EXCLUSIVE – '57 FORD REPORT: OWNER MAINTENANCE

AUTO MECHANICS

A.N.C.

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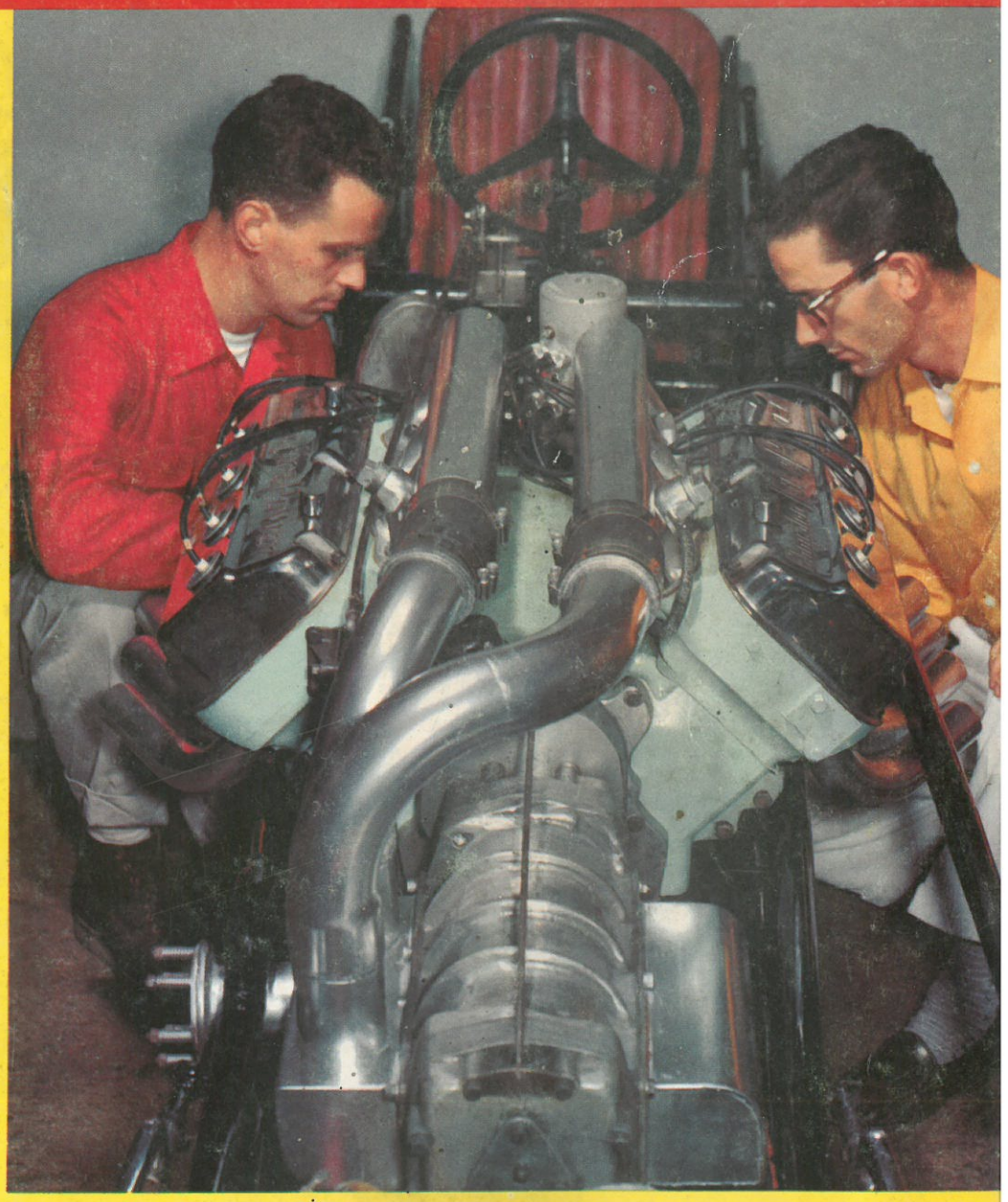
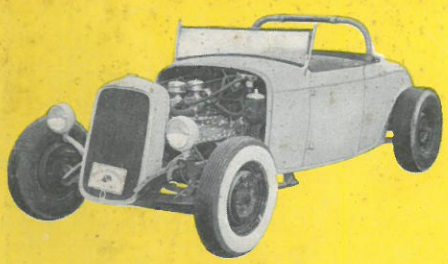
SPECIAL HOT ROD ISSUE



THE BEST DRAGSTER?

