a tire *IS* soft.)

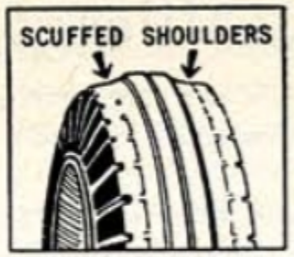


» UNDERINFLATION is one of the most common causes of excessive tire wear. The chart below, based on actual tests, shows the effect of underinflation on tire life. If the pressure is only 5 lbs. less than that recommended, tire life will be 32% less, and if you were to habitually carry 9 lbs. too little—and even that might not make the tires noticeably low—tire life would be reduced 52%.



How the normal mileage of a tire is reduced by underinflation.

Consult your dealer for proper tire pressure.



A RESULT OF UNDERINFLATION

Underinflation is bad for tires made of natural rubber, and even worse for synthetic tires. Both types become warm in use, even when they are properly inflated, as a result of flexing or bending as the tire rolls along. The lower the tire's pressure, the greater the amount of bending—and the more heat produced.

Tires containing synthetic rubber, due to their different composition, develop even more heat than natural rubber tires.

Heat, of course, causes deterioration of both tread and fabric. Add to this the increased wearing of the tread due to more of the "soft" tire's surface being in contact with the road, and it's easy to see why underinflation really *burns up* tires.

Another effect of underinflated tires is to waste gasoline, because more power is needed to move the car. *It is as though you were always traveling up hill!*

The pressure that should be used depends on the tire and on the car. If you don't already know the correct pressures for the tires on your car, find out at once—either from your instruction book or from your dealer. *Learn the figures by heart and check the pressures at regular intervals.* It's good insurance against road trouble to have your tire pressures checked once a week as a matter of regular habit—and even more frequently if you are doing an extra amount of driving. *Don't forget the spare once in a while.*

Remember, tires may lose a little air even when the car is not driven. If one tire consistently loses more air than the others, have it checked by a good tire man. The cause may be dirt in the valve, or a tack or nail in the tire. It's good insurance to find the cause and have it corrected at once. *Don't take chances!*

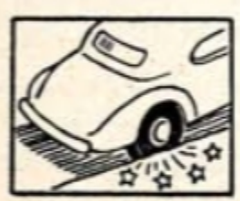
» TEMPERATURE CHANGES. It's best to check pressures when tires are cold—before the car has been run very far—but if there's a sudden sharp drop in temperature, the tires may need more air, because air contracts with cold. On the other hand, if too much air is put in when the tires are cold, they're likely to be overinflated when hot. While this variation may not matter much on a short drive, it might have an important effect on tire wear if ignored for any length of time.

Mild overinflation—say 2 or 3 pounds—won't cause any harm and may actually be beneficial, but beyond that it's hard on the tires as well as the passengers.

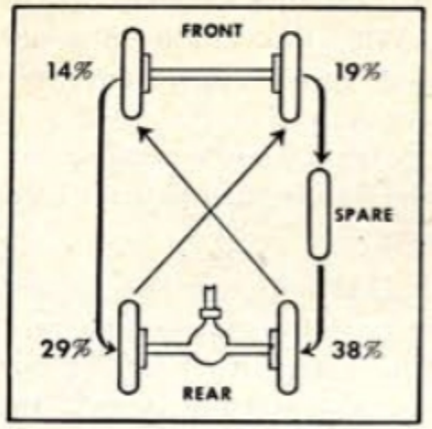
» THE VALVE CAPS *are more than just dirt shields;* in fact they are the only positive protection that you have against air leaking out through the valves. The delicate "insides" are only *check* valves, whereas any standard valve cap with metal plate embedded in rubber washer will hold air pressures up to 260 pounds! *Never drive without them and do not tighten with pliers!*

» "SLAM-BANG DRIVING"—*making the tires squeal on turns—jamming on the brakes whenever a stop is made*—may all be very thrilling, but it's also very expensive, because such driving scuffs and burns the tread off the tires and puts an undue strain on the fabric.

» CURB SCRAPING. You can make your tires last a lot longer by being careful not to scrape against curbs when parking. This weakens the side walls, increases the possibility of blow-outs, and very definitely shortens tire life. One tire manufacturer goes so far as to say that one-half of all tire trouble can be traced to damage caused by curb scraping.



» "CRISS-CROSS." To get maximum tire life you should change the wheels (together with tires) from one position to another at regular intervals. If your "spare" is in good condition, it should be used, taking its turn at the various positions *as indicated in the diagram*. Never let a good spare remain idle until the other tires are worn out because the spare will *deteriorate from disuse* even though it may appear to be new and in perfect condition. Tires need to be *massaged* or *exercised*, so to speak, in order to keep "alive" and in good condition.



The percentage figures indicate the average wear that can be expected at each position.

By including the spare tire in each of these changes, all of your tires, at the time of the fifth change, will have run the same distance on each wheel position.

For example, when tires are switched at 4,000 mile intervals, your car will have gone 20,000 miles—*but the mileage on each individual tire will be only 16,000!*

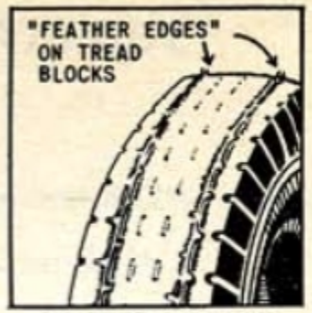
However, if your spare tire is in poor condition, and suitable only for emergency use, then the four "regulars" should be "criss-crossed" simply by switching them to the opposite corners of the car.

The big point, in either case, is that changing the tires around to different positions will help prevent undue wear on any particular one, by compensating for the different kinds of wear on front and rear wheel positions, as well as on the left and right sides of the car.

» "STITCH IN TIME." A minor cut or snag in a tire may be likened to a small cavity in a tooth and should be repaired before it develops into something more serious.

You may save trouble by having your tires inspected regularly.

