J. D. Nichols

MORE SPEED AND DURABILITY FOR YOUR CLASS H CROSLEY

The following information is the result of many years experience in the racing field in general and several years devoted exclusively to the observation of the problems of Class H racing, especially as involved in the use of Crosley engined cars. Actually there are very few "speed secrets", and success in the racing field is based upon meticulous attention to the many, many apparently small, but important details necessary to a durable, dependable and fast racing car.

ENGINE

Since the "go" department is the most important part of the race car, we will deal with this subject first. Fundamentally the Crosley engine is a very sound and modern design, with only a couple of inherent design problems. These are, of course, the fact that the cylinders are of Siamesed intake port design. This creates many problems of intake manifolding and fuel distribution, which will be discussed later under "manifolding". The other design problem is that the engine is designed for a short reach plug, which, when coupled with Siamese ports, brings problems due to the narrow heat range with 3/8" spark plugs.

BLOCK: As you probably know, the Crosley block was made in two basic forms, one the stamped sheet metal and tubing block which was brazed together, and the cast iron blocks. For the purpose of this article we will completely ignore the brazed block. The cast iron blocks are made in two forms, one with a flat head combustion chamber, and one with a raised portion in the head, known as the turbulator. The only way these two blocks can be identified from each other from the outside is that the flat head block at the rear has one opening, into which the heat indicator gage is screwed. The turbulator block has another opening in the rear which is plugged up with a pipe plug. Whenever you order pistons of high compression ratio, it is always necessary to mention whether or not you have a turbulator block. In general, it is the writer's opinion that the turbulator block is the more desirable of the two, as it is possible to obtain high compression ratios and still maintain turbulence.

CRANKSHAFT: Most Crosley engines as found have cast iron cranks. These are not usable. Later model engines have either cast steel or forged cranks which are usable. The forged steel cranks are identifiable by the fact that the throws are machined on both sides and the outer diameter. Both cast iron and cast steel cranks show the casting marks on the throws and can only be identified from each other by "sparking". This consists of holding a portion of the throw against a grindstone and observing the color of the sparks, dull red for cast iron and white sparks which have a tendency to break up, for the cast steel. If you use a forged shaft, I strongly recommend the use of "white" bearings, which were those having a silver-like color (McQuay-Norris). If you use the cast steel, then I would recommend the bronze color bearings (Federal Mogul). Crankshaft bearing fits as well as rod bearing fits, should be the same as recommended in the Crosley Service Manual (this is a must and can be purchased from Service Motors at 581 Hempstead Tnpk, Elmont, New York) and should be checked by the use of plastigage, which can be obtained from most any automotive supply house.

RODS: The standard Crosley connecting rod is perfectly satisfactory, though many people including the writer prefer the Italian forged duraluminum rods. The important thing in both cases is to be sure that the pistons are aligned to the rods. This can be done at any automotive machine shop.

PISTONS should be of the high compression racing type -- generally I do not recommend at this time, higher than 10½ to 1. Good results can be obtained by using standard Crosley pistons and raising the compression ratio by milling off about .060 from the top of the crankcase -- this is better than milling .060 from the bottom of the block, which would weaken the comparatively thin bolting flange on the bottom of the block. Incidentally, it is considered good practice at this point to "spot face" the mounting holes in the block so as to insure an even pull when the block is bolted down, which would prevent the possibility of bolt failure. Also at this point be sure and use copper washers or the new type steel washer with the neoprene center edge, so as to prevent oil loss. Because of the many variances in manufacture, it is always good practice when installing high compression pistons to check for piston clearance before bolting the cylinder block in place. The best way to accomplish this is to first assemble all pistons and rods less rings, insert in the cylinder bores, and turn the engine over slowly by hand before bolting the cylinder in place. If no interference is observed, then remove the cylinder and place small strips of modelling clay on the top of the pistons in various spots and repeat the process. The modelling clay will be compressed at points of contact and the clearance can be observed by taking a knife and cutting away one-half (vertically) of each strip. The minimum clearance should be considered as .040. Also it is wise to check with spark plugs of the exposed electrode type in place, as the writer has had one case where high compression pistons actually closed the spark plug gap!! Obviously, wherever there is not enough clearance, material should be removed from the piston so as to insure clearance at running-heating conditions.

CRANKCASE: There were a number of apparently similar but different crankcases used on Crosleys. The very early ones did not have any crankcase breather hole for the crankcase breather filter tube. Do not use this crankcase as "breathing" is a very necessary item on a racing crankcase and actually the Crosley engine should have additional breathing capacity, which can sometimes be accomplished by rigging up an additional breathing tube (with baffles so as to prevent oil loss) mounted on an extended size oil pan. The original Crosley breather tube should have downward facing baffles installed, by making hack saw cuts in opposite sides of the tube and facing them downward at about a 45 degree angle, inserting half circle pieces of twenty gage steel in these cuts and brazing in place. It is also a good idea to extend the height of this tube several inches by welding on an additional piece. The later type crankcases had a milled surface on the right hand side at which point was mounted a full flow oil filter. This filter is considered inadequate and is generally removed. When it is removed it is necessary to cover up the openings with a plate, being sure first that the plug which divided the main oil galley (cast into the crankcase running from front to back on the right side of the crankcase) is driven out, as it was the function of this plug to divide the oil flow at the mid-point of the galley around and through the filter to the rear half of the galley. If you put a plate over the oil filter holes you must remove this plug. Some of the crankcases with the side mounted filter had strapped center main bearings #2, 3 and 4, and if you are lucky enough to possess one of these, you are in good shape. Some of these crankcases were not milled and strapped, but did contain bearing caps thick enough that they could be milled and strapped, and if so I would suggest your doing this. This matter of strapping is probably a little argumentive, but I personally would not think of running one of these engines at racing RPM without doing so. (Note: Strapping - a steel "U" shaped channel held in place by the main bearing bolts, so as to "back up" the aluminum bearing cap.) Some of the real late crankcases (after the Crosley automobile was discontinued) are made with heavier bearing webs, are strapped and contain 3/8" cylinder mounting studs. If you find one of these, you're in real good shape, or if you care to go all out, this crankcase can be purchased from the writer for $60.00.

OIL PAN: The oil capacity of your engine should be increased to at least 3½ to 4 quarts. This can be done by either purchasing a special cast aluminum pan or by welding rectangular shaped sections on each side of the present pan and drilling a few ¼" holes to allow the oil to flow back and forth slowly from the main pan to the new additions. Because a high-revving Crosley is quite hard on oil, I would also suggest that you use an oil cooler, which can be a small refrigeration coil and finned condenser, connected by flexible hose, one lead from the front end of the main oil galley (this should be restricted by a #50 drill size hole), and the other lead (return) to the pipe plug located on the left rear portion of the Crosley crankcase.

VALVES: They are of sufficient size and actually due to physical limitations could not be enlarged to any appreciable extent. It is considered by many that the use of stellite exhaust valves is good practice and I concur. The main thing is that they are properly seated (45 degrees). Sometimes on an older block which has been repeatedly ground, these valve seats become recessed into the head to such a degree as to "pocket" the valve. This is very bad and the correction is to fabricate a small fly cutter and relieve this pocket. If it is not relieved, you will notice that the valve will have to travel an appreciable distance before the incoming or exhaust charge can escape. The later model valve springs as obtained from Service Motors or Thermo King are okay. Do not use the older type spring which was of much less pressure as you will experience valve float at about 5000 to 6000 RPM. Also it is a good idea to check the new valve springs and your used ones each time you reassemble the engine, for proper pressure. This can be done easily by using a household bathroom scale placed on a drill press. Place the spring of the bathroom scale and bring the chuck down until the compressed spring length measures 1-5/64", at which point your scale reading should be between 80 and 90 pounds. Throw away all springs below 80 pounds. Most of the later model Crosley engines used Roto-Caps under the exhaust valves and these can be retained on the exhaust, though some people prefer to replace them with the spacers as found on the intake valves. Do not use rotos on the intakes, as on a racing engine they see to cause excessive valve seat wear. Remember, that if you do not use rotos you must use spacers.

DISTRIBUTOR: A good distributor is a "must" in a racing engine. Since we have a four-cylindered engine, we should have no trouble with misfiring due to distributor dwell, even at 9000 RPM, provided, of course, that we do use a high quality coil and condenser, such as Mallory. If you use the stock distributor, be sure that it is in first class mechanical condition, and spring tension on the points increased a slight bit. Also, the advance range should be increased to about 28-32 degrees. The best suggestion is to buy a new Mallory distributor, condenser, and coil, specially designed for the Crosley.

BALANCING: It may come as a surprise that I do not recommend dynamic balancing of the crankshaft, piston, wrist pin, rods, assembly. I do recommend that the crankshaft be dynamically balanced by itself, and then with the flywheel-clutch assembly. Then the pistons with wrist-pins should be weighed, and the heavier ones brought down to the weight of the lightest one. The same thing should be done with the con rods, but they should be matched by making a jig, so that you can weigh only the big ends first, and then the small ends.