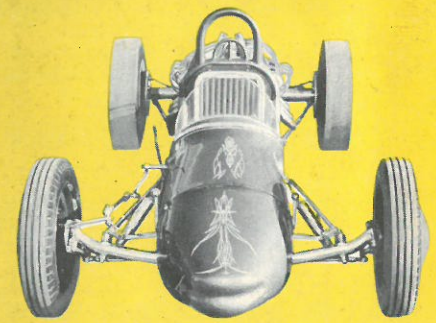
SERVICING THE McCULLOCH BLOWER

A ZIFF DAVIS PUBLICATION

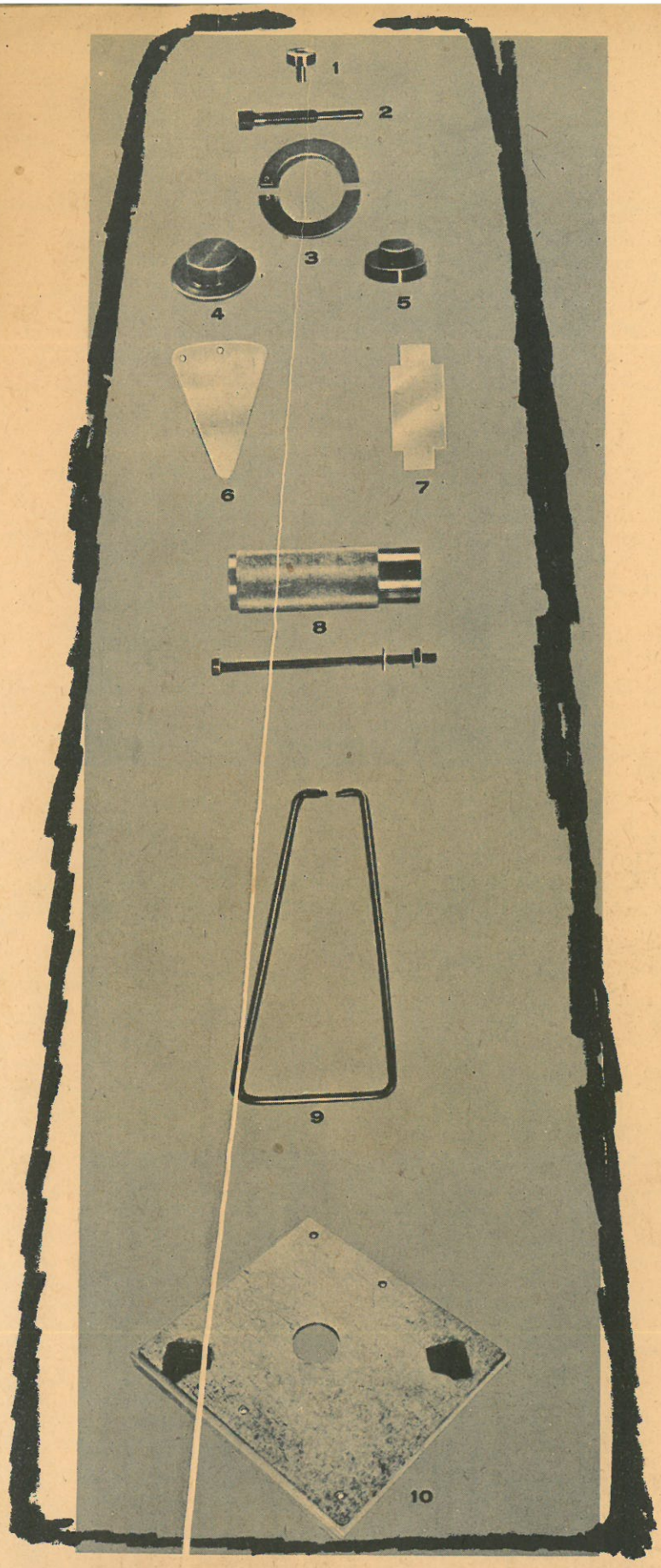


STREET RODS

HOT STOCKS



DRAGSTERS



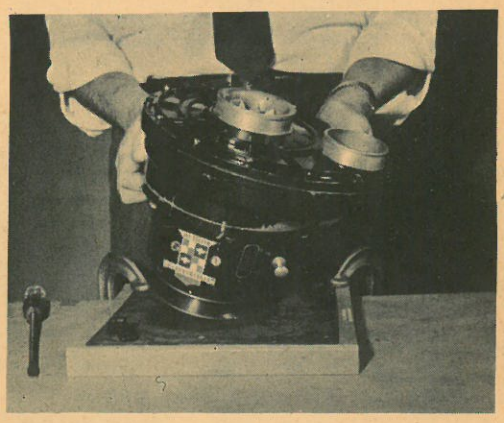
Special tools for blower overhaul are: 1—input shaft centering button; 2—impeller puller screw; 3—bearing remover adapter; 4—scroll housing bearing race anvil plug; 5—pulley bearing centering button, large; 6—impeller holding clamp; 7—float level gauge; 8—front and rear bearing installer; 9—spline hub puller; 10—holding fixture.

IN the scramble for increased horsepower, one can go only so far in adding inches to engine displacement before running into a weight and size impasse. Addition of a supercharger to an engine can produce a phenomenal power increase, ranging as high as 50 per cent, against an almost negligible increase in weight. Introduction of the McCulloch blower on the Studebaker Golden Hawk marks a step in the right direction.

The fact that Studebaker will service the McCulloch at local dealerships will be welcome news, not only to Golden Hawk owners, but to the ever-increasing number of enthusiasts who have found a supercharger to be a simple and effective path to power. We were fortunate to have been allowed to attend the Studebaker service school session on the repair and servicing of the McCulloch (renamed the "Studebaker jet stream supercharger" for the Golden Hawk installation.

Contrary to conventional blower practice, the McCulloch

1 *Remove dip stick, drain oil from blower. Place it with pulley end down on holding fixture, clamped to work bench.*



SERVICING

By Alexander Walordy

pushes pressurized air through the carburetor rather than pulling it through. The carburetor is completely enclosed in an air chamber cover, which receives its air supply through a flexible hose connected to the blower. If the entire carb was not pressurized, blower pressure would cause fuel to back up through jets into the float chamber. Carburetor adjustments are made by removing plates in the air cover.