» WHEEL ALIGNMENT. Probably one of the greatest enemies of long tire life is improper front wheel alignment. When a wheel is out of alignment the tire tends to drag sideways instead of rolling along freely. Even a very slight variation from the correct adjustment will cause rapid wear. *It is as though you were constantly scouring the tread with coarse sandpaper.*



TOE-IN OR TOE-OUT MISALIGNMENT WEAR

Examine the treads on your tires occasionally, and if you see any signs of *uneven* or "*feather edge*" *wear*, have your dealer check the alignment of the wheels. It's especially important to get this done after a minor accident—such as skidding into a curb. As a matter of fact, it's wise economy to have the wheel alignment checked up every 6 to 12 months depending on how much, and how severely, you use your car. The chances are that your dealer has special equipment for doing this job and the cost is not very high.

WEAR DUE TO CAMBER

» RECAPS. When the treads of your tires are worn smooth, a good recapping job may extend their useful life for several thousand miles—provided the casings have not been seriously injured, or the cords exposed.

However, it should be remembered that if the cords, fabric, or sidewalls are worn or broken, it is more than likely that the tires are not worth recapping, especially now that new tires are again fairly plentiful.

» WHEEL BALANCE. When new tires or recaps are installed on wheels, they should be checked to make sure that they are correctly balanced. Otherwise wear may be rapid and the "ride" may be somewhat rough. If necessary, the balance can be adjusted by attaching little counterweights on the wheels.

SUMMARY OF SUGGESTIONS

☑

☛ **CHECK** tire pressures at least once a week.

Underinflation wastes tires and gasoline.

Excessive overinflation causes more wear at center of tread, and tires bruise more easily.

☛ **DON'T** make jack-rabbit starts. A sudden start causes wheel slippage which scuffs off rubber.

☛ **DON'T** drive too fast—speed and heat are both enemies of tire life.

☛ **DON'T** stop too fast—every time passengers are thrown forward when stopping, tire life is shortened.

☛ **DON'T** make tires squeal when rounding turns. Squealing indicates soft tires, or too fast driving. Check tire pressures, and also—check your speed.

☛ **AVOID** scraping or bumping curb when parking—damaged sidewalls may result in ruined tires.

☛ **DON'T** run on a flat—even for a short distance. It will probably ruin the tire, or tube, or both.

FOR GREATER TIRE MILEAGE

☑

☛ **KEEP OUT** of car tracks and avoid sharp impacts, deep chuck holes, etc.

☛ **KEEP** brakes adjusted. Uneven adjustment causes uneven wear.

☛ **KEEP** valve caps on all valves.

☛ **CRISS-CROSS** your tires at intervals of 4,000 to 5,000 miles to compensate for different rate of wear on each "corner" of car.

☛ **HAVE YOUR WHEELS** checked for alignment every six to twelve months—or oftener if necessary.

REGARDING POST-WAR TIRES

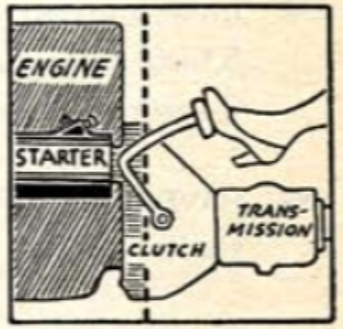
At the time this book goes to press, all passenger car tires and tubes being made contain synthetic rubber. They can be expected to give excellent service if properly cared for, but it is emphasized that ALL of these suggestions on "Stretching Your Tire Mileage" apply EVEN MORE FORCIBLY to the care of such tires. Beyond that, you should observe the manufacturer's recommendations on the care of any tires you may buy.

Your Driving Habits

JUST AS WE ARE ABLE TO WALK without stopping to think when we lift one foot and put it down in front of the other, so we are able, with practice, to perform many of the operations necessary to drive a car without giving them conscious thought. But there are *right ways* and *wrong ways* of doing most of these things, so the cultivation of proper driving habits is fully as important—and worthy of just as much attention—as the proper maintenance of the car itself.

It is with these thoughts in mind that the following suggestions on driving technique are offered—driving habits that other experienced drivers have found to be effective in stretching their gasoline dollars and prolonging the useful life of their cars.

» STARTING THE ENGINE.★ Always keep the clutch pedal pressed down while starting the engine. This allows the starter to crank the engine without having to turn the transmission gears and results in easier, quicker, more positive starting, particularly in winter weather when the transmission lubricant is thick and heavy. Aside from making it easier to start the engine, holding the clutch pedal down also provides a safeguard against accidents if the transmission happens to be in gear.



Depressing clutch pedal allows starter to turn engine without turning parts on right side of dotted line.

In case the engine doesn't start after it has "turned over" a few times, the chances are that something's wrong, and continued use of the starter will merely waste gas and run down the battery. If you're unable to determine the cause of the failure, and if a push from another car doesn't help—then the thing to do is to call the service station.

★ Don't forget the deadly carbon monoxide which is present in the exhaust gases of all cars. This gas is colorless, odorless and tasteless, but as little as 15 parts in 10,000 of air will, if breathed for an hour, cause death. Higher concentrations are more quickly fatal. Make sure the exhaust manifold, muffler and exhaust pipe on your car do not leak, and *always* open the garage doors before starting the engine.

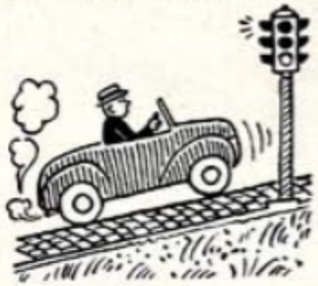
» HAND CHOKE. Study the use of the hand choke (if your car has one) and use it as sparingly as possible, for improper use of this device can waste enough gasoline to drive your car several blocks. Moreover, too much use of the choke may cause serious dilution of the oil in the crankcase. The choke should be pushed all the way in just as soon as the engine will fire regularly without choking.

