94 Questions *and* Answers *about* Chalmers-Detroit Cars

Questions and Answers About Chalmers-Detroit Cars

1—Why difference in design between the two 1909 Models

Ans.—The Forty is a development of three years' satisfactory service upon the market. It is a larger car than the Model F "30" and there are many of the constructions upon the Model F which would be inadvisable to incorporate in the "Forty" for the reasons of the difference in size, power and weight. These differences in construction are explained under various headings below.

2—Matters pertaining to bearings, both annular ball and Timken.

Ans.—Model F. Annular ball bearings are used throughout. The silent type is used in motor and transmission where noise would be a serious factor, and the full type is used in axles and wheels. The annular ball bearing is used universally in motor car construction abroad and is used largely in high priced American cars. The Model F is the first American car at a price below $3,000 to use them throughout.

Model E. Bearings upon the Forty are annular ball upon the cam shaft, plain die-pressed nickel babbitt upon the crank shaft and connecting rods and Timken taper roller throughout transmission, wheels and axles. The Timken roller bearing is an American development. We have used thousands of sets of them during the past seasons and have found them entirely satisfactory for motor car service. We have always used them upon the Forty with the very best results.

3—Ball bearing crank shaft.

Ans.—Ball bearings are used upon many crank shafts both in America and abroad. In America notable examples are Stearns, National, Thomas, etc., Thousands of cars of all horse powers have been produced with this construction. The great factor of safety which we have allowed may be understood when it is known that upon our motor of 3⅞" bore we employ bearings only one or two sizes smaller than those used upon the big Stearns motor having 5⅜" bore. Upon motors of the size of our Model F, 3⅞" x 4½", there can be absolutely no question as to the satisfactory service given by these bearings. We consider 4" bore the limit of motor size for ball bearings on account of sizes and weights.

4—Why are two bearings satisfactory, permissible and advisable upon small motors?

Ans.—The two bearing crank shaft is a new but well-tried feature of the most modern motor car construction. The question of the strength of the shaft is purely one of design and as Mr. Fay, President of the Society of Automobile Engineers, so aptly says in one of his recent articles: "The two bearing crank shaft of to-day is stronger than the three bearing crank shaft of yesterday." In other words, the advance in quality of materials and in features of design have been such as to warrant such construction.

Omission of the middle bearing permits moving the cylinders close together and thus shortening the lost space beneath the bonnet and bringing the two end bearings of the crank shaft so close together as to render the construction perfectly safe and satisfactory. The use of two bearings naturally necessitates a larger crank shaft, but this feature is a desirable one also, in that it enables us to very greatly increase the size of connecting rod bearings upon the shaft. Our connecting rod bearings should not need adjustment once in a season.

The feature of bearing alignment must also be noted. With a three bearing crank shaft the greatest care is necessary to get these bearings absolutely in line. With the two bearing crank shaft mounted upon ball bearings, the slight variations encountered do not affect the construction at all.

Finally and more to the point, the two bearings crank shaft construction is running every day upon hundreds of light cars and cabs, both in America and Europe. It is used upon many of the foreign taxicabs which have been imported into New York city and which are in successful operation in the hardest kind of service every day. It has been used upon the hundreds of taxicabs and small cars turned out at the Thomas plant in Buffalo. It is not in any way an experiment.

5—Why are intake valves in the head and exhaust valves in the side?

Ans.—When valves are placed on opposite sides of the cylinders too great an amount of wall surface is exposed in the combustion chamber tending to allow the heat of combustion to escape through these walls. Valves upon one side of the motor are satisfactory, provided they may be made of sufficient size. But when a motor is decreased in size say from 5″ bore to a 3⅞″ or 4″ bore, it is impossible to use the valves all in a row, either in the head or upon one side and make them as large in proportion as the valves used upon the 5″ bore. The reason for this is that the thickness of the metal walls and the thickness of the water jacket about and between the valves, are fixed quantities, determined by foundry practice. They cannot, therefore, be reduced and hence the valves themselves must be reduced in greater proportion or the valve chest must be made to extend beyond the endwise limits of the cylinder casting.

Again, an exhaust valve in the head is an endless source of trouble, as it must be carried within a cage, the valve seat of which is not directly in contact with the cooling water.

With the valves in a row alongside the cylinder, foundry conditions run up the cost of production to nearly double the figure of that obtained upon our Model F en bloc casting. Therefore, for reasons of economy of production, for the proper carrying of the exhaust valve and in order that we may make both intake and exhaust valves large in diameter, we have placed the intake valve in the center of the cylinder head and have placed the exhaust valve at the side.

This arrangement gives us a water-cooled seat for the exhaust valves of as large a diameter as we desire to use and an intake valve in the head which throws the easiest possible work upon the overhead rocker mechanism. Not only is the inlet valve spring light, but its operation is aided rather than retarded by the action within the cylinder. The disagreeable rattle frequently noticed upon the rocker mechanism of valve-in-the-head motors is always chargeable to the heavy work thrown upon these parts in the operation of the exhaust valve because this exhaust valve is operated not only against heavy tension of the exhaust spring, but must open against from 40 to 50 pounds pressure per square inch encountered within the cylinder at the time of exhaust valve opening.

6—Why are intake valves larger than exhaust valves?

Ans.—It is desirable to get at all times a full charge within the cylinder. As this charge must be sucked in at atmospheric pressure, it is desirable that the resistance encountered en route may be reduced to a minimum. Therefore, we make the inlet valve exceptionally large. Making this valve as large as we do also enables us to give it less lift and consequently we introduce less wear into the rocker arm parts.

Exhaust valve is made smaller as we may easily lift it higher without the introduction of any of the wear incident upon rocker arm parts. Also passage of gas through the exhaust valve is at a considerable pressure and consequently the wire drawing effect is not pronounced, as in the case of the inlet valve where the charge must be drawn through at atmospheric pressure. A good "rule of thumb" for the relation of size of valve to cylinder bore, is to make the valve one-third the diameter of the cylinder. Our valves are considerably larger than the dimensions usually employed.