The main feature of the McCulloch, and the one that makes it so attractive for passenger cars, is the fact that it is a variable speed centrifugal blower. Use of a variable drive eliminates the drawback of most centrifugal blowers — low delivery pressures at low rpm. The McCulloch provides high blower rpm at low engine speeds, for plenty of low-end torque. At high engine speeds, where boost pressures would become excessive, a control mechanism is provided that cuts back on the blower speed to keep the pressure

below 5 psi, which still gives a comfortable 34 per cent theoretical power increase at top boost.

Blower Operation

The blower is driven by a special cog type belt that connects an engine pulley to the supercharger pulley. The engine pulley has fixed sheaves, while the distance between the sheaves of the blower pulley is controlled by a regulating piston located inside the blower. When the sheaves are close together, the belt rides high in the pulley, the effective diameter of the pulley is large, and the blower is driven at low speed. When the sheaves are far apart, the belt rides low, the effective diameter of the blower pulley is small, and blower speed is increased.

A spring-loaded belt tensioner not only maintains the belt tension, but also tends to spread the sheaves of the blower pulley by pushing the belt between them. Thus, at idle, the belt rides at the bottom of the pulley; when the maximum manifold boost is reached, the governing mechanism must overcome the pressure exerted by the belt tensioner, and bring the sheaves closer together. This lowers boost pressure. On the other hand, if the pressure drops below the required point, the governing mechanism is pushed back by the belt tensioner until a new balance point is reached.