Of course, if your car is equipped with an Automatic Choke, you don't have to bother about this point at all. The Automatic Choke is designed to regulate the fuel mixture exactly in accordance with the needs of the engine—and does it better than even expert drivers can do it with the conventional hand choke.

» WARM-UP PERIOD. Avoid "racing" the engine during the warm-up period. In addition to using a needless amount of gasoline, you run the risk of increasing the wear on pistons, piston rings and cylinders when you speed up the engine before the cold oil has had a chance to circulate completely. You probably won't want to wait until the engine is thoroughly warmed up before you start out—and we're not saying you should—but it's a good idea to take it easy for the first few minutes of driving.

» CLUTCH. Here's a good rule to remember: *Always keep your foot off the clutch pedal until you're ready to use it!*

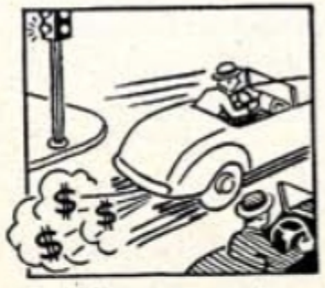
One of the worst habits some drivers have is "riding" the clutch—in other words, keeping the foot on the clutch pedal while rolling along the street or highway. This causes some slippage, even though it may not be noticeable to the driver. The result is that the clutch lining is rapidly worn away, and has to be replaced at considerable expense.



Another bad practice indulged in by some drivers is to *slip the clutch*—that is, let the pedal up part way to keep the car from rolling backward on a slight upgrade. This may seem to be the easiest thing to do at the time, but it can be a cause of rapid clutch wear. (Suggestions for starting your car on a grade can be found on page 50.)

» GEAR SHIFTING. Driving at high engine speeds in low or second gear can easily double the amount of gasoline used in getting under way. Most drivers agree, as do automotive engineers, that it is a good plan to shift into high gear before a speed of 25 miles per hour is reached.

Normally, a car should be started in low gear—although some cars can be started satisfactorily in second gear on a level road.



If you start in low, it is not necessary to make a long run in that gear before shifting to second—once or twice the length of the car is usually sufficient, unless you are starting up a hill. With the car in second and still picking up speed, it is best to shift into high at about 20 to 25 miles per hour.

Many motorists seldom use second gear at all when starting on a level road. After the car is moving fast enough—*around 15 miles per hour*—they shift directly from low to high. While pick-up

may not be quite as good this way, it is a perfectly satisfactory method if you want to eliminate one shifting operation.

» STARTING ON ICE. Maybe we ought to mention an exception to these general rules on getting the car under way. When starting the car on an icy pavement, *don't use first gear at all*—but start in second or high—engaging the clutch slowly. Go easy on the accelerator pedal to avoid racing the engine. This allows the tires to grip the ice better because the wheels have less tendency to spin.

Many drivers do not realize that gear shifting is sometimes just as important in stopping as it is in starting. The experts tell us that if the pavement is wet and slippery, there is nothing so effective in stopping—when driving at moderate speeds—as to shift into second and let the engine do part of the braking for you.★

» ACCELERATION. Gasoline can be saved, and tire and engine life prolonged, by avoiding unnecessarily rapid acceleration. Modern automobiles are designed to give quick pick-up and get-away—as an extra margin of safety in getting out of tight places. But there is not much excuse for using this speed just to beat another car away from a traffic light.

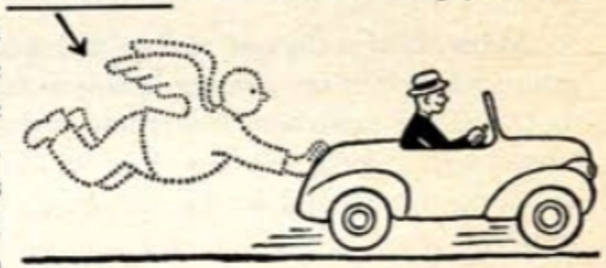
» ECONOMY ASPECT. When the accelerator pedal is depressed, a charge of raw gasoline is squirted into the intake manifold, just as though you had squeezed the bulb of an atomizer. Incidentally, this is why it is a bad habit to "pump" the accelerator pedal after starting the engine, or while waiting

★

CAUTION—***Do not let up on accelerator too fast on slippery pavements, especially when in second gear. The engine will act as a brake on the rear wheels ONLY and too sudden a change of speed is likely to cause a skid.***

for a traffic light to change. And on the highway, the driver who frequently calls on the engine for extra bursts of speed, *only to slow down a moment or so later*, uses a lot more gas than one who maintains a steady cruising speed whenever possible. Usually the steady driver will get to his destination just as soon as the one who drives by "fits and starts." *Try it!*

» BRAKING. Sudden stops, like sudden starts, are wasteful. A good part of the energy that you use in getting under way is stored up in the form of momentum which tends to keep your car rolling even after you take your foot off the accelerator (when the car is in high gear). You might say that it's there as a sort of a "bonus" which you can cash in on by letting it take you the last few hundred feet before you come to a stop.



Clearly, then, when a driver uses the accelerator right up to the last instant and then applies the brakes suddenly, he is not only wasting the momentum that his engine has built up, but he is subjecting his brakes and tires to needless wear.

It's just as easy, and a great deal more economical, to plan ahead and let the momentum of your car carry you into the stopping position *with a minimum use of the brakes.*

Thus, you will be "collecting your bonus" on the gas that was required to get your car rolling—instead of using the extra energy to burn up your brakes and tires.