7—Why do we suspend the body forward of the rear axle?

Ans.—Body is suspended forward of the rear axle, as per practice of carriage manufacturers upon all high grade carriages. Such suspension insures the easiest riding qualities possible.

8—Why do we enclose the clutch within the fly-wheel and fly-wheel housing?

Ans.—Clutch is enclosed within the fly-wheel to economize space and shorten up the power plant unit. There would otherwise be considerable lost space within the fly-wheel housing. This entire clutch and fly-wheel assembly are enclosed with an oil-tight housing, in order that we may supply proper lubrication to the clutch. We also thus insure against any leakage from either the front end of the transmission or the rear end of the motor dripping from the car.

9—Why do we employ a unit power plant?

Ans.—A unit power plant is of great advantage, both in handling in the factory and in the matter of repairs after the car is in service. It is particularly advantageous upon cab and commercial car work, inasmuch as an entire power unit may be substituted upon short notice and with the least possible labor. Freedom from dangers of disalignment of all working parts, under the strains of the road, is the paramount advantage of this construction.

10—Why do we suspend the transmission from the rear of the fly-wheel housing, permitting it to overhang instead of supporting it upon the frame of the car?

Ans.—Our system of suspending the transmission from the rear of the fly-wheel housing insures absolute alignment of the transmission shaft with the crank shaft. It also gives us very nicely a housing for the clutch and fly-wheel parts. It would be very easy for us to throw out two additional arms at the rear end of this transmission case, thus making six supporting arms in all, but we do not deem it necessary as the transmission case and flange are amply strong to carry this comparatively light transmission. Morever, this practice would cause considerably more trouble when removing the transmission. We support the motor independently on the frame so that transmission may be readily removed. Both theory and practice have proven to us that we do not need an additional support for this transmission.

11—Why do we not use radius rods?

Ans.—We have never employed radius rods upon the Thomas-Detroit or the Chalmers-Detroit cars. We are not unique in this. Many American and foreign cars do not use radius rods. One or two of the best foreign cars do not even use a torque tube, preferring to let the springs take both the drive and the torque of the drive. One of the best known American cars following the identical system which we ourselves use is the Stevens-Duryea. They have always used a sleeve propeller shaft without radius rods and have depended upon the springs for taking the drive. There is no experiment whatever in this construction.

12—Why do we not use a torque tube on Model F?

Ans.—The sleeve about the propeller shaft is in reality a torque tube. The tendency of this torque tube is to lift at the forward end under the action of the drive. With the advantage of a five foot leverage between the universal joint and the rear axle very little effort is necessary to hold this sleeved propeller shaft in place at the front end. No strain can be thrown upon it that is greater than these parts have been designed to meet.

13—Why do we use half elliptic springs in front and three-quarter elliptic springs in the rear?

Ans.—Half elliptic springs are used in front in accordance with the most accepted practice of motor car construction. These half elliptic springs give an ample spring effect for the front end of the car and are anchored rigidly enough side-wise so that the best steering effect may be had. Upon many cars it will be noted that the front springs are so hung that their action upon the road tends to lengthen and shorten the distance between the axle and the steering gear, with the result that the wheels swing to the right and left bodily upon an uneven surface, causing irregular steering and excessive tire wear. We have avoided any such trouble.

Three-quarter elliptic springs are used by preference in the rear as they combine the easy riding advantages of the full elliptic with the rigidity of anchorage sidewise of the half elliptic. In other words, they give the maximum of easy riding qualities with the minimum of side sway and rock. The three-quarter elliptic is the equivalent of a very long half elliptic.

14—Why do we make all the brakes so much bigger than those hitherto used upon other cars in this class?

Ans.—In our estimation, American cars have been sadly deficient in braking qualities. Many accidents have been traceable in the past to this deficiency. We have attempted to absolutely assure to the operator that he may be able to stop his machine at any time or place, suddenly or gradually, upon any grade. Compare our brakes with those to be found upon other cars.

15—Why do we make our wheels so heavy in comparison with other cars of this size, price and power?

Ans.—More or less wheel trouble is sure to be experienced where size of spokes has been sacrificed in an effort to obtain lightness. Both hub flanges and spokes upon the Chalmers-Detroit are as large as those employed upon the average American car of from 50% to 100% greater weight. It is an insurance we give our customers that they cannot dish a wheel when taking a corner at high speed. Nine-tenths of American low-priced car makers have had wheel trouble. In the Jericho Sweepstakes on Long Island Motor Parkway, where our "30" won both first and second place in record time, one of our competitors was put out of the race on account of three broken wheels.

16—Why do we use a swinging foot throttle?

Ans.—Swinging foot throttle enables the operator to maintain a uniform carburetor opening even upon a rough road. Moreover, he can retain this condition without the tiring of the ankle, so noticeable upon the ordinary lever or push button type of throttle. With these latter types it is necessary to hold the ball of the foot in a certain position and depend upon the action of the muscles to do it. It is well known that this is an impossibility upon a rough road and it is extremely tiring in a long drive.

17—Why do we place both clutch and running brake control upon the same pedal?

Ans.—Both clutch and brake pedal have been attached to one foot lever in order that we may simplify the operation of the car, particularly for ladies. The control of the car is by this system vested in one foot, leaving the other free for the operation of the throttle. A few minutes' operation of the car will accustom the driver to this arrangement and we have yet to find an operator who does not like it immensely after having tried it a few times. Even for the beginner, the only possibility of trouble is that the brake may be applied by pushing out the pedal further than may be necessary in relieving the clutch. We believe this system has simplification that is desirable for a car of this size and power.

18—Why do we use a floating type of rear axle?

Ans.—Floating type of rear axle is an ideal construction for a car of this size. Bearings, hubs and other parts are not of abnormal proportions because of the comparatively small driving shafts which we are able to use. A full floating type of axle upon a car of large horse power is a considerably heavier axle than is the semi-floating type such as we are using upon the Forty. We desire at all times to insure against tire wear, so keep all dead weight possible off of rear axle. This is our reason for the use of the semi-floating type on the "40."

19—Why do we use a frame of the same section and strength upon the $1,500 car as upon the $2,750 car?

Ans.—There is only 2 in. difference in the length of wheel base upon the Models E and F. In view of the fact that a great many of the Model F chassis will be used for closed car work, we have considered it advisable to use the same channel section upon the F frame as upon the Model E. This is a stronger frame than is necessary for touring car work, but we believe it is money well spent.

20—Why do we place the safety "horse-shoe" upon the middle cross member in such a way as to encircle the driving shaft and sleeve?

Ans.—Safety "horse-shoe" is fitted to the Model F about the driving shaft sleeve in such a way that this sleeve cannot drop down into the road, even were the driving shaft to break. We have never known one of them to break but prefer to apply this safety device as an insurance against any possible accident at this point.

21—Why are valves with nickel steel heads necessary for exhaust valves?

Ans.—Nickel steel heads are used upon valves, both upon the Forty and the Thirty. Nickel steel offers a resistance to pitting and corrosion not found in ordinary carbon steels. Carbon steel valve stems are welded to these nickel steel heads in accordance with best practice in this work.

22—Why do we place an extra pin through the inlet valve stems?

Ans.—Cotter pin is inserted through inlet valve stem below locking device as a safety against the possibility of any one of these inlet valves being dropped into the cylinders, even though the spring spool might become loosened or the valve stem broken where recessed for the split washer. Possibility of such an accident is remote, but we prefer to insure against damage to the motor in any event.

23—Why do we place a check-valve in the oil pipe leading from the oil tank to the oil pump on the Model F?

Ans.—A check valve is used in the suction oil pipe of motor in order that the oil pump may be kept primed. If this oil pump does not force oil through the sight feed it will be because the intake pipe or screen is clogged with dirt and needs cleaning.

24—Why do we place the oil pump in an inaccessible position within the fly-wheel case?

Ans.—Since the oil pump consists merely of two gears meshing together, there is nothing about it which can possibly get out of order. Placing it as we do within the fly-wheel case and bolting it against the rear cam shaft bearing, we have no need for stuffing boxes. All leakage from this pump must be through the rear cam shaft bearing and will be caught within the crank case of the motor. There will be no occasion for removing this oil pump.

25—How do we strain the oil before it reaches this pump?

Ans.—Oil from the crank case is strained through a circular screen of fine mesh placed about the suction oil pipe. This screen may be removed for cleaning through a plug in the bottom of the oil tank.

26—How do we clean out this pump if it should ever be desirable?

Ans.—Pump may be cleaned without removing from the case by disconnecting the inlet and outlet union and flushing pump out with gasolene.

27—Where do we look for trouble in case the flow of oil through the sight feed glass on the dash is not sufficient?

Ans.—Stoppage of the flow of oil in the sight feed will be due either to the clogging with dirt of the oil screen or suction pipe, or may be traced to a leaky union in the suction pipe. Be sure that unions are tight. Drain out old oil from the tank and clean the oil screen about every 500 miles of running. Refill with fresh oil. It may sometimes be necessary after cleaning to prime the pump with oil can after having loosened top union.

28—How much oil should be kept flowing through this glass?

Ans.—A steady stream of oil should show in the sight feed glass. If air bubbles are in evidence, it is caused by leaks in the suction pipe and the unions should be tightened up.

If the oil flows merely a few drops at a time, it is because the screen and suction pipe are becoming clogged with dirt. They should then be cleaned.

29—How can we remove the transmission and clutch?

Ans.—Clutch and transmission are assembled together in one unit. To remove from the motor:

First: Unbolt the flanged portion of the universal joint from the back of the brake drum.

Second: Disconnect the links between the gear shift mechanism and the gear shift slide rods of the transmission.

Third: Remove the eight cap screws which hold the transmission flange against the fly-wheel housing. These bolts should be removed beginning with those at the bottom. In this way the transmission case will be retained in position until the last two bolts are removed at the top. Transmission may then be pulled back and dropped out of car. In reassembling be sure that the three driving studs are inserted through the holes in all of the copper plates. It will frequently facilitate reassembling to throw the clutch in and out, as the plates are being slipped over the studs.

30—How can we adjust the clutch if it should need attention?

Ans.—Clutch may be adjusted without removal from the car. Remove the hand-hole cover upon the slanting portion of the case and the three clutch springs and their adjustment will be exposed to view. Care should be taken to tighten these springs, equally, if at all. Whether the clutch slips or sticks, the addition of a little kerosene to the contents of the fly-wheel case will remedy the trouble.

31—What kind of oil do we use in the fly-wheel case to keep the clutch operating smoothly and without jerk?

Ans.—Lubricating oil may be used in this clutch compartment. It will usually be found advisable to add a little kerosene, particularly if the clutch does not operate smoothly.

32—What is to be done should the clutch stick or take hold too quickly?

Ans.—Add a little kerosene. The lubricant should stand at least two or three inches deep in the case.

33—What is to be done should the clutch slip?

Ans.—Add kerosene to the clutch case contents. One prominent manufacturer using a disc clutch, recommends a mixture of two-thirds kerosene and one-third lubricating oil. The proper mixture is frequently dependent upon the condition of the plates and consequently the operator should satisfy himself as to the best proportion of kerosene and lubricating oil to be used in his case.

34—Is there a gasolene strainer and settling basin in the gasolene pipe line?

Ans.—A combined gasolene strainer and settling basin is screwed into the gasolene tank. The strainer may be removed by removing the 1 in. pipe plug into which drain cock is screwed. This drain cock may be opened occasionally to allow any water to escape which may have accumulated in this settling basin. Pipe plug itself may be removed when it is desired to drain the tank quickly.

35—Why do we water-jacket the carburetor and when should this water be shut off?

Ans.—The water-jacketing of the carburetor insures at all times a more uniform mixture and a better vaporization of the fuel. This water should be closed off in hot weather, as it may be found that the motor during a hard run will begin to "spit back" through the carburetor. The cause of this is that the temperature may become high enough to vaporize the gasolene so rapidly within the float chamber as to interfere with the proper supply of liquid fuel at the spray nozzle.