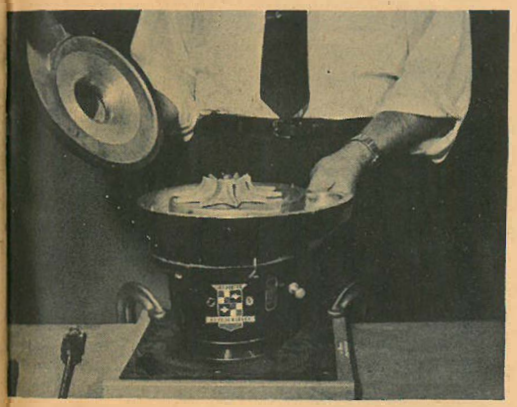
An input shaft within the blower is driven by the pulley, and the ratio between engine speed and blower input speed ranges from 1:13 at "low blower" to 1:23 at "high blower". At top engine speeds of around 5,000 rpm, the input shaft of the blower runs between 6,500 and 11,500 rpm. However, these speeds are far too low to drive the impeller, which must turn at approximately 29,000 rpm to produce five pounds pressure.

An ingenious ball drive provides the necessary multiplication between the input shaft and impeller shaft. This system is quite similar to a planetary gear train, with the ring

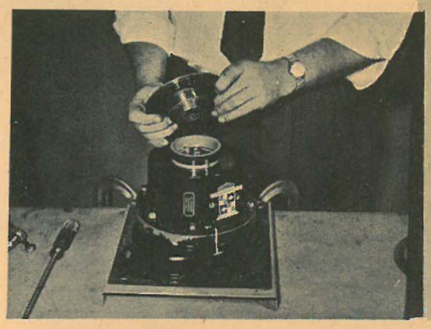
2 *Scribe marks on housing, scroll cover to assure correct reassembly, then unscrew the cover bolts—remove cover.*

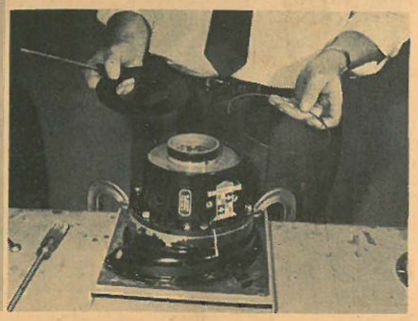
3 *Install impeller holder to keep this unit from turning while removing center bolt. Remove the impeller with puller.*

4 *Remove spacer behind impeller. Invert unit, clamp it to holding fixture, remove center bolt from pulley (below).*



THE McCULLOCH

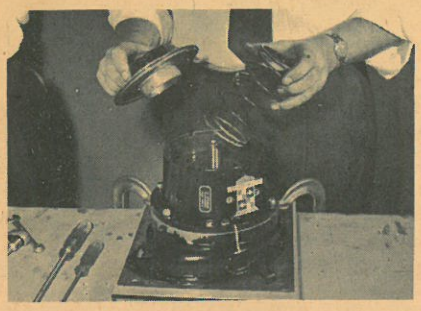




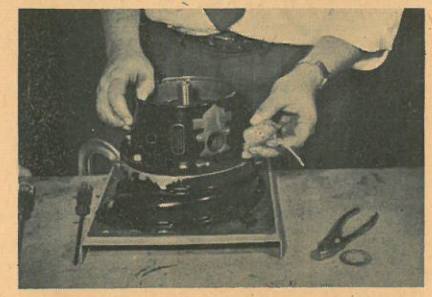
5 *With center bolt removed, pull the front sheave of the pulley up and out of unit.*

6 *The rear sheave is removed next. Then take out baffle at end of blower housing.*

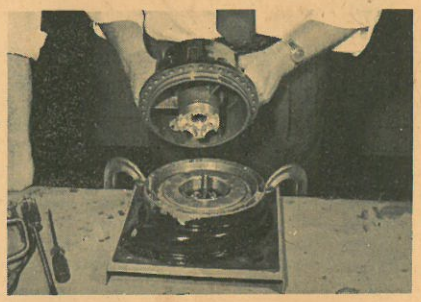
7 *Remove first circlip, then the baffle. Press down on piston, remove inner circlip.*