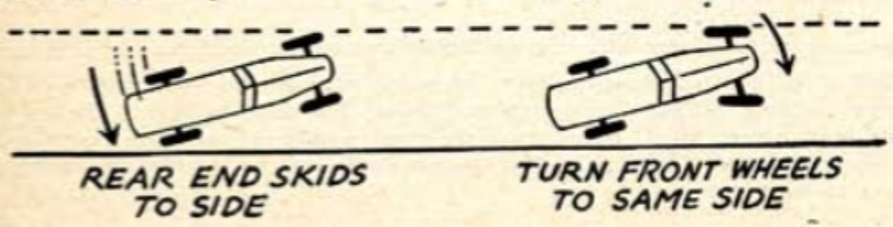
When you have to use the brakes more severely than usual, as in going down long hills, or in slowing down from high speed, a continuous heavy pressure on the brake pedal is undesirable because excessive heat is produced within the brakes, causing rapid wear. Loss of pedal pressure, or "hardening" of pedal pressure, are indications of excessive heat. It is preferable to slow the car by a succession of gentle "snubbing" actions of the brake—or else by *continuous light pressure* on the pedal.

» PARKING BRAKE. It's a good habit always to make sure the parking or "emergency" brake is fully released before getting under way. One way to avoid driving with the brake partially on is to *set it firmly* whenever you use it. Then you won't be able to start your car in motion until the brake has been released.

» COASTING DOWNHILL. It's poor economy to try to save gasoline by coasting down hills in neutral. Even on long hills, very little gasoline will be saved, and it should be remembered that a free running car cannot be controlled as easily and safely as one which is in gear with the clutch engaged so that the engine may serve as a brake, thus saving needless wear on the brake linings. (In many States it is illegal to coast downhill in neutral.)

» SKIDDING. If your car starts to skid, *gradually* take your foot off the accelerator, and at the same time, turn the front wheels in the same direction that the rear end is skidding. Pulling a car out of a skid may be compared to the art of keeping one's balance on a bicycle, where a short, quick twist of the handlebars *in the direction you feel yourself leaning* keeps you from falling over. So, when you feel the rear end of the car beginning to skid to one side, a short quick turn of the wheel *to the same side* brings the car back under control.

If skidding results from braking on slippery surfaces, you should let up on the brake momentarily so that the wheels can roll. At lower speeds, shifting into second gear and letting the *engine* reduce the car speed will also aid in keeping the car under control.



» SLIPPERY PAVEMENTS. Fast stops and starts on slippery roads make any car tend to skid. A good rule to follow is—DO EVERYTHING SLOWLY.

Start slowly, using high gear or second gear,
Accelerate slowly; stop slowly, and, above all
DRIVE SLOWLY.

Incidentally, when applying the brakes don't push the clutch pedal in *until the car has almost stopped.* By leaving the clutch engaged as long as possible, the car is kept under better control, and the wear on the brakes is lessened. This is a good habit to cultivate whether the streets are slippery or dry.

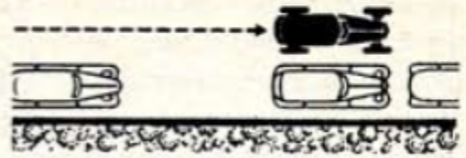
» USE OF THE HORN. It has been estimated that over 80% of all horn blowing is unnecessary and uncalled for. It may be fun—it may help as a means of "letting off steam" when we get impatient—but it's not the sign of a seasoned driver. Horns are loud—they have to be in order to be heard out on the highway where warnings are occasionally necessary. But in cities, one or two short taps are usually sufficient—and are frequently more effective than a long blast in getting the desired results.★

» AFTER A HARD DRIVE. In real hot weather or after driving in mountainous country, the engine should be allowed to idle a few minutes before turning off the ignition. This will prevent loss of water due to boiling, and will also give protection against "vapor lock"—i. e., interference with gasoline flow caused by bubbles in the fuel line when the gasoline gets too hot and boils.

★ One of the most embarrassing experiences ever encountered by a motorist is to have his horn "get stuck" and keep on blowing. The thing to do is to disconnect the horn wiring. Since the wiring is different in different cars, you should ask your service man to show you which wire to disconnect, so as to be prepared for such an emergency.

» HOW TO PARK IN A TIGHT PLACE.

FIRST, and of greatest importance, remember that traffic may be approaching from the rear, so always look back and make sure the road is clear before even attempting to park.



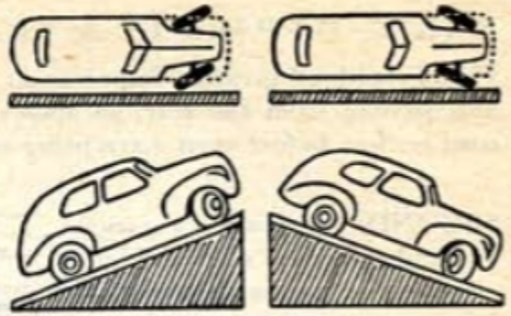
SECOND: Drive up in a straight line and stop even with *and fairly close to* the car in front of the space where you are going to park. Most trouble in parking comes from a wrong beginning—from not pulling far enough ahead or not getting close enough to the car in front—*or both.*

THIRD: Turn the wheels *sharply*—shift into reverse—and back the rear end of your car in toward the curb.

FOURTH: As your rear wheels near the curb—*you can determine this by lining up your outside REAR fender with the outside FRONT fender of the car behind*—continue backing slowly and at the same time swing your front wheels in the opposite direction so as to bring the front of your car in toward the curb.

FIFTH: Now pull yourself ahead into parking position. But don't try to park *too close* to the curb because that makes it difficult to get your car back out again. In most cities you are allowed 6 inches.

» GOOD POINT TO REMEMBER: *Parking your car in a limited space* is exactly the OPPOSITE of getting it OUT OF A LIMITED SPACE—SO if you will watch yourself closely when driving out of a parking space, you will soon know just how far you move the car in each step, so that when it comes to reversing your efforts, the job becomes a lot easier.



» WHEN PARKING ON A HILL, turn the front wheels so that the car will run INTO the curb—instead of AWAY FROM the curb—in case it should start to roll. Also leave the gears in reverse to prevent the car from moving if the parking brake is released accidentally.

» SPEED. Now, more than ever before, safety on the streets and highways demands good judgment in the matter of speed.