36—Why do we cast the intake pipe as a part of the cylinder water-jacket cover?

Ans.—We often hear the expression that when a car has been left standing with the motor running for some little time, the carburetor "loads up." In other words, the particles of liquid gasolene condense or deposit upon the walls of the intake pipe and when the throttle is opened suddenly this liquid gasolene rushes into the cylinders with the result that the motor is stalled by the over rich mixture. With our intake pipe cast as a part of the water jacket cover, it is impossible to experience this loading up trouble. The hot water within the cylinder jackets is closely in touch with this intake pipe and keeps the gasolene within this pipe properly vaporized.

37—How often should valves be ground?

Ans.—Valves should be ground whenever lack of compression is noted in the motor. Nine times out of ten, leakage at the valves is responsible for weak compression. Ninety-nine times out of a hundred, it is the exhaust valves rather than the intake valves.

38—How often should valve timing be inspected?

Ans.—Valve timing should be checked up whenever valves are ground. Any serious irregularity in valve timing may usually be detected by the running of the motor or by the noise of the exhaust. A good rule might be to inspect this valve timing about once a month.

39—How can we see the fly-wheel in order to locate marks showing dead center and valve timing on Model F?

Ans.—The valve time will be found stamped upon the rim of the fly-wheel, together with dead center marks. The removal of the large plug upon the top of the fly-wheel case will enable the operator to see this marking.

40—What is the principal cause of breakage upon automobile springs?

Ans.—Principal cause of breakage upon motor car springs is the insecure anchorage of these springs upon the pads.

41—How do we insure against this breakage?

Ans.—We insure against such spring breakage by the use of extremely heavy clips, these clips are 9-16 in. in diameter and fitted with special ¾ in. nuts and lock washers.

42—How often should spring clips be tightened up?

Ans.—These spring clip nuts should be tested about once every thirty days to make sure that they are absolutely tight.

43—If springs are stiff and car rides hard, what should be done?

Ans.—Springs upon a new car are always much stiffer and much harder riding than after some use upon the road. If springs continue to ride hard, loosen up the clips, spread the leaves apart with a screw driver and lubricate thoroughly between them with an oil can and a thin mixture of oil and graphite. Tighten down spring clips hard when finished. Also if springs ride hard and the loads to be carried are light, a leaf may be removed from each spring.

44—How are rear wheel brakes to be adjusted?

Ans.—Rear wheel brakes may be adjusted by removing the clevis pins from the front or rear end of the side brake pull rods and by screwing these clevises in or out a few threads upon these pull rods. Pins may then be replaced and jamb nuts tightened up.

45—How is transmission or running brake to be adjusted?

Ans.—Transmission or running brake may be adjusted by taking up or slacking away a few turns upon the hand grip beneath the foot board. This brake should be adjusted loosely enough so that ample movement is had between the time of the throwing out of the clutch and the setting up of this brake band on Model F.

46—Why is it necessary to put oil into the crank case at only one point?

Ans.—We have found by experience that if oil is put into the crank case at any point, the action of the crank shaft and connecting rod ends, will churn this oil into a mist, which is distributed evenly throughout the case.

47—Why should this oil be put into the crank case near the front end of the case?

Ans.—Oil is put into the crank case near the forward end in order that in the ascent of a long hill there may be no possibility of lack of lubrication at the front end of the motor. When running down hill the motor is doing little or no work.

48—Why does the motor sometimes "spit back" through the carburetor causing a coughing sound?

Ans.—Should the motor "spit back" through the carburetor, you may be certain that the mixture is too weak. This may be occasioned by a too little opening of the needle valve at the carburetor, to a clogging of dirt in the gasolene connections, to the closing of the shut-off valve beneath the gasolene tank, or too much hot water in the carburetor water jacket. The remedy in the latter case will be to shut off the water circulation through the jacket. The presence of water in a poor grade of gasolene will have this same effect.

49—What lubricant is best for front and rear wheel bearings?

Ans.—Proper lubricant for any wheel bearing is a grease which contains no acid. Arctic grease No. 3 is very good. The lubricants manufactured by the New York & New Jersey Lubricant Co., known as "Non-Fluid Oils," are also very satisfactory.

50—How often should wheel bearings be inspected and lubricated?

Ans.—Wheel bearings should be inspected and lubricated once for each thirty days in average service. Bearings should be kept thoroughly packed with grease and thin oil should be added occasionally through the oil cups in the hubs.

51—How often should gear housings upon the rear axle and transmission case be packed in grease and what grade of lubricant should be used?

Ans.—Gear housing upon rear axle should be packed in Arctic grease. Transmission case may be packed in a mixture of grease and heavy steam engine cylinder oil, or in cold weather this steam engine cylinder oil may be used exclusively. Both rear axle and transmission should be inspected as to lubricant once for every thirty days of average service and oftener if the car is used continuously.

52—How often should spring eyes be oiled?

Ans.—Spring eyes should be oiled every day.

53—How often should oil be put into the motor?

Ans.—Old oil should be drained out and new oil supplied in the motor crank case and oil tanks once for each 500 miles of road service, and the level should not be allowed to remain lower than the bottom try cock. Occasionally with drains open flush out the motor with kerosene.

54—How often should oil be put into the clutch and fly-wheel housing?

Ans.—Old oil should be drained out of the clutch and fly-wheel housing and fresh oil supplied about once for each 500 miles.

55—Why do we use a Stanwood steel step instead of a wooden board and mat?

Ans.—The Stanwood step has been proven to be a very satisfactory construction of running board. We used it exclusively in '07 and upon all runabouts in '08. It is also used by the Peerless Co. It is lighter and more cleanly than is a wooden board and mat, and does not give as much trouble warping. Our agents are divided in their preference of styles, wood and metal.

56—Why do we carry the front axle a little ahead of the radiator?

Ans.—Front axle is carried well forward of the radiator not only as a matter of up-to-date design, but as an aid to easy steering and easy riding qualities. It is entirely out of date in motor car design to project a bonnet forward of this front axle. Cross rod carried behind axle for protection of this part of the steering gear.

57—Why do we use 3½ x 32 Q. D. Diamond tires?

Ans.—3½ x 32 Q. D. Diamond tires are guaranteed for service upon a car which scales, in an empty condition, 550 pounds per wheel or 2,200 pounds in total. The Model F weighs in this condition about 2,150 pounds. Diamond tires are well known as first class tires.

58—Are not these tires more expensive than the clincher type?

Ans.—A Q. D. tire is more expensive than the clincher type but we have adopted them as being the best and consequently in keeping with the other features of this car.

59—Why do we carry the rear mud-guard so high above the wheel, necessitating the cutting away of the body?

Ans.—Rear mud-guards are carried higher than ordinarily above the rear wheels in order that ample tire chain clearance may be allowed, even when the car is heavily loaded. Insufficient clearance is a very common source of trouble on other cars.

60—Why do we drop the front end of the front mud-guard?

Ans.—Front end of the front mud-guard is dropped downward in order that it may catch the soft mud thrown forward by the front wheels. At high speed and with a mud-guard of ordinary shape, this mud is blown back into the face of the operator.

61—Why do we use the single bolt locking device for attaching mud-guards to running boards?

Ans.—It has taken us two years to develop an absolutely satisfactory system of attaching mud-guards to the running board. We believe our present system of a single bolt to be the best in the country. It is free from rattle, it is easily removed and replaced without the necessity of taking out a large number of screws, small bolts, etc., as upon the usual construction at this point.

62—Why do we use drop-forgings throughout the car?

Ans.—Drop forgings are more dependable than castings, are more easily machined, are easier on tools and are just as cheap as castings when purchased in such quantities as upon this car.

63—Why do we support the radiator in a flexible manner?

Ans.—Radiator is so supported as to protect it from the strains set up within the frame by uneven road conditions.

64—Why do we urge magneto equipment upon all machines?

Ans.—Upon magneto ignition we never hear a single complaint. When a car leaves our factory thus equipped we are sure that there will never be ignition trouble upon it. The magneto spark is much more intense than that obtained by storage battery and spark coil. Moreover, this spark becomes stronger and stronger as the motor is speeded up. It is this feature that enables us, where desired, to equip a car with fixed ignition. The timing of the spark obtained by the use of magneto is much more accurate. The magneto is a self-contained source of spark generation and needs no attention other than slight lubrication from one end of the season to the other. We do not, however, put on other than the best magneto.

65—Why do we urge gas tank equipment instead of a gas generator?

Ans.—Gas tank equipment for the acetylene lamps is a much cleaner and neater proposition than is the ordinary generator. The gas tank is now coming into such general use that this equipment may be obtained or exchanged at almost any garage.

66—Why do we furnish adjustable acetylene lamp brackets?

Ans.—Acetylene lamp brackets are made adjustable in order that any width of lamp within reasonable dimensions may be accommodated. The matter of adjustment as to the direction of the light by the reflector may also be changed.

67—Why do we drill as few holes as possible through our frames?

Ans.—Every time a hole is drilled in the frame, the frame is necessarily weakened at that point. We use a specially heavy frame (same weight frame upon the "30" as upon the Forty) and drill all holes of any size as near the center of the verticle web of the frame as possible. This brings these holes in the neutral axis where they do the least possible damage.

68—Why do we attach our rear lights (upon the Model F) so much higher above the road than usual practice?

Ans.—Lamps are attached to the rear mud guard, or as high as may be possible above the road, in order that they may be free from the dust and mud which tends to settle upon them. Also in this position the lamps are better protected from the rush of air caused by the speed of the car.

69—Where do we recommend attaching the license number?

Ans.—License tag upon the Model F touring car may be attached just beneath the projection of the seat at the rear. This will place it in such position that the rays of the light from the lamp will fall upon it.

70—Is there any reason why the operator's left foot should not rest at all times upon the combined clutch and brake pedal of the Model F?

Ans.—No. This clutch throw-out mechanism runs at all times in an oil bath, and the slight pressure of the foot upon the pedal, while unnecessary, will not seriously wear any of the parts.

71—Why do we fill in between the main frame and sub-frame with sheet metal and supply the detachable sod-pan between the sub-frames when the entire power plant is itself an enclosed unit and well protected from dirt and dust?

Ans.—The Chalmers-Detroit cars, both "30" and "40" are the most thoroughly protected from the dirt, sand and mud of the road of any machines upon the market. This dust-proofing construction is clean-cut and the removable portions of the simplest possible design. The method of attachment is patented. Even upon the "30," where the power plant is a self-contained one, we add this dust-pan construction in order that the entire power plant may be kept clean.

72—Why do we attach the gasolene tank to the body in the case of the Model F and to the frame in the case of the Forty?

Ans.—This is largely a matter of convenience and in accordance with our system of manufacture upon these two cars. In either case particular care is used that there may be no possibility of leakage due to strain at any point. All rivet heads in the sides and bottoms of these gasolene tanks should be found capped, so that even if rivets loosened up leakage would not be possible.

73—What kind of cam shaft gears do we use?

Ans.—Cam shaft gears have an all fibre face. In three years' use we have found this construction the most quiet in operation and the most generally satisfactory. The grade of fibre which we use and the methods of manufacture which we employ insure that these gears will not be affected by the hot oil with which they come in contact.

74—What pitch are these cam shaft gears?

Ans.—10 pitch upon the "30" and 8 pitch upon the "40."

75—Is not an all-fibre gear affected by warm oil?

Ans.—Not one made of the proper material and of proper construction.

76—Have not annular ball bearings of American manufacture given a good deal of trouble in the past and how do we prevent such possibility?

Ans.—Yes, but all bearings which we are now using are not second in quality to any imported bearings. We have followed the construction and treatment of these bearings through from start to finish, have our own inspectors at work upon them and know exactly as to the quality of this material.

77—Can we turn our '09 cars within a small radius?

Ans.—Yes. The turning radius has been considerably decreased upon the '09 Forty, and the "30" may be turned in any ordinary size street.

78—Is there a good deal of wear and consequent noise in overhead valve mechanism and how do we prevent it?

Ans.—Wear and noise in overhead valve mechanism has been chargeable principally to exhaust valves of this construction. We do not place the exhaust valves in the head. Our exhaust valves are operated by the direct system almost universally employed. In the operation of the intake valve the work thrown upon the rocker mechanism is so slight as to be almost negligible. The employment of a large intake valve also cuts down the work upon these parts. This intake valve is opened against a tension of a fairly weak spring (only 30 pounds) and at a time when there is a suction instead of a pressure within the cylinder. This operation is therefore very easy when compared with the exhaust valve which is operated not only against a stiff spring tension (40 to 50 pounds) but also against a pressure within the cylinder at the end of the working stroke of possibly 50 pounds per square inch. Trouble will be impossible with a rocker mechanism in connection with the intake valve.

79—Is it not necessary to replace all four cylinders should even one of these cylinders become damaged?

Ans.—Yes, but the cost of replacing the four is about the same as replacing the single cylinder of any other maker. It is certainly less than the replacement of twin cylinders upon any car of which we know.

80—How much would it cost the user to replace the entire set of four cylinders?

Ans.—Only $35. The repair parts list of any other maker will show a replacement of about $30 for a single cylinder and of from $50 to $100 upon twin cylinders.

81—If the water within the water jacket and radiator does not get hot and boil upon the road, why is it that the motor will sometimes continue to fire for a few revolutions after the spark has been shut off?

Ans.—This is an indication either that there are some carbon deposits within the cylinder, the particles of which become incandescent, or that there are some sharp metallic points or edges which become so highly heated as to retain sufficient heat to fire the charge when compressed. A little investigation will show whether or not carbon exists. Two or three spoonsful of kerosene if introduced into the motor while still hot at the end of a run and allowed to stand over night, will usually loosen up the carbon. Any sharp metallic points may usually be removed with a file or a cold chisel.

82—Why do we not make the body bigger upon the "30"?

Ans.—Ample seating space for five people is provided. We desire to keep this car as light as possible, consequently do not add weight at any unnecessary points. The various parts of the running gear and all critical points of our construction throughout are much heavier than usually employed upon a low priced car. We are averse, therefore, to adding weight unnecessarily in the body where it will do us no good insofar as the comfort of the occupants may be concerned.

83—Why do we use a 55 in. tread upon all models instead of the so-called standard of 56½ in.

Ans.—A 55 in. tread is exactly the right tread to use with a 4 in. or 3½ in. tire. With this tread a 4 in. tire will chafe neither upon the inside nor upon the outside when driven in the ruts of the country road. Many of the cars made in America use a 54 in. tread. With this dimension the inside of a 4 in. tire will chafe upon the inside of the average country road wagon rut. Many other cars employ a 56½ in. tread and with this dimension the tires are very apt to chafe upon the outside. We believe that the 55 in. dimension is the proper one and it has been used by several makers who have turned out the greatest quantity of machines since the beginning of the industry.

84—Why do we use single piece drop forged front axles instead of tubular axles?

Ans.—The single piece drop forged front axle is the highest development of front axle construction. We believe that only one high class American car employs a tubular axle and upon this machine (the Packard) the tubing is made so large as to be of extraordinary strength. The Packard axle is not in any way comparable to the ordinary tubular front axle, such as is used under low priced cars. The fact that every maker in his advertising matter makes particular point of the statement that he uses a drop forged I beam front axle is proof enough of the excellence which is considered as pertaining to this style of construction. Many I beam front axles are welded in the center, but upon the Chalmers-Detroit Model F the I beam front axle is not only a drop forging, but is a drop forging in one single piece. This, of course, necessitates great expense of dies, but it is the best that can be had.

85—Why do we use ball bearings upon the front wheels of the "30" instead of roller bearings?

Ans.—Although annular ball bearings are used exclusively upon all foreign cars as front wheel bearings, we are not in favor of this form of construction upon any car weighing over 2,500 pounds. Consequently we use Timken taper roller bearings upon the front wheels of the Forty. But we have no hesitancy, whatever, in using annular ball bearings upon the front wheels of the "30." We have made these bearings of ample size and know that they will do the work required of them. We have yet to hear of a single complaint upon this construction upon this car. As stated above, this construction is old for front wheel work, it being used upon practically every foreign car that has been built for several years past.

86—Directions as to how to disassemble, assemble and adjust all parts will be found in the Instruction Book.

87—Why do we place the cut-out at the back of the muffler, instead of in the exhaust pipe forward of the muffler?

Ans.—Muffler cut-out is placed at the rear of the muffler in order that we may obtain the results for which the muffler is intended, namely: the relief of all back pressure upon the exhaust without the attendant noise which is so disagreeably noticeable when a cut-out is situated in front of the muffler. It has been our aim to keep these cars as quiet as possible at all times, consequently we have supplied a muffler which will at all times release the back pressure just as effectually as will one at the front of the muffler, and yet will not sound like a Gatling gun let loose upon the city street.

88—Why do we not use copper water-jackets?

Ans.—Copper water jackets have been discarded by all manufacturers of first class cars. Not only is this construction a more expensive one, but it is one that is much more apt to give trouble from water leaks. Moreover, the copper water jacketing can only be done to good advantage upon motors employing the separate cylinder construction, which leads into a multiplicity of water connections, joints, gaskets and pieces of hose. We believe that not a single well known high priced car, either foreign or American, employs copper water jackets.

89—What will cause a motor to sometimes heat up?

Ans.—A motor is frequently caused to overheat on account of a slipping clutch. Slippage of clutch upon the Model F may be stopped by the addition of a half pint of kerosene to the clutch compartment. It is sometimes advisable to draw out old oil and replace with fresh gas engine oil mixed with kerosene. In any event, whether the clutch shows a tendency to stick or whether it shows a tendency to slip, addition of kerosene will remedy it.

Overheating of a motor may be caused by running with an open throttle and a retarded spark. The spark lever should be kept well up on the quadrant—experience will soon dictate at what point it can be carried without causing the motor to knock. It is also much more economical in fuel consumption to carry this spark lever well up.

The slope of fan blades or a slipping fan belt may sometimes cause the water to overheat in the radiator. These items should be checked up when looking for trouble of this kind.

Carburetor adjustment is frequently responsible for the heating of the motor. If black smoke can be detected at the exhaust, the mixture is too rich. If the motor fires back through the carburetor at high speed or when the throttle is opened suddenly, the mixture is too light.

Inspect all water passages, making sure that the gaskets at flange joints have not swollen in such a way as to cut down the effective opening. Use only the very highest grade gas engine oil in motor. It is always cheaper in the end. We recommended "A" Mobile oil.

90—Why do we not use two bearing crank shaft construction on the Forty?

Ans.—A two bearing crank shaft construction is advisable only upon small motors, say of 4 in. bore or under. Upon motors of larger size, such as our Forty, the parts would have to be so proportioned as to be extremely heavy. Also, inasmuch as it is not advisable to cast en bloc cylinders in such large size as is used upon the Forty, we would not be able to set these cylinders close enough together to shorten up our crank shaft in proportion to the shaft used upon the Model F. Briefly, therefore two bearing crank shaft is an entirely desirable construction when used upon a small motor where cylinders may be cast en bloc, thus giving the shortest possible distance between the crank shaft main bearings.

91—Why do we not use the Forty cylinders en bloc?

Ans.—Because, we might build a double barrelled shot gun is no reason why we should construct a twin 13" gun. Cylinders cast en bloc have been used upon several well known cars as large in bore as 5 in. or even 5½ in. We do not favor this construction as a casting of this size becomes unwieldly in the shop and has no particular advantage over the twin cylinder construction where a three bearing shaft is to be used.

92—Why do we not use annular ball bearings upon the crank shaft of the Forty?

Ans.—We have set a limit of 4 in. in cylinder bore as the largest motor which can with entire success be equipped with a ball bearing crank shaft. We have arrived at this conclusion not from our own experience, but have taken the statements and recommendations of some of the best of foreign engineers. These men have had under their observation for several years the motors of such concerns as the Hotchkiss, Mercedes and many others, and we have in our files in this office data over the signature of one of the best known English engineers in which 100 m. m. (approximately 4 in.) is set as the maximum limit of cylinder size in connection with which annular ball bearing crank shaft may be used with entire satisfaction and success. Consequently we use plain bearings upon our forty horse motor. We at one time made all arrangements to equip this motor with ball bearings for the 1909 season, but discarded the idea upon receipt of definite data from abroad.

93—Why do we not use a governor?

Ans.—A governor is an unnecessary complication upon any motor such as ordinarily employed in a motor car. A governor is necessary upon a big power unit such as is used in stationary practice where any racing of the motor, occasioned by the sudden throwing off of the load, might tend to break the fly-wheel or do other damage. For instance, in a big power plant where the engines are scheduled to turn over from 150 to 300 turns per minute, a governor is necessary for the closest regulation of the speed at which the work (driving electrical equipment, etc.) must be done. With the small power units employed in motor car practice, a governor is an absolutely unnecessary piece of complication. Six or eight years ago in the infancy of the industry almost all makers started in to equip their cars with governors. It was found unnecessary and an additional source of trouble and vexation to the operator. As a result, governors have been dropped almost entirely. A few of the larger cars are still equipped with them, but every effort has been made to remove all complications and to make the cars as nearly fool-proof as possible. A governor is out of place upon any small or medium size machine.

94—Why do we not put both brakes upon the rear hubs, using two internal or one external and one internal?

Ans.—A good deal of discussion has been brought to our attention of late and we have heard a good many arguments pro and con as to whether all the brakes of a car should be placed upon the rear wheels or whether one efficient brake should be placed upon the rear wheels and the other brake upon the drive shaft. Before going into our own ideas in this matter, let us make a statement which we believe to be the truth. Every car of prominence built in England, France, Germany and Italy (all countries which we must acknowledge as widely experienced in motor car construction) is equipped with one set of brakes either upon the drive shaft, if the car be a bevel gear drive, or upon the jack-shaft, if the car be a side chain drive vehicle. Moreover, this set of brakes is almost without exception made the foot brake, the one most used in the ordinary operation of the machine. The rear wheel brakes are almost without exception utilized as the emergency brake and are connected to the hand lever at the side of the car.

Now, we do not for a moment believe that this arrangement is the result of accident or chance, and as only some few of the American builders can but now begin to feel upon an even footing with these foreign manufacturers, it is perhaps very logical that we assume that this almost universal brake arrangement has been arrived at after some exhaustive experience and that it is backed up by sound reason. Permit us, however, to give our own ideas briefly as to the proper brake construction.

We prefer the foot or regular running brake to be placed upon the drive shaft of the car and to be an external contracting band of wide face. The emergency brake we place as an internal expanding band upon the drums of the rear wheels, thoroughly dust-protected. The advantages of the drive shaft brake are the following.

First: It can be made an external contracting band and yet be thoroughly protected from the dust, grit and mud of the road by the apron of the car.

Second: The effort of this brake is multiplied through the bevel gear reduction of the rear axle in such a way as to require very small labor by the foot in applying it.

Third: This brake operating through the balance gear of the gear axle as it does, insures absolutely an equally retarding action upon each wheel just as certainly as does the drive of the motor exert an equally strong accelerating motion in the forward direction upon each wheel.

Fourth: A saving in weight is made by the use of the drive shaft brake. For instance, upon the Chalmers-Detroit Forty a drive shaft brake of 10 in. diameter and 3 in. face is used. Were we to use a 2 to 1 gear ratio in our rear axles, it is clear that the action of this one drive shaft brake would be exactly equivalent to the combined effect of a brake of 10 in. in diameter by 3 in. face placed upon each wheel. With a 4 to 1 gear reduction in the rear axle, the effect of the one drive shaft brake would be equal to two such brakes upon each wheel, or as multiplied four times in retarding effect.

Fifth: We often hear the argument against the drive shaft brake that the braking through the gearing of the rear axle is hard upon the axle. With this we cannot agree. Granted that an axle is properly constructed in the first place to withstand the accelerating influence of the motor, it will certainly be of ample strength to stand the retarding influence of this brake. As a matter of fact it can be readily proven and has been proven by us that the braking strain cannot at any time amount to as much as does the force of acceleration due to the letting in of the clutch quickly and putting the car under way rapidly. Therefore, we may take it for granted that there is no objection in the matter of undue strain upon the rear axle.

Sixth: Any objection which can be urged against the drive shaft type of brake upon the standpoint of the burning out of the brake lining, must be based necessarily upon the character of that lining itself. This is a serious item in hilly countries, but if either "Thermoid" or "Raybestos" linings are used, this objection immediately disappears.

Seventh: The matter of adjustment upon the drive shaft brake is one of much greater ease than upon a rear wheel brake and this adjustment owing to the differential gear of the rear axle, must necessarily at all times be an adjustment which will exert an equal retarding force upon each wheel. In other words, you have not the problem of adjusting a brake upon each wheel in such a way as to get an equal braking effect; to say nothing of the inaccessibility of the rear wheel brakes as compared with the ease of adjustment of the drive shaft brake where this adjustment is arranged as upon such a car as the Chalmers-Detroit Forty.

Now, let us look for a moment at the other types of brakes.

The best American practice has followed the foreign practice of making the internal expanding brake upon the rear wheels the emergency brake connected to the hand lever at the side of the car. Inasmuch as this brake is present in any event, we may pass it by with the statement merely that it should be equipped with a dirt protecting cover and that it must be of ample proportions to bring the car to a halt in any emergency. This brake being placed upon the hand lever and used infrequently, is much more apt to be at all times in good adjustment than is any other brake upon the machine. It is therefore entirely logical that the emergency brake should be the brake upon the hand lever and that it should be given surface enough to bring the machine to a sudden stop.

Let us glance, however, for a moment at the external contracting band brake upon the rear wheel. The usual construction employed as a foot brake where double brakes are used upon the rear wheels, is the externally contracting band for operation by the foot and the internally expanding brake within the drums attached to the hand lever as an emergency appliance. We do not advocate this construction for the following reasons:

First: One of the most serious problems in the matter of expense of up-keep that the motor car owner has to face, is the item of tire wear. It is clear that all weight added to the axles or wheels of the machine below the springs is a dead load, and is many times more serious from a tire standpoint than would be an equal load applied above the springs. The addition of a double braking system to the rear axles cannot but increase this rear axle weight, and even a slight increase in this weight must show up serious results during thousands of miles over the road. We attribute the absence of tire trouble upon the Chalmers-Detroit Forty during the '07 and '08 seasons to the fact that we have avoided all dead axle weight possible.

Second: The externally contracting band upon the rear wheels is necessarily exposed to the weather, to the sand and mud, and must necessarily need frequent adjustment and frequent relining upon this account. Upon the 1907 Buffalo-Thomas car an externally contracting foot brake was used upon the rear wheel drums. This construction was extremely unsatisfactory and unsuccessful, as any Thomas representative will tell you. We will admit that several very good American builders equip with an external contracting band brake upon the rear wheels, but this fact does not make the construction right.

Third: As a matter of adjustment, it is practically impossible to get the rear wheel brakes to act uniformly when service or running brakes are upon the rear wheels. Even though an equalizing device may be employed for the application of these brakes, yet their uniformity of operation depends entirely upon the condition of the friction surfaces. A little oil, moisture or sand upon one of them may still cause this brake to behave differently than that upon the other wheel, although the effort of application may be exactly balanced. One or two of the most serious accidents that have occurred in road racing has been charged to the unequal operation of the brakes upon the rear wheels, causing the car to swerve off the road when at high speed.

Fourth: The use of a double braking system upon the rear wheels entails the application of many small parts, springs, levers and complications that we firmly believe have no place upon the thoroughly well designed motor car. It is a certainty that they will become loose and will rattle or lose off the car bodily. It is our judgment that the most satisfactory motor car for American roads must be constructed with the fewest parts possible, and that the machine from one end to the other must be free from all toggle and everything that may suggest claptrap. While the car equipped with the double brakes may not appear particularly complicated, yet you will find upon counting up the actual number of pieces required, that there are easily three or four times the number required to equip and operate a well designed brake upon the drive shaft.

Fifth: In the case of poorly designed double brakes upon the rear wheels, it is customary to use one drum only, allowing the internal brake to operate on the inside of the drum surface and the contracting external brake to operate upon the outside of this same drum. It may readily be seen that in descending long hills where it is advisable to use either or both of these brakes at once or to use them alternately in order that the banded surfaces may not become unduly heated, the drum itself must become very badly heated. To avoid this trouble, one or two manufacturers, who have adopted this type of brake, have found it necessary to use double drums upon each rear wheel, one drum surface being used for the expanding brake and the other or tire drum surface being used for the contracting drum brake. This construction, while still retaining the other unsatisfactory features mentioned above, must mean also additional dead weight upon the rear tires.

In summing up, it seems quite clear to us that every advantage of cleanliness, ease of adjustment, efficiency, simplicity, design, operation and durability lie with the drive shaft brake as opposed to the external contracting band upon the rear wheel drums. As strengthening our own experience in this matter, as mentioned above in relation to the 1907 Flyer, we have within the last few days had the statement from the chief engineer of one of the biggest companies in the country (who last year adopted the internal and external braking system upon the rear wheels) that he was very sorry that they had ever done this, as these brakes were not only inefficient as compared to their former practice of the drive shaft brake, but were also extremely hard to keep in order and to keep from rattling.

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