8 *Remove the piston with its inner piston ring. The piston spring is then removed.*



9 *Remove the name plate, the spring behind it, then the diaphragm control valve.*



10 *Remove bolts that retain the bearing housing, and remove the housing. Be sure that work area is kept clean.*

gear held stationary, the movement imparted to the pinion cage and the sun gear keyed to the output shaft. At the speeds involved, a gear train would be unusually costly and noisy. In the McCulloch, the planetary gears are replaced by steel balls; the ring gear is replaced by a spring-loaded outer race which is stationary, and the inner race replaces the sun gear and turns the impeller shaft.

Multiplication obtained by the ball drive is 1:4.4. Thus in the low blower position, with the engine revving at 5,000 rpm, the impeller turns at 28,600 rpm (1.3 x 4.4 x 5,000), while in the high blower stage it would turn at more than 50,000 rpm (2.3 x 4.4 x 5,000).

One side of the ball drive outer race is pressed into the scroll housing, while the other side is held by the race load assembly. A series of springs in this assembly exert a load against the balls and take up any wear. The front sheave of the blower pulley is set on an externally-splined sleeve which is keyed to the input shaft. The rear sheave is splined internally and engages the splines of this sleeve. The tension of the belt tends to push the rear sheave back against a spring-loaded piston.

A passageway controlled by the diaphragm control valve transmits blower pressure to one side of this piston; the other side is exposed to the atmosphere. Spring tensions are so balanced that when blower pressure reaches five pounds, the combined pressures on the piston from the piston spring and the blower are sufficient to move it forward, closing the distance between the sheaves and bringing them into low blower position.

Control Valve Solenoid

The diaphragm control valve contains a solenoid which governs the position of a sliding sleeve and a spring-loaded valve which is pushed against a button in the center of a spring-loaded diaphragm. This valve remains open as long as the solenoid is not activated; when the accelerator is pushed beyond seven-eighths of its travel, a kickdown switch closes the circuit to the solenoid, activating it, and causing the sliding sleeve to seat against the valve, closing off the passage between the blower and the piston. With the control system out of the way, the blower goes into the "high" position, to meet the sudden power demand.

However, when the maximum five pound pressure is reached, the diaphragm overcomes the pressure of the con-

11 *The bearing load assembly is removed. Next step is to remove steel balls.*

12 *Use lint-free paper to hold the balls. Finger marks will corrode the surface.*

13 *Tap out input shaft, complete with bearings and the oil pump, from the housing.*

trol spring, and allows the valve to become unseated and to admit blower pressure to the piston.

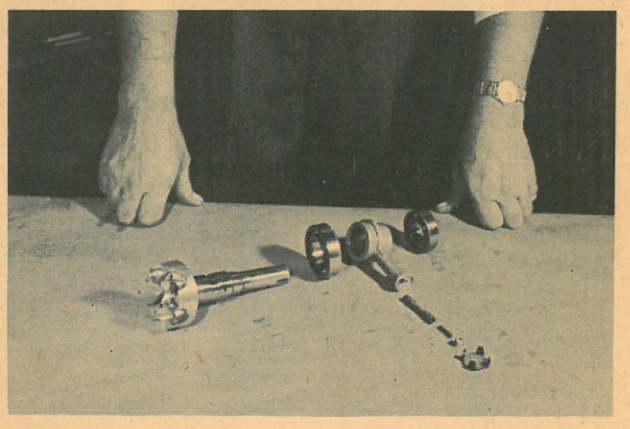
Cut-in point of the solenoid is controlled by the kickdown switch, and at the same time the kickdown acts as a wide open throttle stop. To adjust it, loosen the bracket that carries the switch and pull it out of the way. Make sure that the accelerator linkage opens the throttle all the way, and adjust if necessary. Then set the throttle in the wide open position, push the switch against the auxiliary throttle lever so that the switch plunger is fully depressed and lock the bracket in place. A manual overide switch can be branched to provide an early cut-in for the blower. One terminal of the switch is connected to the solenoid terminal on the blower in addition to the kickdown switch terminal. The other side of the switch is grounded. However, *constant or prolonged use of the blower in "high" will burn it out.*

Maintenance Checks

The McCulloch boasts its own oil supply and oil pump. Use regular *Type A Transmission Fluid;* never use a cheaper grade. Blowers are more expensive than oil. The capacity is eight ounces, and the dip stick carries maximum and minimum marks. A piston-type oil pump is operated by a camway on the input shaft; a return spring keeps the piston in contact with the cam. Oil is delivered through a drilled passage in the piston to the back of the output shaft. Noise in the blower is definitely a sign of impending trouble. Check the oil level, and change or replenish if necessary.

With the engine running at idle speed, the belt should ride at the bottom of the groove. At 1,500 rpm, the belt

(Continued on page 60)



14 *Top left: use the proper pullers to remove bearings. Protect end of shaft with button in tool kit. Bottom left: input shaft with the two bearings, oil pump, screen, plunger disassembled. Bottom right: use a screw driver to pry out the outer race from housing.*

Ford Maintenance

(Continued from page 58)

bring the level within one half inch of the top of the filler neck. Ford power brakes are a pedal assist type; the power unit is linked mechanically to the brake pedal and assists the driver in applying the brakes. Should the power unit become inoperative, the car still has brakes, although greater pedal pressure will be required for a given application. To insure an adequate vacuum supply under all normal driving conditions, a vacuum reserve tank is mounted on the left front fender apron. Capacity of the tank is such that about three powered brake applications can be made after the engine has stopped.

Clutch Maintenance

The Ford clutch is a semi-centrifugal single dry plate cushion disk type unit on all cars (except Fordomatic), available in 9½, 10, and 11 inch sizes. Adjustments are the same for all Six and Eight cylinder cars. Depress the clutch pedal just enough to take up the free travel and note the reading on a ruler. The difference between this reading and the reading when the pedal is released, is the clutch pedal free travel, which should be 1⅛ to 1⅜ inches. To increase free travel, turn the adjusting nut clockwise on the clutch release lever rod; to reduce free travel, turn the adjusting nut counter-clockwise.

Conventional three speed transmissions are nearly identical for both Thunderbird and passenger car models. It might be pointed out that there are six sets of gear ratios depending upon the engine selected. Overdrive transmissions are identical to the conventional unit with the exception of the overdrive gear train mounted to the rear of the three speed gearbox. The 7/10ths to 1 overdrive will automatically shift from direct to overdrive at road speeds above 28 miles an hour when the overdrive handle is pushed in. As road speed drops below 22 miles per hour, the unit will automatically shift from overdrive to direct free wheeling. The kick-down by accelerator pedal operates at any road speed. Lubrication of the overdrive is done through the transmission case filler plug only. Lubricants are added slowly until they run out the filler plug hole. Conventional cars have a capacity of three pints; T'Bird capacity is 4½ pints.

The Fordomatic automatic transmission offers a wide range of transmission ratios by combining a torque converter and automatic gear system. There is no unusual treatment for the Fordomatic transmission except that it will last longer (as will all automatics) if you wait until the bands lock up before stuffing your foot through the floorboard. Transmission level in the Fordomatic is checked with the engine idling by means of a dip stick on the right side of the car. Ford recommends that the bands be adjusted every 15,000 miles.

Drive Line

The Ford drive line is a Hotchkiss type with a balanced, tapered, tubular shaft and two universal joints. Universals are of the needle bearing type, which only require Ford's recommended repacking at 20,000 mile intervals. The differential is completely new for '57, with the drive pinion mounted 2¼ inches below the center line of the drive gear. All cars and T'Birds require 4½ pints of lubricant, which should be checked only when the axle is warm.

Rear suspension consists of semi-elliptic leaf springs attached through shackles and rubber bushing through the frame side members. Springs are insulated from the rear axle by rubber pads at the spring mountings. Wax impregnated fabric inserts are installed between the spring leaf tips, and should not be lubricated. Rear shock absorbers are attached between the rear spring clip plate and a bracket on the frame cross member. They are non-refillable and non-adjustable.