It is not always safe to drive as fast as the posted speed limits. Road conditions, visibility, traffic, and the condition of the car itself, may require reduced speed.

This is especially true now, when the average age of cars in use is relatively high so the chances of tire failures and mechanical difficulties are correspondingly high,

—and even though your own car may be in perfect condition, the fact remains that your safety on the highway depends in no small measure on the cars you meet and pass.

» CAR STORAGE. Automobiles are built to be used and they need regular "exercise" to keep them in good condition. A car left standing idle for any great length of time is likely to deteriorate more rapidly than if it had been driven regularly—and should be carefully checked over and reconditioned before being put back into service.

If ever you have occasion to store your car for an indefinite period of time, it's a good idea to consult your dealer about it.

Preparing a car for "dead storage" is a major operation, involving a great many details, some of which are rather difficult to perform. If properly serviced and cared for at the time of storing, the job of preparing the car for use later on will be easier and less expensive.

Some Highway Hints

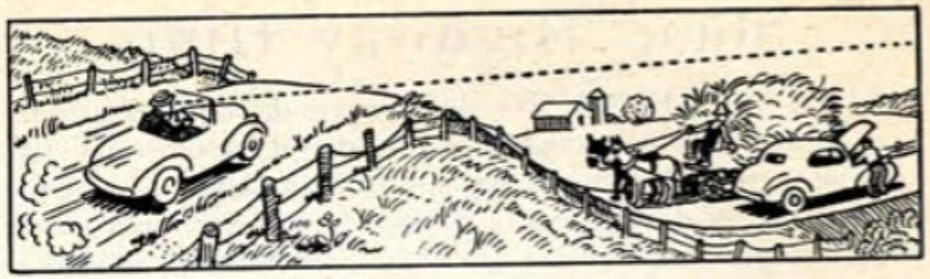
» THE CAR AHEAD. You should never drive too close to the car ahead—stay far enough behind so that if the other car stops suddenly, you'll be able to stop also without danger of accident. Then, too, by staying back a reasonable distance you'll have a better view of the whole road, which is important if you want to pass the car ahead of you.

» PASSING OTHER CARS. Never try to pass a car unless you're sure that you have plenty of room ahead. Look at it in this way—when you pass a car that is going forty miles an hour it's just like trying to pass a standing string of cars 300 feet long, or longer—depending on your own speed in passing. Don't take chances. After passing, always *wait until you can see the car you have just passed in the rear-view mirror* before moving over to the right in front of it.

» IN ROUNDING TURNS, always keep well to your own side of the road and don't drive too fast. An interesting lesson can be learned from the technique of professional racing drivers who —instead of keeping at full speed until they are well into the turn and *then* putting on the brakes—always slow down *when approaching* the turn—enter it at reduced speed and then accelerate as they come out again on the straightaway.

» WHEN ONE WHEEL RUNS OFF PAVEMENT, the natural inclination is to turn the car quickly back on the road again, or to jam on the brakes. Neither method is safe unless you are driving very slowly. A better way is to take the foot off the accelerator, hold the wheels straight and allow the car to *slow down gradually* until it can be brought back into the road *easily—without jar or sway.*

» TIRE BLOW-OUTS. The same is true in the case of a tire blow-out. We seem instinctively inclined to jam on the brakes when a tire "blows", whereas the proper thing to do is just to hold the car steady, using the brakes lightly, off and on, until a more moderate speed is reached. Then use the brakes *gently* until the car stops.



» ON HILLS. Keep well to the right when climbing and approaching the crown of a hill. Never try to pass a car on a hill—there's no way of telling what may be in your path on the other side.

Since you can't see what's over the brow of the hill, you should drive so that you can stop quickly in case you should have to. Extra caution should always be your watchword when driving in hilly country.

If you should accidentally stall your engine on an upgrade, the thing to do is to set the emergency brake until you have started the engine again.

In starting the CAR on an upgrade the motorist has a choice of two accepted methods of getting under way without letting the car coast backwards. A little practice—following either method you prefer—is all that is necessary to enable you to handle such a situation easily and expertly.

METHOD No. 1

Hold the car with the foot-brake, push the clutch down and put the car in low gear. Then accelerate the engine with the dash throttle while slowly releasing both clutch and brake at the same time.

METHOD No. 2

Hold the car with the emergency brake and use the foot accelerator in the regular way while simultaneously releasing the emergency brake and letting up the clutch pedal.

» MOUNTAIN TRAVEL. Mountain driving, especially going down long, steep hills, used to be looked upon as a severe test of one's driving skill. But with modern synchronized transmissions, it no longer requires an expert to shift from high down into second—*even in the middle of a hill*. If you are in doubt, however, as to how steep the hill may be, the safest plan is to go into second or low, before starting down.

One of the most common faults in hill *climbing* is to stay in high gear too long. You've seen cars laboring up hills, going slower and slower until both car and engine have almost stopped. This is a bad practice and sometimes dangerous. What's more, it's a common cause of overheating and "vapor lock." (*See page 46.*) Unless traffic or sharp turns force you to drive at a very slow speed, most cars in good condition will climb any ordinary hill in high gear, but it should be remembered that the gears *are there for a purpose* and they should be used for that purpose when the necessity arises.

There is no point in straining to see how steep a hill you can climb in high gear. When your car begins to labor on a hill, you should shift to second when the speed drops down to around 20 miles an hour.

» DRIVING THROUGH WATER. If it should be necessary to drive over flooded pavements or through large or deep puddles, you can usually avoid "drowning" your engine by going slowly enough so that water is not splashed up under the hood. If some water does get inside the hood from splashing or from a heavy driving rain, and your engine should begin to miss or sputter, pull over to the side of the road, shift to neutral, and speed up the engine enough to keep it running. Its heat should dry off the moisture within a few minutes, and as soon as it begins to

run smoothly again you will be able to proceed on your way.