RINGS: Since generally a racing engine is torn down fairly often it is considered probably more important to use rings which seat fast, than those which might have maximum wear life such as chromed rings. The writer uses and recommends Grant rings. The width of the rings, of course, is dictated by the piston that you use and while many schools of thought suggest the choice of only three rings, there is also much to be said about the use of four, so as to prevent blow-by in very high compression engines. Many Italian racing engines use four rings -- one below the wrist pin. Also remember that whenever you take an engine down, it is good practice to put in new rings, as their cost is comparatively small considering all of the labor involved, and in every case of re-ringing, be sure and have the glaze busted by having a hone run through the cylinders lightly so as to provide a cross hatch necessary to seat the rings.

CAM FOLLOWERS: We are now getting near the heart of the dependable Crosley engine, which is largely centered around the camshaft - cam follower - valve action. New cam followers have a thin chrome facing which can be very easily damaged and quite quickly, - as a matter of fact within the first half hour of running a new camshaft - cam follower "marriage". This is a trouble that has plagued auto engine manufacturers in recent years when they went to high output engines with the necessary wilder cams, and by many owners of hot engines of all types. Never run with worn or pitted followers - they MUST be replaced or they will ruin your camshaft. Since there isn't much that can be done about the metallurgy and finish of these two mating surfaces, it is suggested that you break your engine in with the most expensive of 10 - 30 premium oils, which contain a small percentage of extreme pressure additive for this express purpose. This additive, which is usually used in .5 to .7% in premium oils is found only in premium grade oils, and most premium oils unfortunately stop at #30 weight, which brings up a problem - Crosley racing engines are generally run on 40 weight oil and sometimes 50. In this area we had very much camshaft - cam follower wear and pitting problems, until the writer was able to obtain this remarkable pressure additive which can now be supplied under the name "Jabro J2X". This is used in very small quantities - approximately 1% of your total oil volume, - about 1 ounce to 3½-4 quarts of oil, and can be bought for $1.50 for a 4-ounce bottle. Use of this type of additive has completely eliminated our camshaft - follower problems -- unlike other oil additives, no other claims are made for this product!

CAMSHAFT: This is probably the heart of a racing engine and its choice and use should be very carefully considered and applied. Keep in mind the type of courses you are to run on and pick your camshaft to match. Be sure and don't be carried away by fantastically wild cams which have no performance below 7000 or 8000 RPM, when for a fact you will be probably doing a high percentage of your actual running below this speed. What you need in Class H in most instances is a cam shaft with comparatively high torque around 6000 RPM, and I believe the Iskenderian T3 is an excellent cam for this purpose. It will turn an easy 8500 but has tremendous torque at around 6500, and this will be where it does the most good, - like coming off a turn. If you want a little wilder cam for long courses with easy bends, then I would suggest an Isky Rev Master 8000, which is made just for that purpose. Of course, there are other good makes of camshafts, and I mention the above by name only because I am acquainted with their characteristics and performance. In setting up the camshaft, it is very important that you follow the manufacturer's settings very accurately. Also, that your entire cam drive train of gears are meticulously set up to the clearances shown in the Crosley manual, as otherwise you cannot possibly hold the opening and closing points that were intended by the camshaft manufacturer. The above information is most important and many cases of poor running can be attributed to general sloppiness regarding gear and camshaft clearances -- remember this is the heart of the engine! Furthermore, it is suggested that since it is an easy matter to do that you check the camshaft to follower clearances before every race. I would not allow over .001 plus or minus variation. You will find that this checking will quite often disclose quite a bit of jumping around of clearances and sometimes show up valve shims that have worked loose, - all of which can make a big difference in the running of your car.

PLUGS: The Crosley engine uses the "short reach" (3/8") plug, which means that if you use high compression pistons, it is very important that you do not use plugs of a longer reach, as they will cause serious damage. The short reach plugs have a comparatively narrow heat range, and in general cause quite a bit of trouble in trying to locate the exact heat range of your particular engine. In general the range will run between J6 and J3. More commonly if your engine is in good condition for competition it should require plugs in the approximate order of J5 down to J3. Champion make a companion line for outboard motors, which have offset electrodes, and which usually carry the suffix J and therefore we should be discussing J6J, J3J. The use of the J series plugs (offset electrodes) is very much recommended because of the oil fouling tendencies of a high-revving Crosley. The offset electrode gives a sharper point for the spark to jump to and it will therefore fire under an oiling condition that would probably cause misfire on the right angled electrode plug. Whenever you remove or replace a spark plug you should always use a new gasket, and see that they are properly torqued down. In the case of a 3/8" 14 mm plug in a cast iron head, this is 30 ft.-lbs. Spark plug gaskets can be obtained from any good automotive supply house. Avoid over-tightening and using of worn and smashed gaskets, as either will materially change the heat range of a given spark plug.

MANIFOLDING AND CARBURETION

Actually volumes could be written on these subjects and since space does not permit, I can deal only with the generalities of these subjects. First, since we have Siamese ports as mentioned in the opening paragraph, we cannot properly tune the intake manifold and since the intake manifold will contain a mixture of different sized small globules of gasoline mixed with air, we are going to have some problem in getting an even mixture in all four cylinders. In general, you will find that cylinders one and four will have a similar mixture and cylinders two and three will have a similar mixture. (This can be shown by your spark plug colors after running.) Since no two successful Crosley engines have the same intake manifold theory, all I can say is that this will require some experimentation on your own part. In general, I would suggest that you do not enlarge the ports in the Crosley block but simply clean up any rough spots and that the manifolding going to these ports should be of the port diameter. Various manifolds can be constructed, such as the "Y" type using one carburetor, or the log type using one or two carburetors. In general, the Venturi size of the one or more carburetors is again local option, and with each Venturi size comes the subsequent experimentation for the proper size main jet. If you use one carburetor (and I do), I would suggest a Venturi of approximately 7/8" or 1". If you use two carburetors, I believe I would use between 3/4" and 7/8". Two carburetor effect can be obtained by using a Ford 60 carburetor on a "U" shaped manifold, and again the "U" shaped manifold can be used with two separate carburetors, as is done by Nardi. My own car is presently using a log manifold and a 1" Amal Mono-Block carburetor with a #260 jet feeding a 1¼" log having 3/8" buffer ends and 1-3/16" curved tubes from the log to the Siamese ports. This seems to be very satisfactory over a wide range of RPM, though it still suffers from the inherent problem of Siamese ports -- imperfect distribution. With regards to the exhaust manifold, much success can be obtained by tuning, and I am listing below a chart showing the tuned length for the different RPM ranges. All measurements are taken from piston crown at T.D.C. to the "dump point". This is the point at which the exhaust gasses are dumped either into the open air or into a common pipe of larger diameter. Pipes must be joined at under 45 degree angle in order to take the tuned measurement of the common pipe. I would suggest that this angle be approximately 30 degrees. It is considered good practice on an engine of the firing order of Crosley to use the first and fourth cylinders joined and the second and third joined, and bring these two junctions together into the dump pipe at the selected tubing length. I would suggest that this tuning length be at about 5000 to 7000 RPM, as this is our most useful range as described earlier. This will give us an exhaust manifold length of approximately 30" to 31", less the distance from port to T.D.C. This manifolding can be constructed of 1" thin wall conduit, and it is suggested that you do not make it any larger than 1" diameter, as we want to keep the velocity up.

RPM	LENGTH-INCHES	RPM	LENGTH-INCHES
2000	102	7000	29
3000	68	8000	25
4000	51	9000	23
5000	41	10000	21
6000	34		

BRAKES

Since the "stop" department is important in sports car racing, it is well to say a few words about the much misunderstood spot brakes used on some model Crosleys. The important thing about Crosley spot brakes is that they must be adjusted accurately (both pads must be parallel with the discs) and they must be adjusted very close and before each race. The proper way to do this is to jack up the wheels, loosen the lock nut and turn the adjusting screw until the brake pads just start to drag when the wheel is turned in its proper rotation direction. Sometimes turning the wheel backwards will cause the pads to "cam" in and give you a false reading. When the pads rub slightly, tighten up the lock nut. This close adjustment and repeated adjustment may sound a little out of order, but you must remember that spot disc brakes operate through very small actuating distances and failure to keep them in proper adjustment will very quickly lead to no brakes at all, and general dissatisfaction with this type of brake. While this adjustment sounds complicated and would seem to indicate a lot of brake wear, it is not true as the adjustment is very easy and the writer has competed for the last two years with the same set of pads. They are remarkable brakes and have never been known to fade.

The regular Drum type brakes are very ample in size and need only the adjusting and attention normally given brakes of that type. Because Class H cars are inherently light, (you should try to keep yours below 850 lbs.), the driving technique requires very little braking and for very short periods, so aside from the notes on spot brakes you should have no trouble in this department.

CLUTCH

Since we will turn about 8500 RPM, the clutch must be selected so as not to fly apart. This means that it should be of relatively small diameter, perfectly balanced on the flywheel, and have springs which are held in position, either by being enclosed on the outside (Morris Minor), or supported on most of the inside (MG TC).

TIRES

Anyone who has competed with a light Class H car over a period of time will agree that these cars are quite sensitive to tire pressure, tire pattern and composition. In general let me say that on tight courses and using 12-4.50 tires, you will probably find you will do best with comparatively low pressures in the order of 18 to 24 lbs. If you find the back end skitterish, try reducing the pressure, and if you find the front end dishing out try reducing the pressure in the front end. With a little experimentation and practice you should be able to achieve, if your car is properly balanced, the right degree of control to suit your own requirements, keeping in mind that if you have brand new tires (that were designed for street automobile use) they will not hold well until they have worn down a bit and become "contoured". This contouring is very important and watch out whenever you change to a new set of tires, especially if you run very high pressures, as you may find your car will get out from under you very easily. Since the influx of many foreign economy cars, there has been made available a much wider range of tire sizes to fit the 12" wheels from 4.50 up to and including 5.90. Furthermore, you can switch to European 13" wheels as found on the Nash Metro and get another range of tire sections with obviously increased circumference (good for long courses). In general, I believe you will find that on a well balanced car you will maintain a difference of about two to three pounds between the front and back with the greater pressures and cross section being used in the back.

REAR AXLES

In most cases competition cars using Crosley rear axles have had their effective tread widened by either reversing (dishing) the rear wheels or by use of wheel spacers or both. The effect of this widened tread is to create a very long "overhung load" on the rear axle assembly. This will invariably sooner or later cause breakage which usually occurs near the large end of the taper where it enters the hub. Also as to be expected this usually occurs on the left axle because of the predominance of right turns in S.C.C.A. racing. Experience has shown that if you will have the axles machined so as to reduce their diameter to about .75" for a distance of about 3" to 4" and taper this reduction up to the main diameter on a very gradual smooth slope that the torsional absorbing effect of this reduced section will materially reduce or almost eliminate axle breakage. This is done on the inside of the axle and the slope should start about 1-1/2" from the inner oil seal. The work should be very smoothly done and should be polished so as to show no "turning marks" which might in themselves cause breakage due to the mechanical phenonomen known as "notch effect".

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I should like to again repeat that success in the racing field is based upon meticulous attention to all phases of your car's operation -- engine, brakes, steering, tires, transmission, etc. Lack of this attention, along with proper knowledge and intelligence, is usually the basis of failure to win.

Space limits the amount of information that could be passed along, but I believe that I have covered most of the fundamentals that will help you to score "wins".

YOURS FOR MORE AND BETTER CLASS H RACING!!

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STILL MORE SPEED AND DURABILITY FOR YOUR CLASS H CROSLEY

CHAPTER II

In probably no other field is progress and experience so necessary in order to win, as in motor racing. What was the greatest thing yesterday is considered passé today. And so, we must constantly seek for more ways and surer ways of obtaining that last extra bit of speed, handling, braking and increasing our durability factor, so that we have less and less maintenance; and that is the purpose of this article. Since writing the last article, I am more and more convinced of the necessity for adhering to the things outlined in it, in order to provide a dependable engine and competition car. But since progress is progress and time passes on, I have found many other things to add to those already mentioned. Please do not overlook any of the things mentioned in the first article on "More Speed and Durability." They are all basic.

Which brings us up to one of the greatest single changes that can be made in the Crosley power plant - -

FOUR PORT

As I mentioned in the first article, the inherent design weakness in the original Crosley engines, when used for racing purposes, is the fact that, for practical production reasons, the original block was saimesed, i.e., there were two intake ports, each of which feed two cylinders, and I mentioned at the time that this made intake tuning, or so-called 'ram tuning', impractical. We have now found a practical way to convert a Crosley block to a four intake block. This is a major surgery job, entailing the cutting and brazing in of four new intakes on the opposite side of the block from the present intake port locations, thus giving you the intakes on the left and the exhaust on the right. For those of you who have the courage and ability, I have available a set of instructions and drawings showing how this is done. For those of you who would care to go the route, but do not want to do it yourself, I can supply a reworked block (you must send in an old block suitable for reboring to .030", and it will be returned to you with the four intake ports brazed in on the left side, and ready to accept carburetors such as the Dellorto SSI-25 Spigot type, which, incidentally we find very satisfactory. Of course, you could use other carburetor combinations, such as Amal, or Weber; the block will be clean-bored to .030"; valve seats will be ground; there will be new valve guides, a new tower-shaft bushing; and the cups containing the cam followers will be honed to renew their concentricity, which is sometimes distorted through the brazing process. The block will contain a new manifold-type water outlet which picks up the water at 3 points, thus preventing the end cylinders from running hotter than the others.

At this point it might be well to suggest that in <u>any</u> Crosley competition engine if you use a turbulator block then use turbulator pistons - cutting a horizontal V groove about 1/2 wide, about 5/32 deep and about 3/4" long toward the center of the piston and starting at the point where the piston at TDC meets the spark plug hole.

If you use a flat head block then use turbulator pistons but reverse them so that the turbulator "slug" is on the side away from the spark plug - on "flat heads" use one step higher compression turbulator piston and check for clearance with modeling clay. Also on any engine, use solid copper gaskets on the plug (get from Chamption) and grind off the last thread in the block or so that may show in the block after the plug is installed with gasket.

Obviously, with the four port intake and four carburetors, there is no need for any form of intake manifold. Each of the carburetors go directly to their cylinder, and there is no necessity of any balanced tubes between the various cylinders. You will now find that the engine, if carbureted uniformly, will color all of the spark plugs the same, and you will get away from the annoying habit of the siamesed port Crosley of coloring the center two cylinders the same and the two end spark plugs the same. If nothing else is changed, you will notice a marked improvement in torque at all ranges. But the real value of the four port engine lies in the fact that you can now use a wilder cam shaft and can, if you so desire, tune the intakes for maximum ram effect as well as the exhaust, which was discussed in the last issue. I will not take the time of going into intake ram tuning at this point; sufficient to say that it is rather well known now that its effectiveness has been quite proven - even to the point of being adopted on such passenger cars as the Chrysler family.

We are now in the fortunate position of having an engine that is capable of intake tuning and exhaust tuning, and the using of a wilder cam shaft with much greater overlap than the old original Crosley. This makes it possible for us to pick the three items, intake tuning, exhaust tuning and cam tuning in such a fashion or manner as to best suit our purposes. If we peak all three elements at the same point, we will have an engine that one speed will 'come on like Gang-Busters', and will be relatively poor above and below this RPM range. Since this will be undesirable in sports car racing, it is suggested that you provide these tuning features in somewhat overlapping ranges, which will have the effect of flatening or broadening out the maximum horsepower range, and which is more useful for sports car competition. For example, if we are going to use an Isky Rev-Master 8000 camshaft, which peaks between 7500 and 8000 RPM, I would suggest that we then consider the upper RPM limits of the Crosley to lie in its restricted valve area. For that reason, we should give the most boost at the upper end. To this end I would suggest that the intake turning length be set for about 8500, which would be about 11". The exhaust manifold can then be tuned for 7000 RPM, which would be 29". Since none of these peaks are absolute, and the benefits are generally derived all the way across the line, but more noticeably in the range to which they are attuned, we will now have an engine which will start to come on at about 6000 and show a very definite increase all the way from 7000 to 8500 RPM, giving us a very useful 2000 plus range, which is certainly ample if you have a close enough ratio box, and change your driving technique to match this combination. I'm showing at the end of this article a table which shows the length needed for tuning the intake and exhaust manifolds at the various RPM's shown. Distances are in inches and are from the center line of the piston crown at bottom dead center to the opening of the bell-mouthed ram tubes on the end of the carburetors. In the case of the exhaust, we still start at the piston crown at top dead center and end where our constant diameter tube dumps into another much larger tube, this being the so-called 'dump point', or the termination of the tuned area.

Our experience in this area has been almost exclusively with Dellorto SSI-25 mm carburetors. I might add that they are extremely satisfactory. Our best performance has been with the above carburetors, using #110 main jets, #100 slides, and #M-7 needles. This M-7 needle is adjustable as to position with regard to th throttle body, and it is important that you run it in the second from the top notch,i.e., put the split washer which holds this needle in place in the second from the top notch, which will raise the needle so that from the top of the slide you can just barely see the first notch. A little experimenting with this needle height may be necessary for your locale and gasoline and temperature; but I believe you will find the above correct. If the needle is raised too high, the one-quarter to three-quarter range of the throttle will be rich; and if it is too low, it will be obviously lean. However, lean condition will be very misleading, as it will appear as though you are not getting enough gas to the carburetors, and your engine will stall on fast stops or on sharp turns, making you feel that the float level is wrong. Regarding float level, if the carburetors are mounted horizontally, the outlet connection at the base of the float should be in direct line with the banjo-type inlet at the base of the carburetor, if the carburetors are mounted at an angle, as would normally be the case on one of our four port blocks, then the outlet tube at the base of the float should be about 1/8 to 3/16 of an inch below the center of the carburetor intake connection. At this point it is well to mention that the entire above discussion is as viewed from the front of the engine looking backward, and with the banjo fittings all facing forward, so as to have all the proper and common axes.

Our experience has shown that it is best to mount the bowl in front of all four carburetors, which will have a tendency toward richening on acceleration, and leaning on deceleration, which is far better than the other way around. We have been taking a block of aluminum that will span all four carburetor bases, drilling four holes in this space, the same size as the original banjo fitting hole, rifle-drilling it the entire length - lengthwise with a hole about 1/8 to 3/16 of an inch - and cross-drilling in the middle from the outside to this rifle-drilled hole. The ends of the long passage are then plugged and the block is tapped for 1/8" pipe-tap the center outside edge. Gasoline is fed to all four carburetors from the float bowl at this point. This arrangement has provided a minimum of surge in both stops and corners. As a matter of fact, we've had no feed or surge problems whatsoever; and, if you do have this type of trouble, it is a matter not of float bowl location or height, (provided of course you followed the previous instructions), but actually your needle height is incorrect.

IGNITION TIMING

Because of the peculiar location of a spark plug in a Crosley engine, this engine seems to require a terrific amount of spark advance. This fact was mentioned in the previous article, but because the ultimate performance of the engine is so dependent upon spark timing being correct, I feel that it is again necessary to call your attention to this peculiarity of this engine. Believe it or not, the total spark advance at running speed, i.e., 4000 R.P.M. and up, is in the approximate order of 50 to 60 degrees advance!! For this reason, I again suggest that you use a Mallory distributor, which has a 32 degree advance within itself, and this, coupled with an idle advance of 20 to 28 degrees, will throw you in the required range without having the starting timing so fast as to cause the engine to 'kick back'. The reason for the variation in the timing point, and the reason I cannot tell you specifically where to time your ignition is that this point will vary with different makes, brands of cam shafts, the amount of clearance you use with a particular cam, the sloppiness or care with which you set up the tower shaft clearnance, and last and probably most surprising, the fact that in many instances, even if you have set your clearances precisely, you may have an engine in which the cam shaft itself is running from a few degrees to as high as 10 or 12 degrees late or fast!!

DEGREEING

The astounding statement made in the previous paragraph is quite possible, and the writer has seen it exist in several cases, due to a peculiarity in the construction of the Crosley valve train. The trouble lies in the tower shaft which appears to be made in one piece, but which is actually in two pieces, and containing a sliding fit, or press fit, joining the two elements together. Since in many cases the ancestry of the various Crosley components for our engine are of doubtful heritage and background, it is possible to obtain this component from an engine that may have twisted this shaft, and hence it will be off a number of degrees, even though the timing marks and clearances are meticulously followed. Whenever you run into a Crosley engine that just simply will not run right, the chances are ten to one that you have this condition; and many engines have been scrapped and the builders have gone off to something else because of their failure to know what was wrong with a particular engine, that seemed to be perfectly all right, but just simply would not run right. Even in the cases of those engines which do run well, it is a good idea to follow the practice of all expert race mechanics, and that is to degree the engine, i. e., to check with a degree wheel and see whether the cam shaft opening and closing points are where they are supposed to be. This information, of course, can be gotten from the cam card which is shipped with the cam, and degreeing is done in the following manner: First, of course, we need a degree wheel, which is a circular piece of metal, marked off in degrees, which is usually bolted on the front of the engine and rigged up with a little pointer from some fixed point, so that either the pointer can be moved or the degree wheel slipped, so that when the engine is set at top dead center, we can then get the top dead center mark on the degree wheel to match the pointer.

TOP DEAD CENTER - this, of course, is the first thing we must do in order to degree an engine, and the accuracy with which we locate top dead center is all important; if it is not accurate, none of the other readings will be either. Remove the spark plugs from the engine and use a dial indicator with a long indicator point, so set through the spark plug hole that it will indicate when the piston is at its uppermost point of travel. Obviously it is necessary to clamp the dial indicator to some portion of the engine to make it rigid during this test. Now, since there are a number of clearance points, such as the bearing clearance, the connecting rod clearance, the wrist-pin clearance, the piston-to-cylinder wall clearance, we will have to take these into consideration when locating the top dead center or any of our other readings; therefore, all readings are taken in two directions: one, the way the engine runs, the other, the opposite. In this way, we can divide the point at which a similar reading will occur, left or right, and know where the true reading is. So to start out, we locate the front piston about 1/4" down, and rotate the engine by hand, a little at a time, until the dial indicator shows no increase in reading and just before it shows a decrease in reading. This, in a rough way, will be our top dead center; but to locate it more accurately, we start over again and stop when you reach about ten thousandths on the dial indicator before the point where you think top dead center is located. Now observe the number showing opposite the pointer of the degree wheel (at this point, it doesn't make any difference what the number is, since we will set the degree wheel later on). The engine is then carried through top dead center, and down on the other side about 1/4", and then brought back counter-clockwise by hand until we obtain a reading on the dial indicator that is the same as the one we noted before when we stopped then thousandths of an inch before what we thought was the top dead center. This reading is now noted on the degree wheel, and top dead center will be exactly one half of the way between the first reading on the degree wheel and the second reading of the degree wheel. The engine can then be rotated by hand to this position. The nut holding the degree wheel can be slightly loosened, and the degree wheel turned around so that it will read top dead center at this point. It is suggested that perhaps you repeat this procedure a couple of times, to make sure that you have actually located top dead center.

Since, to my knowledge, all Crosley cam shafts are of balanced construction, i. e., the intakes and exhausts have the same timings, except that they are reversed, for example, an Isky T-3 is 20-65 on the intake and 65-20 on the exhaust, a stock Crosley is 5-50 and 50-5, etc., it is not actually necessary to check to these opening and closing points, although this is a good idea if you want to go the entire route. If you don't, and are simply checking to see if everything is in order, all we have to do is to check the cam for what is known as 'split overlap'. You will notice, for example, that when top dead center is located on number one cylinder in the firing position, that the two cam lobes, intake and exhaust, on the number one cylinder will be sticking up evenly on each side of the center line of the cam. This is the fact that we want to verify with the degree wheel, since our eye will not show us a difference of say, 3 or 4 degrees. In order to check this, relocate the dial indicator, so that the indicator pin now rests on the cam follower of the exhaust valve and rotate the engine in the direction it runs until the cam just starts to open this valve, which will be indicated by a change in the reading on the dial indicator which would have been previously put under a little load. At the point where this dial indicator just starts to show a change you should immediately stop and take a reading off of the degree wheel. This should be done a couple of times to insure accuracy, taking note of the reading on the degree wheel. The dial indicator is then shifted to the intake valve cam follower, and the engine again rotated in the direction of rotation, until the intake cam is just coming off the follower, which will be indicated by a stop in the movement of the dial indicator. This reading should then be noted. Now, rather obviously, if we divide these two dial indicator readings, we should be at top dead center. Generally, it's pretty hard to get these things to come out precisely to the degree. It would be my opinion that if you get within two or three degrees, you've done a pretty good job. All of these readings, of course, are based on the assumption, that you have meticulously set up the valve clearances, so that the clearance between the intake and the exhaust valve on number one cylinder, for example, will be exactly the same in thousandths of an inch. If they are not, they will change these degree readings quite a bit, and your readings will be of no use. If you want to go the whole route, you should first be sure that your split overlap is correct as above, and then make all other readings by rotating the crankshaft in the direction of rotation, noting the point on the dial indicator where the intake opens and then the point at which it closes, and the same with the exhaust by moving the dial indicator to the other cam follower. If you find that your duration is more total than the cam card indicates, try changing the shims under the cam followers so as to have a little more clearance, which will shorten the duration or vice versa.

Now what do we do if the split cam reading shows that we are 6 or 10 degrees off? Well, the simplest thing is since there are a different number of splines on the gear at the top of the tower shaft than there are teeth on the gear, we can arbitrarily retime this gear by lifting it off the splines and advancing one tooth on the spline. Since this should be done to the number one cylinder on top dead center at about ready to fire, we can then re-mate the cam shaft gear visually so that the two cam lobes on the front of the cylinder appear to overlap uniformly, and we can repeat the process of checking the overlap. By this method, we should be able to get a combination that is within 2^{o} - 3^{o} of correct which is okay -- after this has been done the oil hole in the shaft or gear should be redrilled so that they will still "line up."

SPARK PLUGS

Much has been said about spark plugs but I believe the following from the Engineering Department at A. C. is very much to the point for a competition engine:

> The first step is to start with a plug type which you are sure will be cold enough for the engine under the most extreme conditions to which it will be subjected in a particular event. The plugs should be subjected to a couple of warm-up laps followed by at least one lap at the maximum performance attainable. The maximum performance lap should be concluded by simultaneously cutting the throttle and disengaging the clutch before returning to the pits. This will prevent any false indications due to deceleration. If any sooty or wet carbon deposits are noted on the insulator tips, the next hottest plug type should be tested in a like manner. Progressively hotter plug types should be tried until insulator tips are found to be clean and white, thus indicating the hottest type the engine can safely withstand. However, if dark freckles are found on a white insulator tip, the plug type is too hot and you should revert to the next colder type.
>
> Pronounced rounding of electrodes, especially of the center electrode after a fairly short period of operation, also is an indication that the plug is too hot. However, the freckled insulator tip indication will appear much sooner and, therefore, will be of more value. Rounding of electrodes will not be evident until after several laps have been completed. Bluing of the electrodes is not uncommon and is not necessarily an indication that the plug is too hot. Sometimes, if a plug has operated at extremely high temperatures, the electrodes will turn a greenish color. However, chances are that if such a high plug operating temperature had been attained, the plug would have instigated preignition and subsequently damaged or destroyed the engine."

BRAKING

While most Class "H" cars have excellent braking characteristics, they usually all have a tendency to "lock" the front brakes before the rear. This is due to the fact that the brakes are usually taken from a passenger car which had a high C. G. and a larger portion of its weight on the front wheels. For this reason the rear brakes have either a smaller wheel cylinder or less lining or both. Our competition car is just the opposite - low C. G. and even or more weight on the rear!

The answer is obvious; either increase the rear wheel cylinder or lining area - do not make them equal, but increase it about 1/2 way from what it was, to what the fronts are. Another way is to use two masters with an adjustable link so that the pressure between the front and back can be adjusted. If you use two masters, their individual piston areas should be about 1/2 the original or your pedal linkage should be halved.

WATER PRESSURE

Always run with a 4-6 lb. pressure cap on your radiator; this raises the boiling point to above 212° F. and prevents the formation of hot spots in the block due to small steam pockets (ever watch the small bubbles in the bottom of a pan even before it comes to a boil). I also restrict the water outlet (to the radiator) so that the pump creates additional pressure in the block.

TACHOMETER

Many instances have been found where a defective electric or electronic tachometer has caused high speed ignition misfiring. This is a very baffling trouble and is quite often erratic in nature.

I suggest that you place a dash mounted switch in series with the tachometer lead that goes to the distributor points. In this manner any time that you may have a high speed miss you can flip the switch to "open" and immediately know whether or not your tachometer is the culprit.

OIL PUMP

The later model Crosley oil pump with the longer gears (11/16 in. long) is quite satisfactory as far as volume and pressure are concerned. It has been found however that in many cases the hardened steel stub shaft (on which the idler gear runs becomes loose in the casting), the trouble experienced with this shaft is that through heat and vibration it becomes loose and the oil pressure then actually forces the shaft up and sometimes completely out of the housing! There are two solutions; one is to fabricate a metal bracket which is sort of "Z" shaped and held in place by two 1/4 inch cap screws which in turn are screwed into the two tapped holes in the pump body. This bracket is so dimensioned that the other portion of the "Z" fits over the end of the stub shaft in such a manner that it cannot come out. The other method is to drive this shaft out, grind off about 3/32 of an inch, replace it in the pump body, and then with a center punch "upset" the perifery of the hole so that the stub shaft cannot move in that direction.

FULL FLOW OIL FILTER

Class "H" engines usually are so located that they operate in a very dirty atmosphere which usually causes premature failure of rings, bearings - valve guides - and intake valves! The rings wear in the "lands" and the bearings (rods and mains) show distinct signs of "dirt" and the intake valve seats "wear."

The first thing is to pick up the carburetor air from an area shielded from the dirt and grit from the course. Then we should remove all of the dirt from the oil before it reaches any bearings. This can easily be done by following the Jabro blueprint "full flow oil filter systems for Crosley." - The results of this F.F.F. is amazingly clear oil as well as much longer engine life.

REAR AXLE VENTING

Crosley rear axles run at very high RPM and the resultant pressure build up causes the rear inner seals to fail prematurely. Be sure the little hole (about 1/16" diameter and located about 1/2" from the bottom on the left and 3-1/2 in. from the side of the center housing) is kept open --bet you didn't know that it was there? Also it is a good idea to braze a piece of 1/4" steel tubing into the upper part of differential cover plate--about 2" from the plate put a 2" circle and continue up for another 2"--this will give additional venting--the circle forms a trap or seal.

WEIGHT!

Last and certainly one of the most important is make it light; this means a smaller car (Mark III) -- this means less material in the body etc. --use small wheels and tires (lighter). In the Mark III over 8 lbs. are saved by not using wheel spacers, instead the driveshaft is 2" off center to the right and the axle and housing is widened 4" on the left side, by welding--lighter and no overhung axle load! Running the engine and drive line 2" off center also gives better left to right weight distribution. Use the lightest components you can (a Sprite clutch weighs 1/2 as much as an MG TD!)--many cars run without a seat just a sheet of aluminum formed a seat!. Also note the small white "head lights" on the Elva MK V and the Jabro Mark III (Crosley turn indicator lights!)-- Incidentally, these are okay under the 1961 rules -- lights must light but don't have to brighten the road!

It is hoped that one or more of these "tips" will help you, and if so, I am sure you will agree that your time and money were well spent.

Yours for better and faster Class "H" racing!

James P. Broadwell

CHASSIS by JABRO   *750 mk II*

Competition Accessibility!

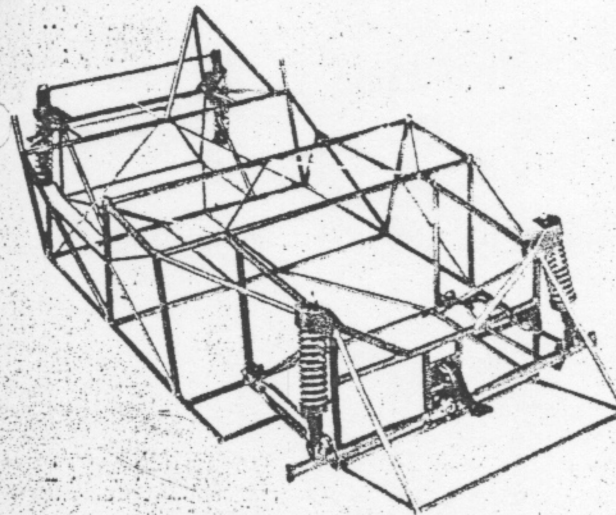


Photo by Greer Cavagnaro.

MK. II Chassis showing coil spring--shocks. Note center steering bracket and swing axles in front.

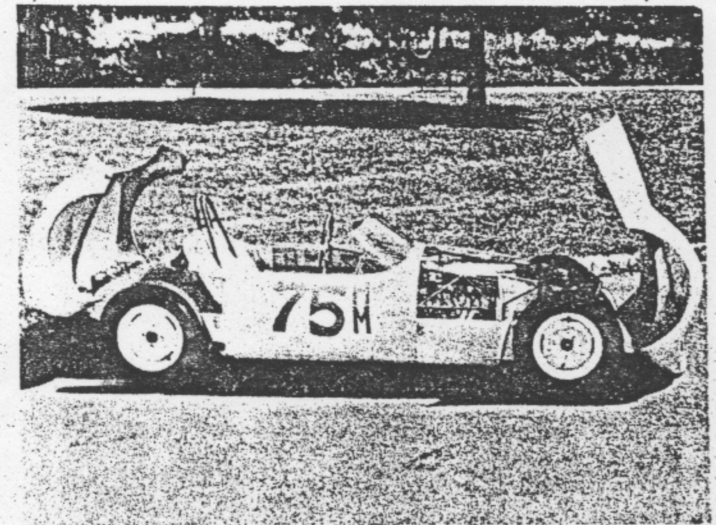


Photo by Bob Hegge.

ALL Jabro Bodies are in 3 sections -- fixed center and hinged front and rear. Front or rear may be completely removed by removing only 2 bolts!

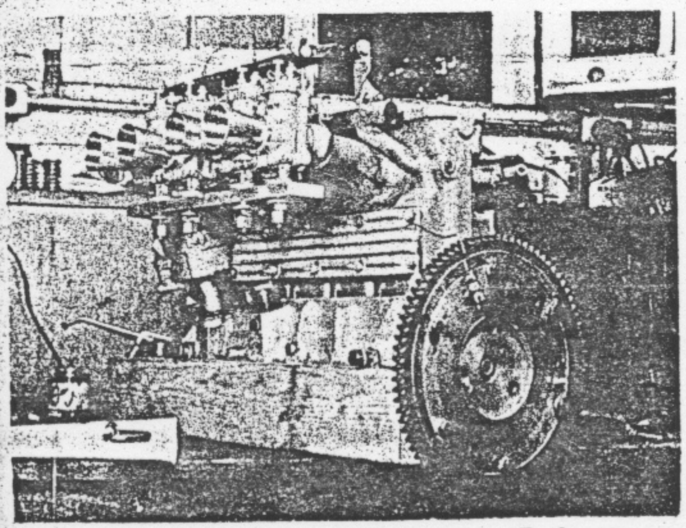


Photo by Bob Hegge.

MK. II at speed, Rollo, Mo.

65 HP !

JABRO-CROSLEY 4-PORT CONVERSION

The familiar and reliable Crosley yields its real potential when given eight separate ports and four Dellorto carburetors

MK. II Specifications

Wheelbase.................	84"
Tread, front...............	46"
Tread, rear................	43-44"
Height at cowl.............	29"
Body width.................	52½"
Body length O.A............	132"
Weight Approx..............	790 lbs.
Tires, front...............	4.50 x 12
Tires, rear................	520 x 13
Top speed (750 c.c)........	115 +

MK. II based on Crosley components

For further information write . . .

JAMES P. BROADWELL

#1 SUNNYMEAD • ST. LOUIS CO. 24, MO.

J A B R O   S P O R T S   C A R S - S T.   L O U I S,   M O.

JABRO DUAL PURPOSE SPORTS 750 mk I

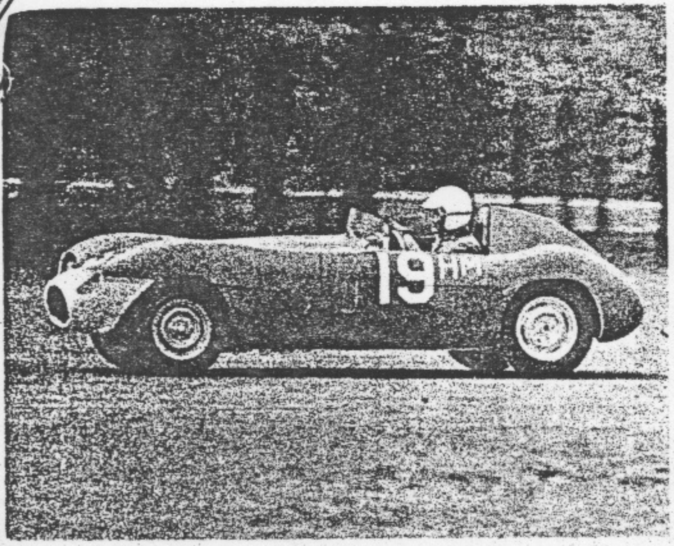
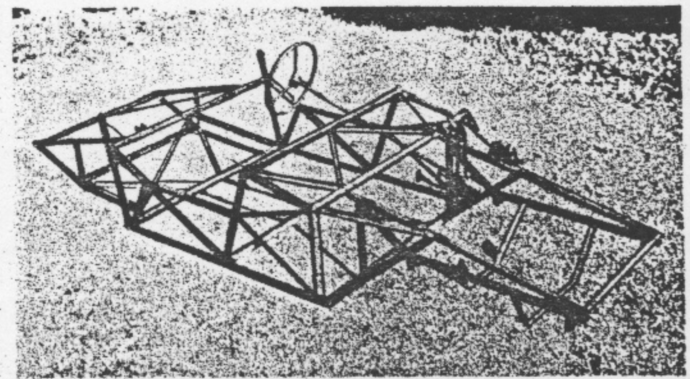


Photo by Action Ltd.

MK. I built by Emmit Pyatt at speed -- Lawrenceville, Ill.

495
250
30
50
100
350
100
100
1465

850

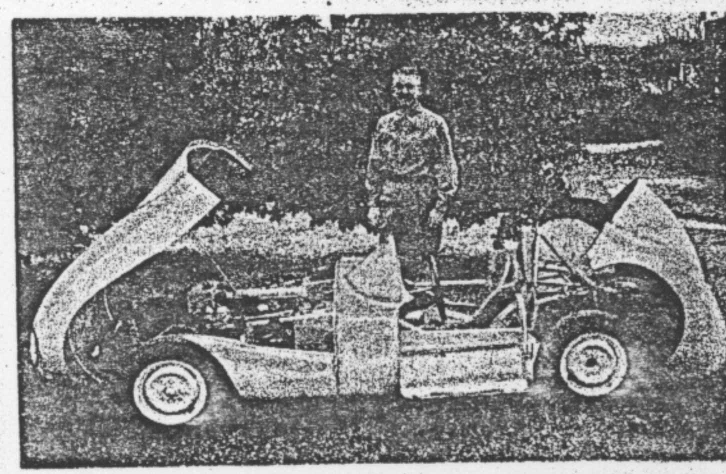


MK. I Chassis. Note sturdy construction and complete triangulation.

MK. I SPECIFICATIONS

Wheelbase..................	84"
Tread, front...............	44"
Tread, rear................	44"
Height at cowl.............	29"
Body width.................	52½"
Body length O.A............	132"
Weight, Approx.............	800 lbs.
Tires, front...............	4.50 x 12
Tires, rear................	5.20 x 13
Top speed (750 c.c)......	108 +

MK. I based on Crosley components



JABRO complete service for the class 'H' sports car builder.

See attached literature for additional Jabro 750-850 information and items, blueprints, literature, castings, speed parts and accessories, fiberglass seats, how to do it dope, etc.

Jabro is the only complete source of designs, components, etc. for Class H modified! Everything has been tested in actual racing.

Any suitable engine can be used in any model Jabro, such as Saab, Crosley, Mercury outboard, D.K.W., OSCA, etc.

Jabro SPORTS CARS

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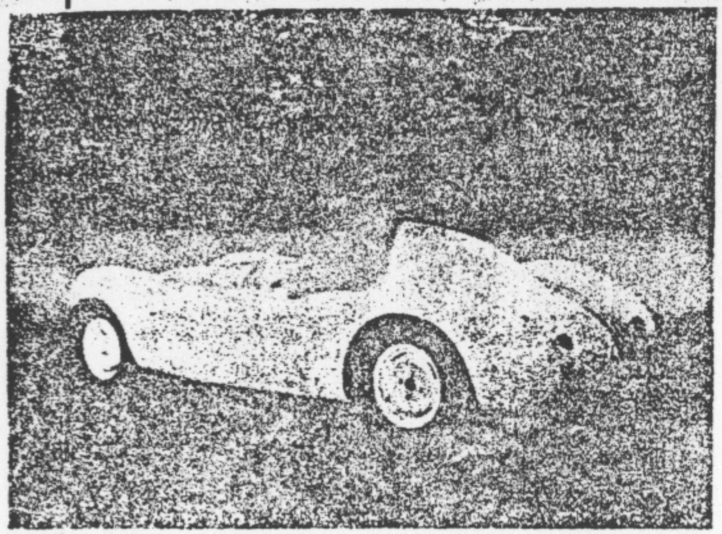
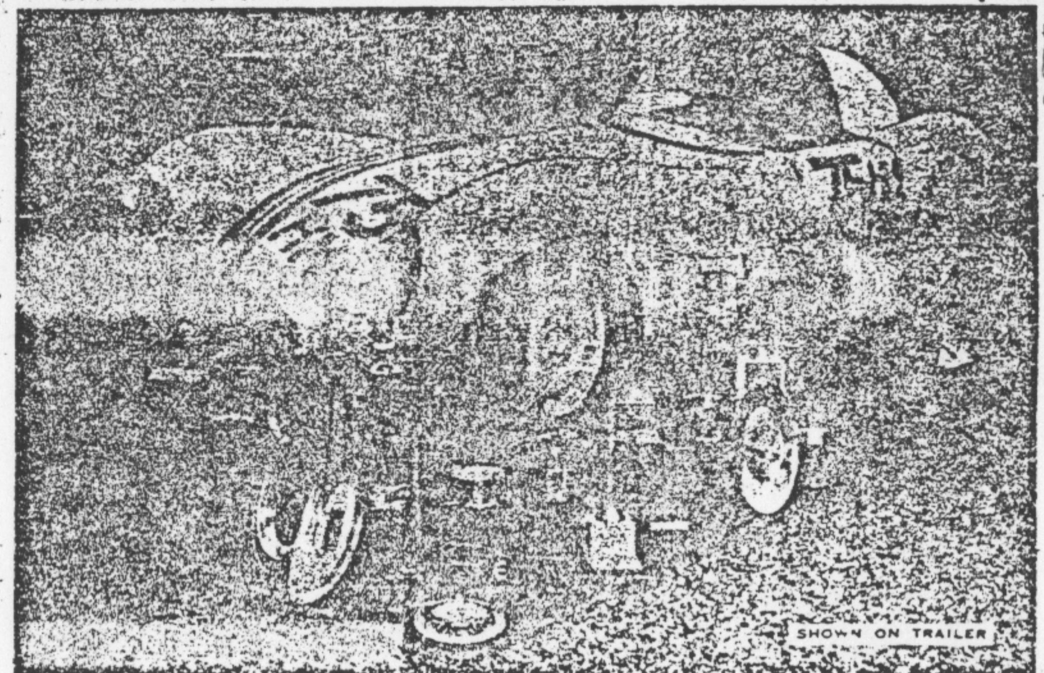
JABRO 750



More Curves than Marilyn
— Just as functional!



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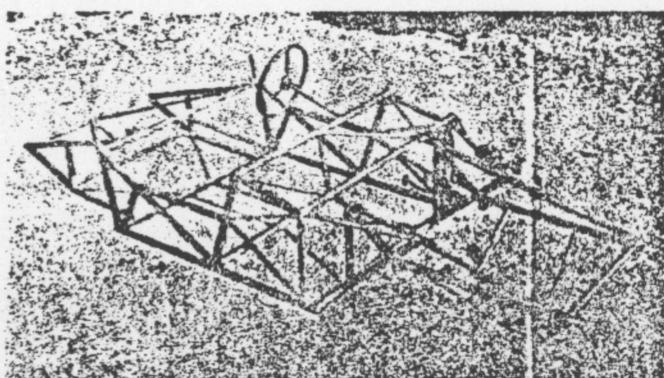
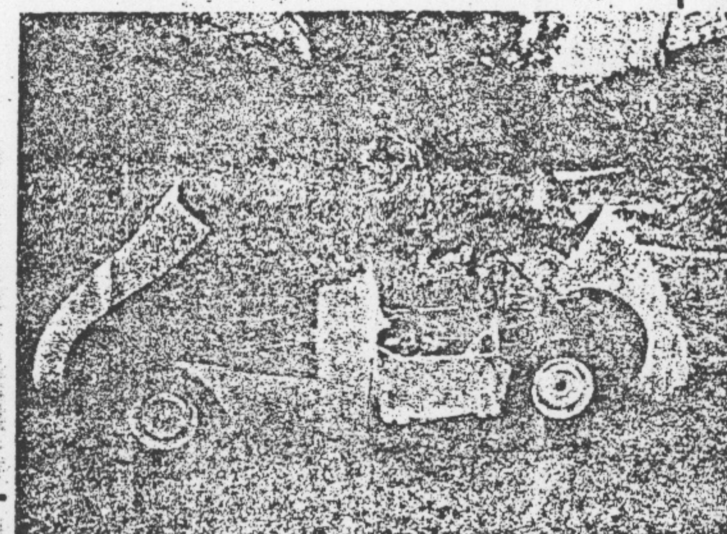


Strong & Light

Jabro 750
Competition Record
20 *Starts* . . . 20 *Finishes*
18 TROPHIES !!
Class 'H' Modified



Competition Accessibility!

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JAMES P. BROADWELL
#1 SUNNYMEAD • ST. LOUIS CO. 24, MO.
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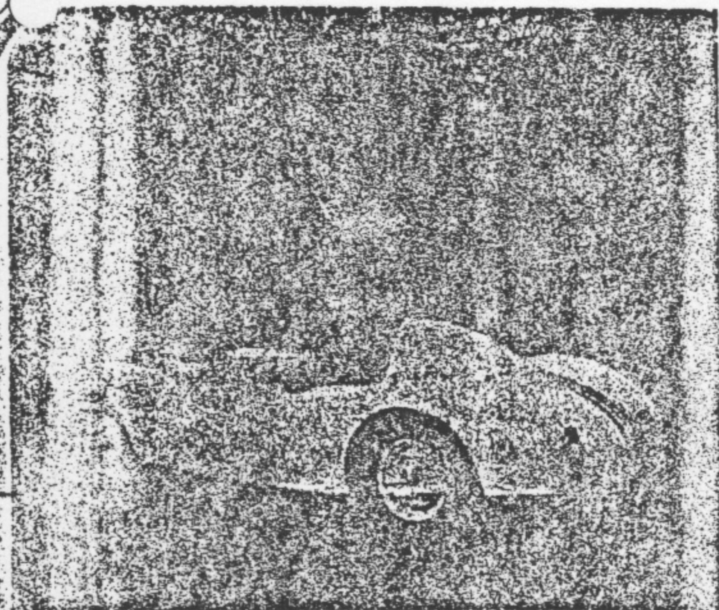
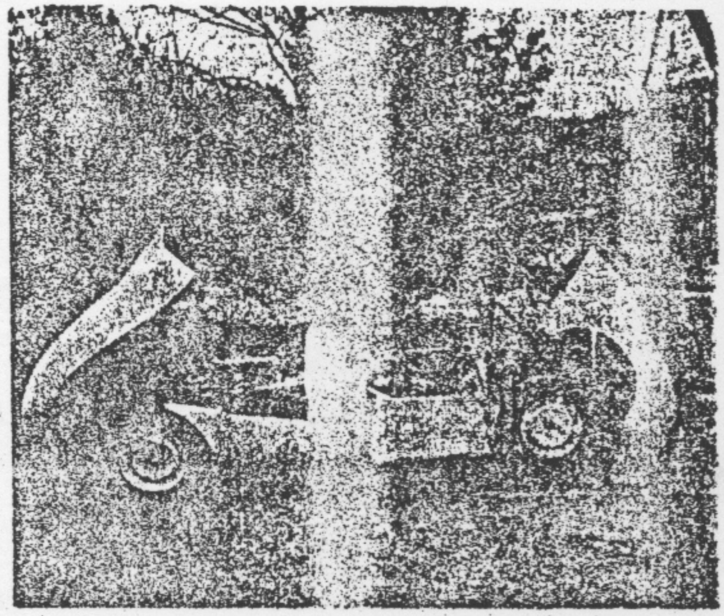
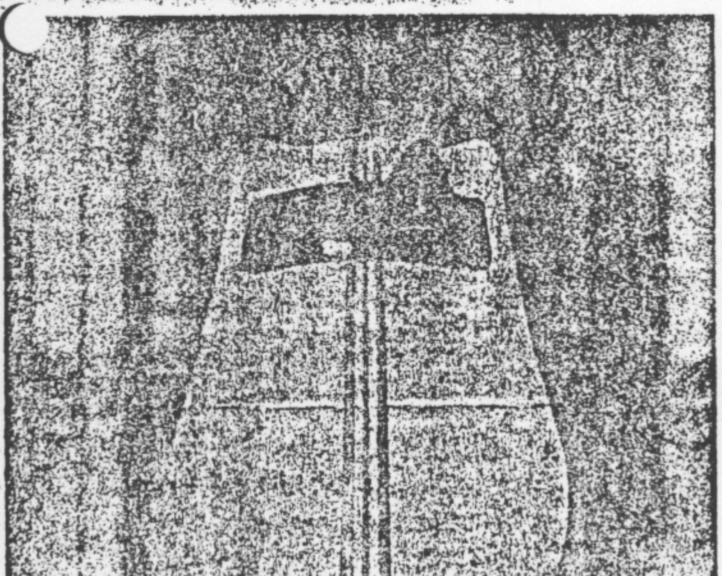
JABRO JR.



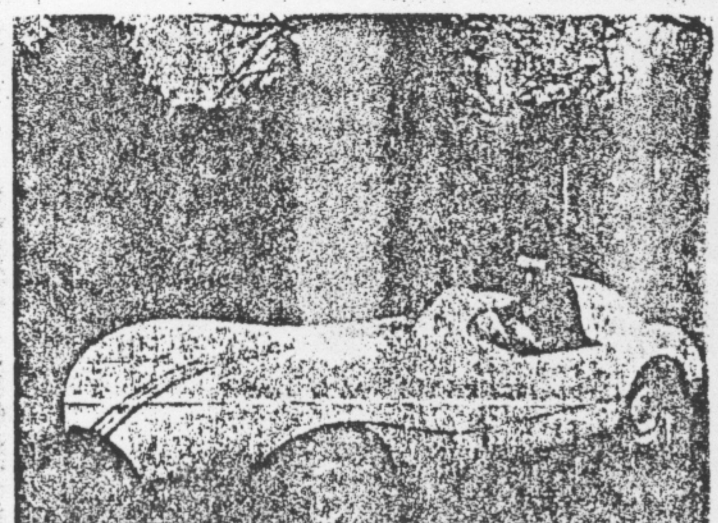
MORE CURVES THAN MARILYN
AND JUST AS FUNCTIONAL !



COMPLETE ACCESSIBILITY !



LONG & LOW ----



READY TO GO !!

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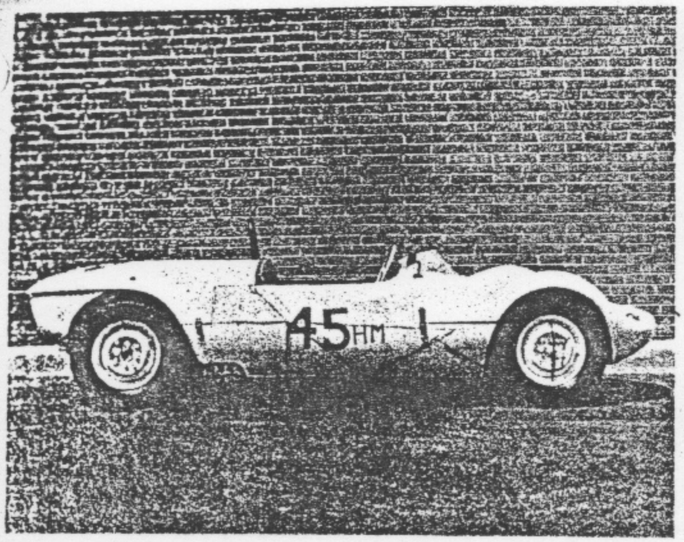


Photo by Bob Hegge.

MK. IV (Rear Engine) Side View showing clean low lines. Small size can be realized from 12-5.20 wheels!

Photo by Bob Hegge.

MK. IV Rear View shown with center steer - car can be also built with left or right steering!

IV
645
125
135
30
100
850
100
50
100
2185

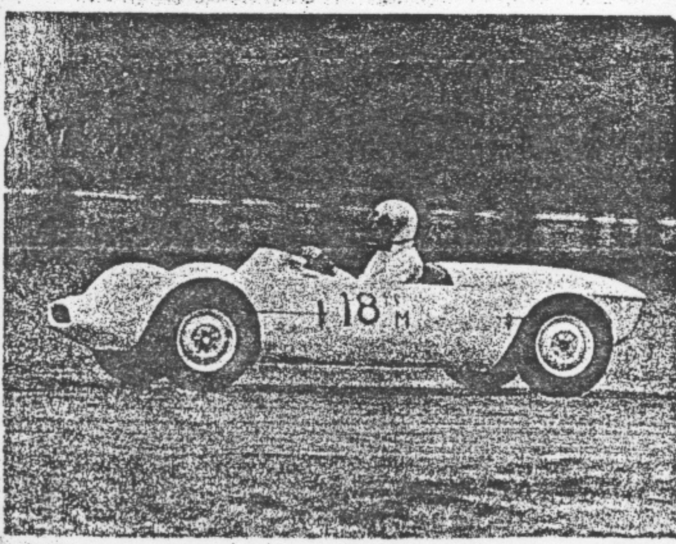
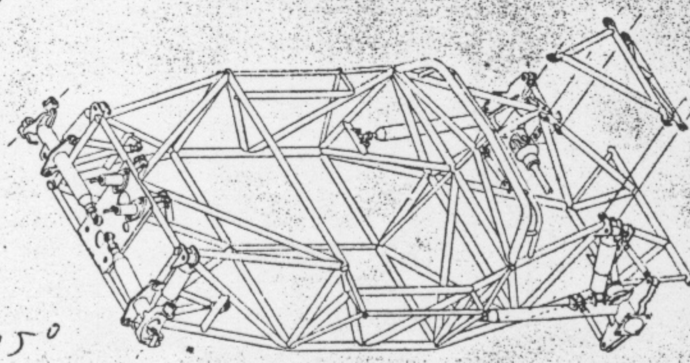


Photo by Action Ltd.

MK. IV built by Ed Alsbury (6' 3" tall) at speed -- Lawrenceville, Ill.



750
65

Drawing by Curt Poulton.

MK. IV chassis, note Pyramidal side construction for maximum strength at cockpit area.

MK. IV SPECIFICATIONS

Wheelbase....................	81"	Body length O.A..........	130"
Tread, front.................	44"	Weight, Approx...........	750 lbs.
Tread, rear..................	44"	Tires, front.............	5.20 x 12
Height at cowl...............	26"	Tires, rear..............	520 x 12
Body width...................	52½"	Top speed (750 c.c.).....	115 +

MK. IV Chassis based on Fiat components, any engine can be used.

JABRO SPORTS—RACING *750 mk III*

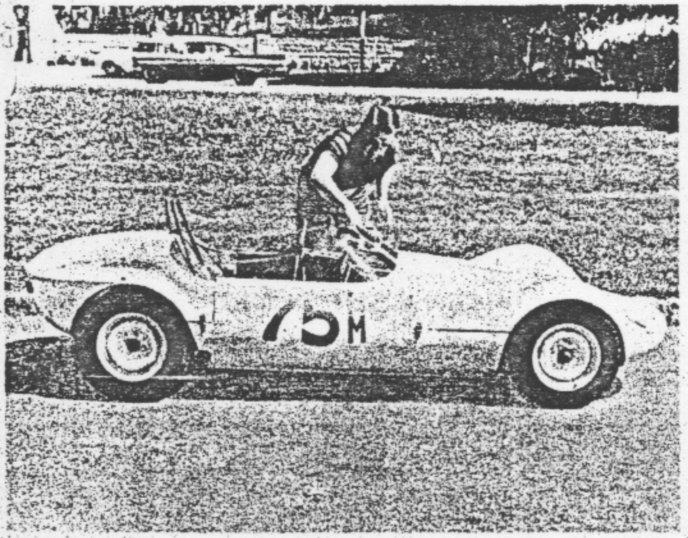


Photo by Bob Hegge.

MK. III (front engine) showing clean low lines - car is only 25" high at base of windshield.

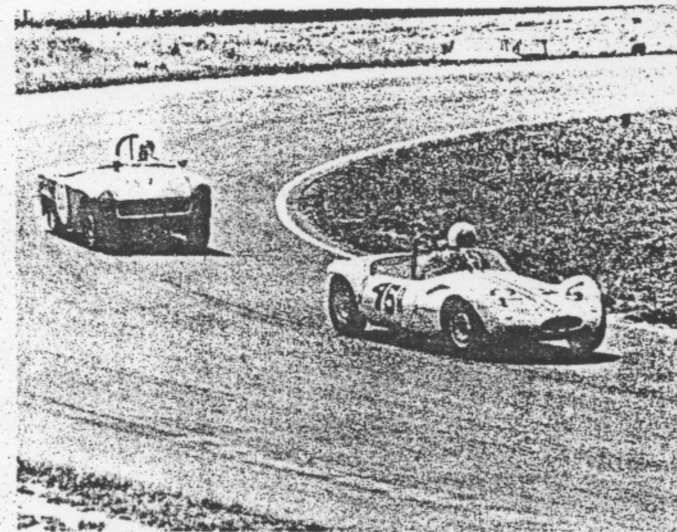


Photo by Action Ltd.

MK. III at Indianapolis. Corners flat, "Like on Rails."

Photo by Action Ltd.

MK. III at Wilmont, Wisconsin - Note four wheel drift.

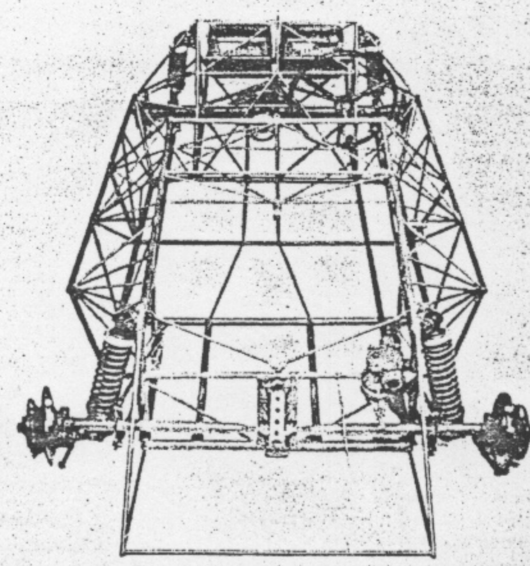


Photo by Bob Hegge.

MK. III "birdcage" chassis - small tubes are only 3/8" Dia.

MK. III SPECIFICATIONS

Wheelbase..........................	84"	Body length O.A.........	132"
Tread, front.......................	46"	Weight, Approx..........	750 lbs.
Tread, rear........................	44"	Tires, front............	4.50x 12
Height at cowl.....................	25"	Tires, rear.............	5.20x 12
Body width.........................	52½"	Top speed (750 c.c.)....	115 +

MK. III Chassis based on Crosley components, any engine can be used.