Lubrication

Ford lubrication recommendations include 1,000 mile chassis lubrications, plus changing the engine oil, oil filter and cleaning the crankcase vent system every 4,000 miles. This latter recommendation is based on normal driving, and cars operated in dusty areas will last longer with more frequent attention. The recommended minimum A.P.I. classification of engine lubricating oil is grade MM for the Six and Eight cylinder engines, with grade MS being required by power option V8's.

Optional equipment for 1957 Fords includes two tremendously powerful V8's, heavy duty extra-capacity springs and shock absorbers, ribbed brake drums for additional cooling, heavy duty batteries, the safety group with padded instrument panel and seat belts, plus generator options for those of you with amateur radio equipment in the car. An extra capacity radiator and high speed fan, heavy duty super-filter air cleaner, and heavy duty transmission complete the list of available options.

Our test car proved itself worthy of the Ford name, and during many miles of rugged mountain driving, a major portion of which was over dirt, conducted itself with all the road handling qualities you would expect from a car costing much more.

Blower Maintenance

(Continued from page 45)

should begin to climb, reaching the top position at 3,500 rpm. Manual operation of the kickdown switch should cause the belt to slip back down between the pulley sheaves (high blower), while release of the switch should bring the belt right up again. If the belt doesn't operate properly, check the solenoid. It should click when the kickdown switch is depressed. The kickdown switch should receive full battery load, not coil current diminished by a resistor. The tensioning arm should not stick at any point of its travel. Pulley sheaves should be shiny, free from gummy deposits that could interfere with belt travel. A belt of improper length could interfere with correct operation.

The rear sheave must be able to slide back and forth without binding. A simple test, with the belt removed is to be able to pull the sheave back against the piston spring tension. It should return snappily when the pull is released. If the sheave works freely and the solenoid clicks when energised, but the blower does not shift, the chances are that there is some leakage in the diaphragm valve, and it should be replaced.

To measure blower output, it's worthwhile to invest in an accurate compound vacuum and pressure gauge with readings from 30 inches to 10 pounds. This gauge can be branched in at the air box. If readings are consistently low and do not show the full five pounds at 3,500 rpm, check for leakage at the flapper valve in the air box and at various seals and gaskets either by feel or by using soap and checking for bubbles.

(Continued on page 62)

Blower

(Continued from page 60)

Malfunction within the blower will call for removal and disassembly. A clogged or dirty air cleaner, however, can acount for a substantial drop in pressure. This can be checked by removing the air cleaner and checking output pressure. If pressure is up, the cleaner is at fault.

Supercharger Overhaul

If, after careful checking, the trouble is found to be within the blower, remove it from the car before attempting to service it. Cleanliness is an absolute must. Any particle of dirt or the slightest knick can mean an expensive failure. The work area must be free of all metal filings and scraps left over from previous jobs.

Rags must not be used to wipe any components. Use a good grade of lint-free industrial wiping paper. In handling the steel balls and races in the impeller drive, do not touch them with the hands. Finger marks will cause the highly-polished surfaces to corrode and pit, and substantially shorten their life.

A supercharger tool kit is available from the Kent Moore Organization, Inc., Warren, Michigan. It is essential for doing any sort of clean work on the blower. The price of the kit is $38.75 for ten tools; disassembly procudures shown here include the use of these factory-prescribed tools.

Disassembly

Remove the dipstick and drain the oil. Remove the scroll chamber cover, after using a scribe to mark matching housings so they can be reassembled in the original position. With the scroll cover off, bolt the impeller holding clamp (in the tool kit) to the housing, and remove the impeller center bolt; then remove the holding clamp. Use the impeller puller to remove the impeller, and remove the impeller spacer.

Turn the assembly over and install on stand (in tool kit). Use the brackets of the stand to clamp down the blower. Use an old fan belt to hold the pulley, and remove the pulley bolt. Remove the splined hub with front sheave, then remove the rear sheave. Take out the circlip from the bearing housing and remove the baffle plate. Then remove the inner circlip while holding down the piston, which is removed next. Remove the inner piston ring and piston spring.

Remove the key from the key way on the input shaft, and take out the bolts holding the bearing housing to the scroll housing (scribe lines in housing so they can be reassembled in original position), then lift off the bearing load assembly. Remove the balls *without handling them with fingers*, and take out the output shaft. The input shaft can then be tapped out from the bearing housing.

The spacer collar is removed next; then use a puller to remove the front bearing. Remove the oil pump screen, plug, spring, plunger and body in that order. Then use the puller to remove the rear input shaft bearing. The next operation can be done without disassembling the blower. Remove the cover plate and spring. Use vice-grip pliers to take out the diaphragm control valve. Remove the two neoprene 0 rings which seal off the diaphragm control valve.

To complete blower disassembly, remove seal in bearing housing and the two 0 rings on the edge of the bearing housing. The front sheave can be separated from the splined sleeve by tapping in the direction of the sleeve. The spacer washer between sleeve and sheave can then be removed. The beveled side of the spacer faces the sheave.

To remove the ball race from the scroll housing, insert a button in the center and pry up the race with a screw driver, using the button as a fulcrum. The ball drive assembly can then be separated from the input shaft.

Clean all parts, *using no rags*, and lay them out on a clean sheet of lint-free paper. Any marks on the ball drive assembly other than normal rolling marks are cause for immediate replacement. Replace all seals with new ones. Have a carefully-cleaned squirt can of Type A Transmission fluid at hand for lubricating parts during reassembly, coating each part liberally.

Assembling The Blower

Install new 0 rings on the outside of the bearing housing, and install new diaphragm control valve 0 rings in the bearing housing. A new input shaft seal is placed in position with the lip facing the bearings. Replace the inner bearing on the input shaft, using bearing inserter tool. Lettering on the bearing must face away from the pump. Replace the oil pump body so the cam-way and inlet port match with the outlet groove and piston of the pump. Press on the outer bearing, using bearing inserter tool. The lettering on the bearing must face away from the pump.

Insert piston, spring and plug in the pump, and replace the pump screen. Check the pump by squirting oil on the screen and rotating the shaft.

Replace the outer race shim and outer race in the scroll housing. Then replace the output shaft, space and slinger, making sure that the gaps on the output shaft sealing rings face in opposite direction. Replace the balls, the spring load assembly, and the input shaft assembly into the bearing housing.

Carefully space the drive balls and insert the bearing housing over the scroll housing. The input shaft must be able to turn freely, and the housings must be carefully squared with each other to avoid damage to 0 rings. Make sure the scribe marks on the housings are lined up. Pressure of the spring load assembly will cause the housings to stand away from each other about a sixteenth of an inch until they are bolted down. Torque these bolts down lightly to 100 pounds-inches (a shade more than eight pounds-feet). Any variation in the torquing will affect the setting of the impeller. Excess torque will snap the cap screws.

Install the diaphragm control valve, spring and cover. The spring is an important electrical connection; don't leave it out. Insert the space collar on the input shaft, making sure it seats against the front bearing. Install the key in the key way. Install the inner piston ring; the lower part of the piston is chamfered and will slide over the ring. Install the piston spring and piston. Hold them down with one hand and insert the circlip back into the bearing housing.

Install the baffle plate and outside circlip. Insert the back sheave and bearing assembly, and the front sheave, making sure the key way and splines register. Install the front pulley bolt and run it down. Then use an old fan belt to hold the pulley while torquing down the bolt to 200 pounds-inches (16½ pounds-feet).

The assembly can be checked by seeing to it that the back sheave slides freely without binding, and that there is no bind in the input shaft when the pulley is turned. Undo the little clamps on the supercharger holding fixture and place the blower on the bench with the pulley facing down.

Install the impeller spacer. Clearance between the diffuser plate (back of scroll housing) and impeller should be between .046 and .051. If you do not have a micrometer depth gauge, use a flat bar and some shim stock. Install the impeller and impeller holding clamp, then install the center bolt and torque down to 200 pounds-inches. Recheck the clearance, using feeler gauges; clearance should still be between .046 and .051 inches. If it isn't, the impeller must be removed and the correct size shim installed, as this impeller clearance is critical. Remove the impeller holder, replace the scroll housing cover, and the job, other than reinstallation on the car, is done.

STOP