If for any reason you have driven, or been towed, through deep water, it's a good idea to make sure that no water has gotten into the crankcase. Drops of water can usually be seen on the oil checking stick if there is any in the crankcase.

» STARTING IN MUD OR SAND, use almost the same method as in starting on ice or slippery snow. Put the car in second gear—*or even in high*—and release the clutch pedal slowly so as not to spin the wheels.

When stalled in deep sand, traction may be increased by letting a little air out of the rear tires—but don't forget to re-inflate them immediately thereafter.

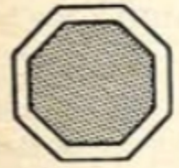
» "THE LONGEST WAY 'ROUND." The best thing to do whenever possible is to avoid bad roads. Ten miles of driving on dirt or loose gravel is likely to wear your tires more (and take more gasoline) than 15 miles of driving on good, hard surfaced roads.

» TOURING EQUIPMENT. When you have occasion to take a long cross-country trip through sparsely settled areas, it's well to give some thought as to what you may want to take along in the way of extra equipment. Just to help you in your planning, here is a *Check List* of items that may add materially to your comfort, convenience and safety:

- ☐ Sun Glasses
- ☐ Flashlight
- ☐ Thermos Bottle
- ☐ Collapsible Drinking Cup
- ☐ Compass
- ☐ Tissue Handkerchiefs
- ☐ First Aid Kit
- ☐ Canvas Gloves
- ☐ Tire Chains
- ☐ Extra Fuses
- ☐ Travelers' Cheques
- ☐ Extra Light Bulbs
- ☐ Tow Line
- ☐ Small Board
  —*to support lifting jack if used on soft earth.*

» TRAFFIC LAWS. When entering a strange city or state, a lot of trouble can be saved by taking steps to acquaint yourself with the local traffic laws, which in some cases may be considerably different from those you are accustomed to back home.

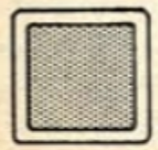
» THE SHORTHAND OF HIGHWAY SIGNS. Many motorists do not realize that the shape of a standard road sign on a major highway discloses its general meaning. It's a good idea to familiarize yourself with the shapes and general meanings of these signs because such knowledge will add much to your comfort and safety especially on dark nights—driving in fog, rain, etc. When it is difficult actually to read the lettering, you can get a pretty good idea from the shape of the sign as to just what you should do.



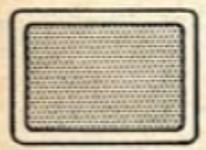
Thus, an **OCTAGONAL** or eight sided sign means **STOP**—you're approaching a Stop Street, a Trunk Line Junction, or perhaps a Dangerous Corner.

A ROUND sign indicates that there is a **RAILROAD CROSSING** ahead. (One horizontal bar means *one track*, two bars—*two tracks*, etc.)

A DIAMOND shaped sign means that you should **SLOW DOWN**—immediately ahead may be a Dangerous Curve or Hill, a Narrow Bridge, End of Pavement, Bad Road, etc.



A SQUARE sign usually conveys important **INFORMATION**, such as School Zone, Playground, Men Working, Hospital Zone, Church Zone, etc.



A RECTANGULAR sign is generally used for giving **TRAFFIC DIRECTIONS**—Keep to Right, No Left Turn, No Parking, Special Speed Limit, etc.

A HELPING HAND on the Highway!

PROBABLY THE MOST MALIGNED users of our public highways are the commercial truck drivers—those sturdy, hard working men who, throughout the length and breadth of the land, transport a large portion of all goods shipped.

By day and by night, they wheel their Juggernauts over the highways, millions of miles per month, supplementing the facilities of our railroads, waterways and airlines—and serving the many thousands of towns and communities that are not reached by any of the other forms of transportation.

And yet the average motorist, if he hasn't thought the thing through, is inclined to look upon these truck drivers as the bane of his existence—to be sworn at, resented and abused—without regard to the indispensable services that they perform—without thought to the huge taxes paid by truckers for the use of the highways and without realization of the fact that these cross country truck drivers are, as a group, the most experienced and cooperative motorists on the highway.

If given half a chance they will help you to pass in complete safety; they will warn you of danger immediately ahead, and flash you an "all clear" signal when they see the road is safe for you to proceed. *But you have to know how to work with them.*

These cross country truck drivers have a system of simple and efficient signals—a highway code that they have developed for their safety and convenience, and while this code was designed for their *own use*, they are always glad to share it with any motorist who is willing to accept it on a cooperative basis.

If you drive up behind a truck on a winding road, or at the approach to a hill, always give him a couple of short "toots" on your horn and then watch what he does.

If he is in the middle of the highway, the first thing he will do is to pull over to the right side of the road—*provided it is safe for you to pass.* But until he can see safety ahead for you, he may not do anything. Then you should be patient enough to wait for the "all clear" signal.

Don't forget that he can see the road ahead when you, in your car behind him, cannot.

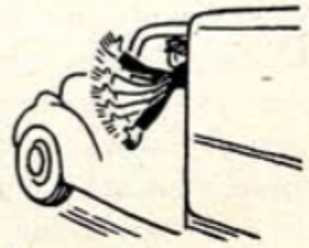
If he can see sufficiently far ahead to know that you can pass in safety, he may signal you to come on. He may either wave you on with his hand, or flash his rear "outline lights." While this gives you your cue to pull out into the passing lane, it does not relieve you of the responsibility of satisfying yourself that the way is clear.

"O.K.—IT'S CLEAR AHEAD"

Never try to thank him by waving your hand. Don't even take your eyes off the road, but as you go by, give him a couple of short friendly "toots" as a "thank you" signal. He'll answer, and both of you will know, as you go on your way, that in each driver there is an understanding of what is meant by "the courtesy of the road."

But if you ever start to pass a truck and see the driver wave his arm up and down, he is frantically warning you to get behind him *and stay behind him. There is danger ahead!* And it is probably approaching at high speed!

At other times, when you and a truck are passing in *opposite* directions, he may flash his headlights two or three times to attract your attention, or try to wave you down with his hand or arm.



"DANGER! STAY BACK"

Don't think him silly. He is trying to tell you something that is extremely important if you will only "listen" and interpret it correctly.

Remember, he has just come over the highway that *you* are

about to travel. He may consider your speed too dangerous for the road immediately ahead; or maybe there has been an accident just around the next curve, and if *you* don't slow down there'll be another. Or maybe he's just being extra friendly and is trying to tell you, "*Look out! Cop ahead! Take it easy!!!*"

Whatever it may be, it's something for your own good—and make no mistake about it. Better slow down and keep on the alert for the next mile or so.

These systems of signals are *not* complicated. They were originated out of friendship of one truck driver for another. They work in a fraternity where safe and efficient driving means much, and they are willing and glad to extend the benefits and courtesies of their code to the driving public, day or night.

If you are in trouble on the road—flat tire, out of gas, breakdown, or lost—the cross country trucker will be one of the first to offer you help; not just superficial help either, but *real help—expert help*—and *enough of it to get you on your way.* If you are a woman driving alone, or with your children, few people on the road will show you greater courtesy and consideration than these veteran drivers.

FRIENDSHIP AND RESPECT are based on understanding. Safety of the highway is based on courtesy. Any car owner can become an honorary member of the commercial drivers' fraternity through just a little better understanding of their position, an appreciation of the important part that they play in speeding up the work of the nation, and a willingness on your part to exchange the full courtesies of the road. *Every* driver can be safer, happier, and more comfortable by watching for the "*helping hand on the highway!*"—and by promoting a better understanding between the commercial trucker and the drivers of passenger automobiles.

APPENDIX

THE PRECEDING PAGES have dealt with how to get the most out of your car—*from the standpoint of operating efficiency, mechanical maintenance, driving habits, highway etiquette, etc.*

"Housekeeping Your Car"

The following appendix offers some practical suggestions: (a) for preserving the exterior finish and protecting the exposed parts against the ravages of rust and corrosion; (b) simple directions for taking care of the interior.

There are RIGHT ways and WRONG ways of doing all these things.

Take the Right Way! It Pays!

"HOUSEKEEPING YOUR CAR"

Care of the Exterior

SUNLIGHT, DEW, RAIN, SNOW, salt air, road grime, dirt, dust, tar and calcium chloride on the highways—all war against the fine finish on your car and in time will cause it to disintegrate unless the proper precautions are taken.

Since strong sunlight is one of the most damaging natural elements, it is a good idea to park in the shade as much as possible.

In this connection, however, there is an important point to bear in mind:

Perhaps you've noticed sometimes, after parking under a tree, that your car is covered with little spots which are sticky when you try to rub them off. These spots appear to be sap from the tree but they actually come from little insects which attack the leaves of certain trees—especially maples and elms. This residue has a chemical content which is harmful to finishes, so if any gets on your car, it should be washed off as soon as possible.

Dew, or moisture condensing on a car at night is especially harmful to the exterior finish and for that reason, if for no other, your car should be kept in a closed garage every night.

By observing these general precautions and devoting a little time and attention to the suggestions given below you can keep your car looking bright and new for a long, long time.

. . . . .

» WASHING. When your car gets dusty, a clean, dry cloth is usually all you need to brighten it up again. If grit or sand particles are mixed in with the dust, or if the car is muddy, it should be flushed off with cold water and dried with a chamois or a soft cloth.

Always use cold water in washing your car and never wash it in the direct rays of the hot sun. Always wait until the sheet metal surfaces have cooled off before starting to wash it.

» POLISHING THE BODY. If the car gets extremely dirty, and especially when the dirt is allowed to remain on it for a long time, it may look a little dull even after it is washed. If so, all that is usually needed to bring back the original brightness and luster is a small amount of good polish. Polish suitable for your car's finish can be purchased from your dealer. Rub the polish lightly until it is dry, so as not to leave any damp surfaces to collect dust. If a little of the color seems to rub off on the cloth, there is nothing to worry about—it doesn't mean that the finish is being damaged but only that the dead pigment is being cleaned off.

» CHROME PLATED PARTS. Salt, calcium chloride, salt air and corrosive atmospheres are especially harmful to chromium plated surfaces, but the destructive action can be greatly lessened if plated parts are washed at frequent intervals. After washing and drying, a protective coating should always be applied. Ordinary furniture wax is quite satisfactory or, if that isn't handy, a little ordinary motor oil may be used. Regular attention to these simple protective measures will work wonders in helping to preserve the plated surfaces.

» REMOVING RUST FROM CHROMIUM. If the above precautions have not been taken and rust spots begin to appear on the chromium plated parts, steps can still be taken to greatly improve their appearance, and prevent the rust from spreading further. The best thing to do is to scour the spots with a scouring powder of a type which would be used for cleaning porcelain. After removing the rust spots in this manner, a film of wax or oil should be applied.

» TAR OR ROAD OIL. Tar or road oil can usually be removed without injury to the finish by using a tar or road oil cleaner of the kind generally sold by automobile dealers. Or, if the tar is still fresh, plain gasoline may be used. If the tar has hardened into lumps, soften it first by using lard, butter or gasoline, *but be sure the gasoline does not contain coloring matter or Ethyl fluid.* Usually it is advisable to apply a little polish afterwards to restore the high luster.

» SALT AIR. If you operate your car near the seashore, a little extra attention is advisable. The body finish and plated parts should be washed more frequently and the body should be polished and the plated parts coated with wax or oil as previously outlined. If salt spray comes in direct contact with the car, it should be washed off as soon as possible.

» CLEANING GLASS. In cleaning windows, windshield and other glass equipment—use a clean linen cloth. Linen possesses a special and peculiar property of removing dirt and grease from glass, in addition to being comparatively free from lint. Since linen becomes softer after it has been washed several times, old linen rags are much better than new linen. When the glass is especially dirty, a little household ammonia mixed with warm water will do a good job. Eyeglass lens manufacturers oftentimes use a solution made by soaking *Soaproot Bark* in a dish of water and it is interesting to note in passing that stale beer is popular as a cleaning fluid in fine glass shops.

» TIRES. For cleaning tires, a sponge and some water are all that are ordinarily required. To remove oil or grease use soap and water—or in the case of tar or some other substance particularly hard to get off, mechanic's soap containing a mild abrasive, or an ordinary kitchen cleanser can be used. Sometimes tires become gray looking from rubbing against curbs. In such cases the luster can be restored by applying a coat of Tire Gloss. For white side-wall tires, a special white side-wall cleaner is available from your dealer.

Care of the Interior

KEEPING THE INSIDE of your car clean is no more difficult and not much different from taking care of the rugs and furniture in your own home. About once a month—or oftener, if you think necessary—it is a good idea to take the dust out of the upholstery with a whisk broom and a vacuum cleaner.

If spots or stains get on the upholstery, they should be removed as soon as convenient—before they have a chance to soak in and dry.

There are two basic types of cleaners generally available:

(a) VOLATILE CLEANERS—colorless liquids generally having carbon tetrachloride or naphtha as a base.

(b) ALKALINE CLEANERS—which have a soap base.★

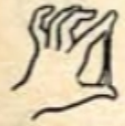
In most cases volatile cleaners are recommended, especially if the upholstery is a flat fabric such as broadcloth or Bedford Cord. In using volatile cleaners, here are a few special directions that are well worth following:

1. **Don't use too much fluid. Some seat cushions and arm rests are padded with "foam rubber," and since volatile cleaners attack rubber, these paddings may be destroyed if the material gets soaked with the cleaner.**
2. **Carefully brush off all loose particles of dirt.**
3. **Wet a small, clean cloth with the cleaning solution, wring out thoroughly. Then open cloth and allow the fluid to evaporate a trifle.**
4. **Tap the spot lightly with the cloth, *but don't rub it.* This will pick up particles which are too embedded to be removed by brushing. *Repeat several times, using a clean part of the cloth each time.***
5. **Moisten another piece of clean cloth with cleaner and allow to evaporate until barely damp. Now rub the spot lightly, working *from the outside in toward the center.* (This, as you probably know, keeps the spot from spreading and is less likely to leave a ring.) If necessary, repeat several times.**
6. **Brush again, to remove any further particles which may have become loosened.**

While volatile cleaners are the most generally useful, some types of stains require special treatment. Following are the most common causes of stains, together with specific directions for removal:

» BLOOD STAINS. Rub the stain with a clean cloth dampened with cold water. Never use hot water, or soap and water, as they will "set" the stain and make it practically impossible to remove.

» CANDY. If the candy does not contain chocolate, the stain can be removed by rubbing with a cloth moistened with very hot water. (Avoid the use of hot water on upholstery, except where specifically called for.) Chocolate stains can be removed by rubbing with a cloth and lukewarm water, then sponging with carbon tetrachloride.



» CHEWING GUM. Moisten the gum with carbon tetrachloride and work it off the fabric with a dull knife while it is still moist.

» FRUIT STAINS. Rub vigorously with a cloth dampened with very hot water. Let dry, then sponge with carbon tetrachloride.

★ Do not use gasoline for cleaning purposes except when specifically directed *and NEVER use any gasoline which is colored or which contains lead.*

» ICE CREAM. Use the same method as for removal of fruit stains. If the stain is persistent, use a cloth moistened with warm mild soap suds, then cold water. After drying, sponge with carbon tetrachloride. (Avoid saturating the upholstery with soapy water.)

» GREASE AND OIL STAINS. Use gasoline or carbon tetrachloride. If the fabric is saturated with oil, pour on the cleaning fluid and soak it up by pressing a white blotter on the spot. Then sponge in the usual manner with a cloth dampened in the fluid.

» LIPSTICK. Apply a little carbon tetrachloride to the stain by means of a saturated cloth and immediately press a blotter firmly on the spot. Repeat this procedure, using new sections of blotting paper each time until the blotter no longer shows any stain.

» MILDEW. Fresh mildew can be removed by rubbing vigorously with a cloth soaked in warm soapsuds, followed with rinsing by rubbing with a cloth wet with cold water. Old mildew can be removed through the same treatment, although some of the discoloration is likely to remain.

» SHOE POLISH. Black or tan polish can be cleaned off with a cloth saturated in carbon tetrachloride. White polish can usually be removed with a stiff brush. If that doesn't do the job, moisten with cold water, let it dry, and then use a brush.

» URINE. Sponge the stain with a clean cloth wet with lukewarm mild soapsuds and then rinse well by rubbing with a clean cloth wet with cold water. Subsequently pour on the spot a mixture composed of one part household ammonia and five parts of water. Allow it to remain for a minute and then rub off with a clean, wet cloth.

The preceding information, while obtained from the most authoritative sources available to us, cannot be guaranteed because of variations in fabrics and in the chemistry of cleaning fluids.

Authors' Notation

The footnote on the preceding page might well be expanded to cover other chapters in the book.

It should be remembered that the primary function of this particular department is to interpret the knowledge of General Motors Engineers and Research Specialists into the language of the practical motorist - and vice versa! and VICE VERSA!

We, of the Customer Research Staff, have only a layman's understanding of engineering subjects. So from necessity, as well as from choice - we have kept away from scientific terms and this, within itself, introduces the possibility of technical discrepancies.

If such are found, let us know and they will be corrected (with apologies) in future editions.

We'd be mighty glad to hear from you anyway, as to how you like the book - your comments, suggestions, etc., - and we'd be glad to send extra copies for your friends.

THANKS!

C.R.S.

General Motors
Detroit, Mich.

INDEX

COMPLIMENTS OF YOUR GENERAL MOTORS DEALER: