TUNING and MODIFYING THE FIAT 600 ENGINE

RICH MOTORS
FIAT 888 cc SEDAN

TUNING and MODIFYING THE FIAT 600 ENGINE

BY

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Although this material was originally prepared to assist Abarth owners and enthusiasts in the preparation of their cars for racing, we hope that much of the information here will also be of benefit to the many Fiat 600 owners who have (basically at least) the same power plant in their cars and who have as much to gain from the addition of Abarth speed and modification equipment.

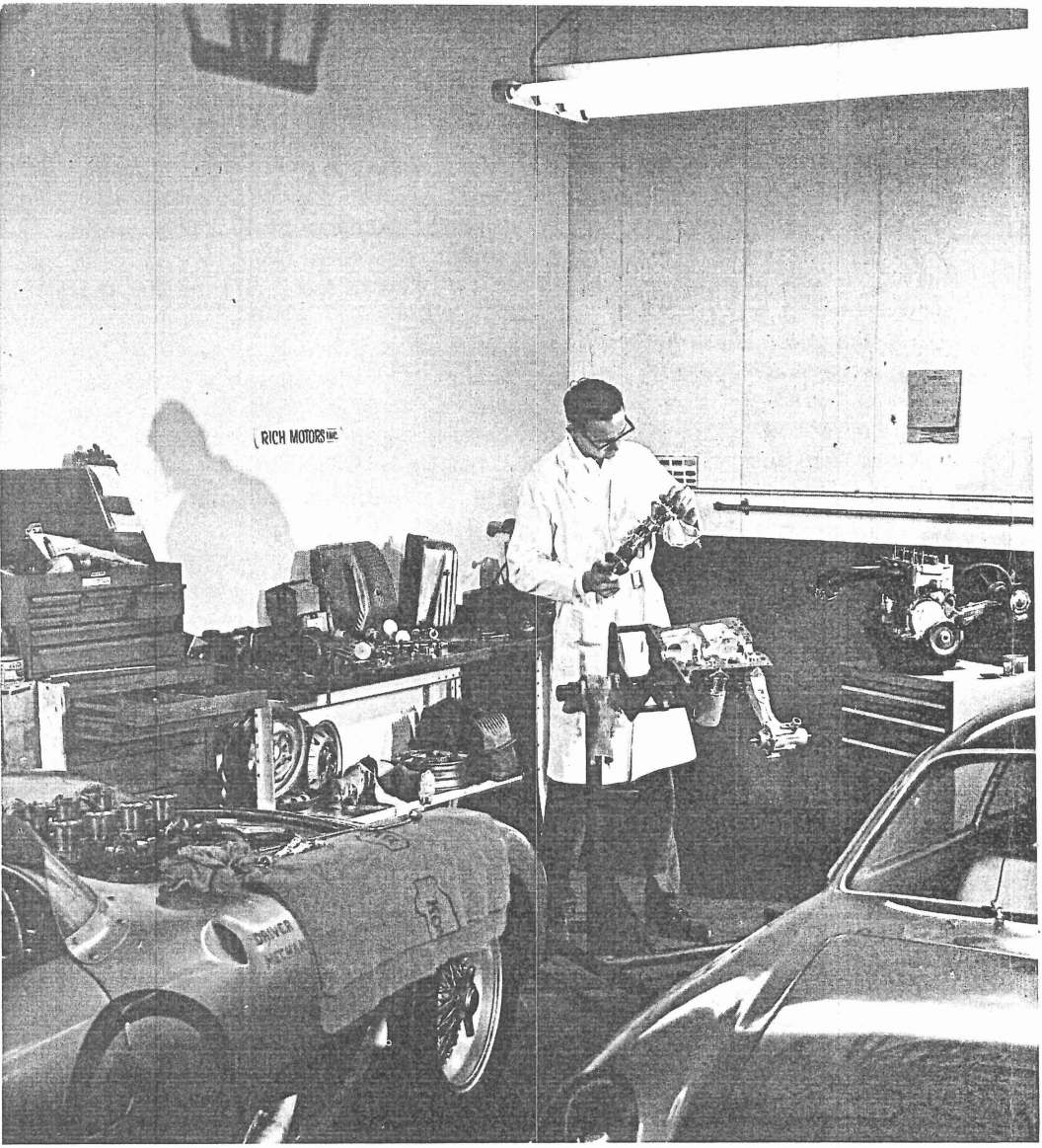
While there are other and newer types of Abarth engines based on the very successful Fiat 600-D, the most numerous and by far the most popular versions have been the push-rod 750 and 850 cc types. Since there are over a dozen versions of the popular 750 model alone, it would be impossible to catalog them all in detail. For the most part we will elaborate only upon the more significant and important phases of engine modification and tuning of the 600 engine.

Basically, an Abarth engine consists of a regular Fiat 600 cylinder block which has been modified to accept a crankshaft with a longer stroke and a special cam with larger lobes. These special parts which are supplied to Abarth by "Gianini" of Rome together with larger pistons of higher compression are the only components, internally at least, that are not basically of Fiat origin.

The regular 600 cylinder head is also used on the Abarth and except for the substitution of different valves and springs is practically the same. However, the ports have been polished and the bolt holes for attaching it to the block have been enlarged from 8 to 10 mm. This is very necessary, since the compression ratio in most cases is 9.8:1. These special head bolts have a 10 x 1.25 mm thread and it is very important that they be torqued to 38 ft. lbs. It should be remembered that this is more than a 600 is normally torqued.

While it is no longer a practical undertaking monetarily, in view of the newer and better equipment presently available at far less cost, it is still possible to modify and convert any Fiat 600 to 750 cc or 850 cc. All that is required is the necessary parts and the reboring of the block to at least 61 mm. The installation of the special 64 mm crankshaft requires little modification, except that the tappet holes in the block will have to be counterbored .040" and the center cam bush will have to be notched in order to allow the installation of the Abarth cam. The cylinder head and block will have to be drilled and tapped for the larger bolts as already mentioned. The clutch springs will also have to be replaced to handle the added power. This, and the addition of the special induction and exhaust systems supplied by Abarth completes the transformation.

All early 600 blocks can be bored to a maximum of 62.5 mm. While they make nice 750 engines they should not be used with the 850 69 mm



1. Before attempting a major engine modification the purpose for which the car is intended should be carefully thought out, as the existing gears and other considerations may not be suitable.

crankshaft, as they will then require too great a modification to be a practical undertaking, although a great deal of this is still being done.

Engines with crank strokes of 69 and 74 mm should be built from the later type 600 'D' block, since these blocks require little or no modification at all for the camshaft and only minor relief for the larger 74 mm stroke of the 1000 crank. An added advantage of the 600 'D' block is that they can be bored to a maximum of 65 mm. This is a very important consideration in itself and should be taken advantage of whether the engine is to have a 64, 69, or 74 mm crankshaft. Pistons of 64 and 65 mm are readily available for any of these strokes.

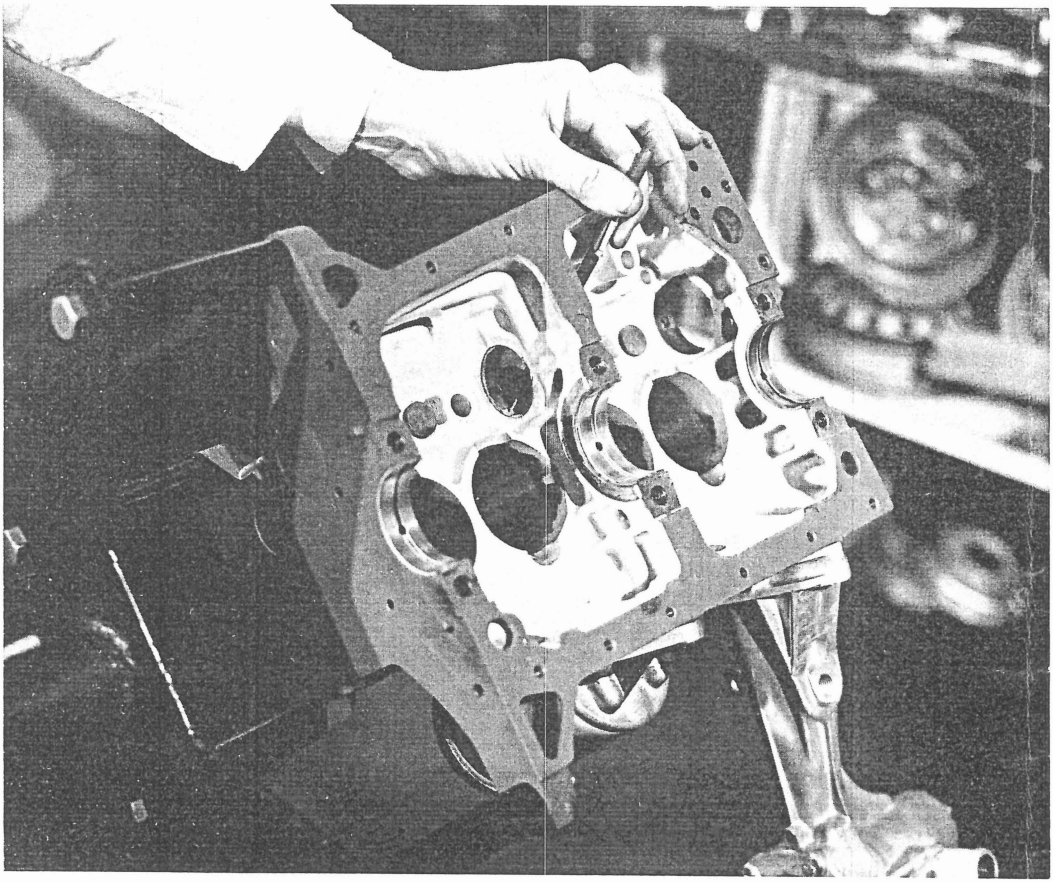
Since assembly procedures, tolerances and torque specifications for the Abarth are the same as for the Fiat 600, differing only in the head bolt torque, Abarth owners should have no difficulty at all in preparing their own engine. A very important consideration, however, is in the piston clearance and piston pin fit. Rod and main bearings should also be given special attention and should always be checked with "Plasti-gage" No. 1. Piston clearance should not be more than 4/1000" and not less than 2.5/1000" for engines prepared for racing. Pin fit of the rod should not be less than 2/10ths. of 1/1000 in. and the pin should not be driven in or out of the piston cold, as this will distort the piston and affect the clearance. Pin to piston should be an interference fit at room temperature and a press fit at approximately 176 degrees F.

Main journals should have a clearance of 1.5/1000 to 3/1000 in. and the rod journals, 1/1000 to 2/1000 in. End float of the crank can be adjusted by thrust washers at the center main and should range within .0102". Oversize thrust washers are available if clearance is greater (but these are rarely required.)

It is important to remember that piston size for Abarth engines given as 61, 62 or 64 mm is an expression of bore size or diameter. It does not indicate the actual size of the piston itself which actually would be somewhat smaller. Borgo pistons which are original equipment in all Abarth cars, will have the factory recommended clearance stamped on the piston crown, along with the bore size and weight code. A stock number will also be found and in most cases will be helpful in identifying the engine model or type. For example:

3608
61
8 B

is a piston for a 61 mm bore with a recommended clearance of 0.0800 mm. The remaining four digit number is the application or stock number and the letter within a box is the weight class which should be quoted whenever a single piston is being ordered.



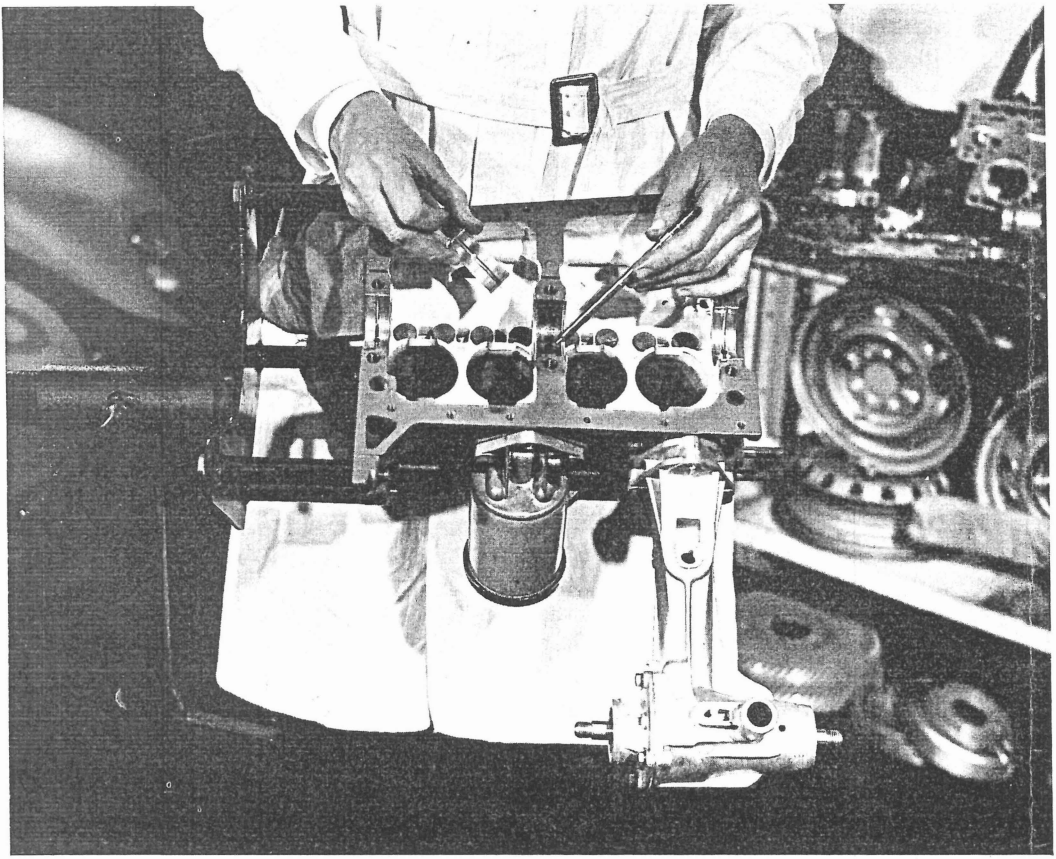
2. The camshaft is of particular importance and if an Abarth cam is selected to be used in an early block, a modification to the center cam bush will be necessary as well as the counterboring of the tappet holes to allow for the larger lobes.

Engines assembled with new pistons and rings should not be broken in with racing or detergent oil. The bores should actually be left slightly rough by honing lightly with a 120 grit stone. This is of utmost importance. Unless the ringing-in is properly carried out, all the labor will be of no avail as engines that fail to ring in will usually have to be done over completely.

Normally, a 750 Abarth engine should read approximately 180 to 200 lbs. on a compression gauge, with throttle open. While this is sufficient for a street machine, it is necessary to have at least 230 lbs. for a good competition engine. Raising the compression ratio is the easiest way to obtain added performance, however it is not always advisable to obtain this by re-surfacing the cylinder head. A fully modified cylinder head can easily cost more than a good block and should not be re-surfaced, unless absolutely necessary to correct a warped condition. Although more labor is involved, it is better to remove the necessary amount off the block and to modify the pistons to suit. How much to remove can be calculated by determining how much the cylinder head chamber holds in relation to the displacement of the bore. It should actually be cc'd physically with the pistons in the block as the dome of the piston interferes with purely paper calculations. A regular 600 cylinder head of the early type has a chamber of approximately 20 cc. The later type, or 600 'D' head, displaces approximately 22 cc. Cylinder heads that have had the largest inlet valves installed will in most cases displace as much as 30 cc. The area around the inlet valve is naturally removed for better flow with a consequent increase of chamber displacement. This should always be taken into consideration when the large valve cylinder heads are used so that necessary measures can be taken to prevent the compression ratio from falling below 9.1 x 1. The compressed thickness of the cylinder head gasket should be included in the calculation. This is approximately .040" for the regular copper composition Abarth head gasket. There is also a special thin copper gasket which will raise compression .5 point.

All 750 engines are identical in every respect except in the case of the "Derivazion" sedan and the "Sestrierre" model of the Zagato coupe. These are de-tuned versions with lower compression (9.1). These two types and the 750-GT type 149 all have the smaller valve sizes of the early 600 Fiat. Later engines beginning with type 150 have the larger valves of the later 600's. The induction system of all Abarths is very much restricted and larger valves of up to 1⅛" (for the inlet at least) should be substituted in every case as a performance increase of 20% can be obtained from this modification alone.

Valve sizes for the earlier engines were 24 and 22 mm. Later engines, beginning with the "Mille Miglia" or type 150, and all later models including the 850's come with the slightly bigger 26 and 24 mm valves.



3. An oil hole at the center main is not ordinarily provided except in very early blocks. This hole is no longer necessary but can be provided if desired. The proper inserts to use for blocks with oil holes at the center main is Vandervell No. VP 348 for all crankshafts with 2″ main journals.

Abarth valve springs come in varieties of 34, 43, and 50 kg measured at a compressed height of 1.25″. Special inner springs have also been used and are very desirable. These inner springs measure 29 kg and work best when used with the regular Fiat 600 outer spring of 24 kg which gives a total spring pressure of 53 kg.

All cylinder heads are interchangeable as are the head gaskets regardless of bore size. Any cylinder head can be reworked to accept the large inlet seats and valves as shown in the photos. When substituting the late 'D' type cylinder head it is also necessary to substitute the complete rocker arm assembly as a small but important change was made here.

When cylinder heads are installed on an engine they should be torqued at least twice during the break in period and a third time would not be too many. All this should be done when the engine is completely cold.

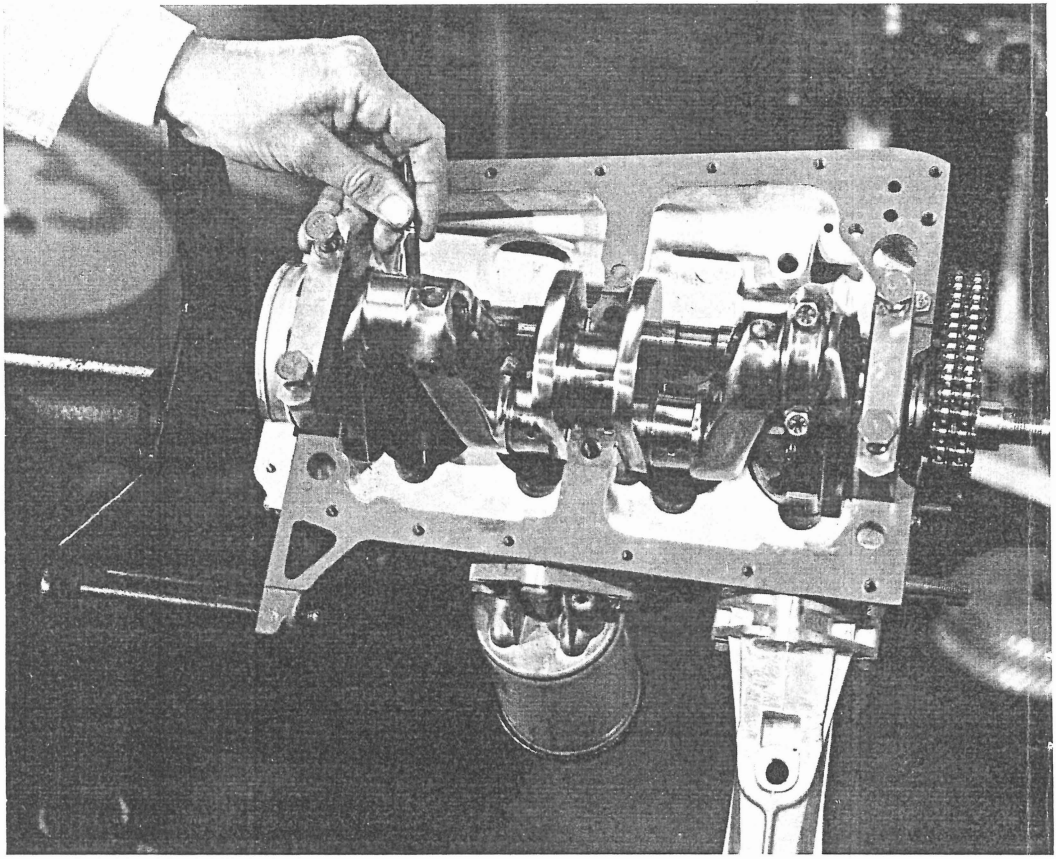
To convert a 750 or 600 to an 850 it will be necessary in most cases to linebore the block for larger (2.123″) main bearings and thrust washers as the 850 or 69 mm crankshafts have had both the rod and main journals increased in size. In addition to different inserts these cranks will also require different rods which are not interchangeable with the earlier type found in the 750's.

When installing 69 mm cranks it will also be necessary, in most cases, to modify the piston skirts in order to provide clearance for the counterweights of the crank. This, of course, should always be done before the crankshaft and piston assembly is to be balanced.

850 engines actually have only 833 cc in standard versions of 62x69 mm. The Super versions of slightly more compression are actually 847 cc engines with a configuration of 62.5x69 mm.

A later type 850 engine can be obtained in short block form from Rich Motors. These will have a perfectly square and decidedly better bore and stroke configuration of 64x64 mm and 823 cc. These engines can be revved higher with more reliability due to the extremely short stroke and greater piston area and are more than a match for the original long stroke versions in spite of their 24 cc advantage. Another feature of the newer 850 or 823 cc engines is that they can be bored another .40/1000 in. if necessary, while the earlier engines with 62.5 mm bores cannot be re-bored at all. Best of all, these new short blocks come completely assembled with a high capacity oil pump and an aluminum oil sump ready to race for only $395.00, which is less than the price of a complete overhaul on the old 750 model alone!

While the Abarth engine may be found in a bewildering variety of body styles and engine types, one thing they all share in the push-rod version is the camshaft, which is the same in all models. The Abarth cam is considered the ultimate compromise between low end torque and top end power. These camshafts may be marked or finished differently but all have the same lift



4. When 69 mm or 850 cranks are installed in 750 or early 600 blocks a great deal of relief is necessary for the rods to clear. This relief is necessary on both sides as can be seen in the next photo.

and duration: 6 mm (.250″) at the lobes (9 mm at the valves, hot) and timing of 30/70 x 70/30.

For special application and particularly when bigger valves are used, we recommend the "E1" or "E2" grind as they are extremely durable. John Rich, who has had a hand in testing and grinding more cams for the Abarth than any one else on the American scene, can supply proven grinds of different characteristics for special application in big engines with big valves. These grinds, particularly the "E" series, have undergone extensive flow tests. When matched with the cylinder head and valves that they have been developed with, they give far more power than is normally obtained with the stock Abarth cam, but of course they must be wound up to at least 7200 RPM.

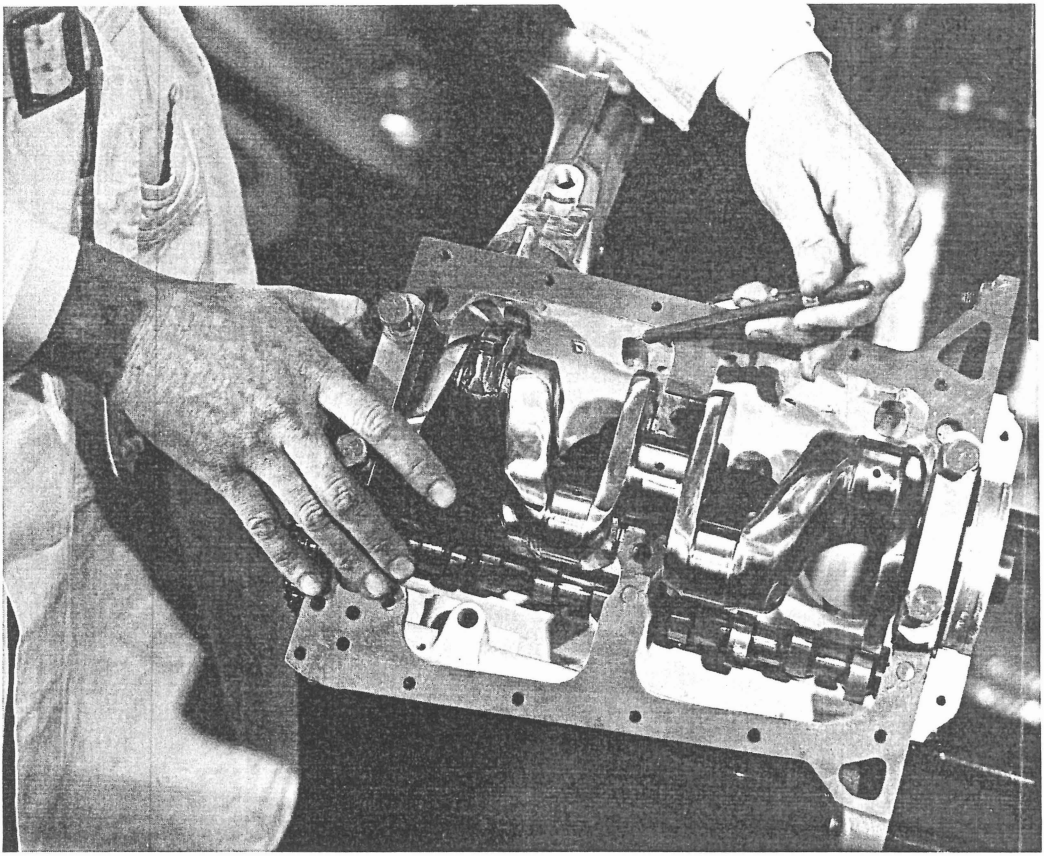
Reground cams for the Abarth will require shortened rocker arm towers, as the modified lobes allow the push rods to become too short. To correct this, .045″ should be taken off the bottom of the rocker arm towers, then the valves can be adjusted without too much of the adjusting screw being exposed below the rocker arm. This extension of the rocker arm adjusting screw below the rocker arm is a frequent cause of breakage even with an Abarth cam. This modification to the towers should be done to all engines.

Valve clearance for all engines is 8/1000 in. cold and 10/1000 in. hot, and for no reason should the clearance be varied as performance can be adversely affected.

All engines prepared for racing should be equipped with a high capacity oil pump and the special 6 qt. aluminum oil sump which is baffled to prevent surge. The purpose of these special, and very necessary, parts is to control the very high oil temperature which will shorten crank and cam life in the Abarth. An Abarth that is raced without these two components will not last a season. These parts are legally allowed in production racing while an oil cooler is not. Therefore, every effort should be made to fit these parts. The specially baffled and finned sump can be seen in the photos and the special oil pump shown has larger gears (25 mm in height) which gives 20% more volume. The gears in the stock oil pump supplied in the Abarth are those of the regular 600 and measure only 20 mm in height.

Additional cooling can also be obtained by the use of an auxiliary radiator which is fitted under the car. This too is allowed in production racing and the unit will also fit under any 600 sedan.

Lubrication for a racing Abarth should consist of a 50/50 blend of 30 and 40 wt. de-gummed castor bean oil. It can be used over and over again if allowed to settle after draining and strained through a clean silk or nylon stocking. This oil can be obtained from the Abarth Parts Distributor in five



5. All 69 mm cranks will require that the piston skirts also be modified to clear the crankshaft counterweights. This of course should be done before the crankshaft and piston assembly is to be balanced.

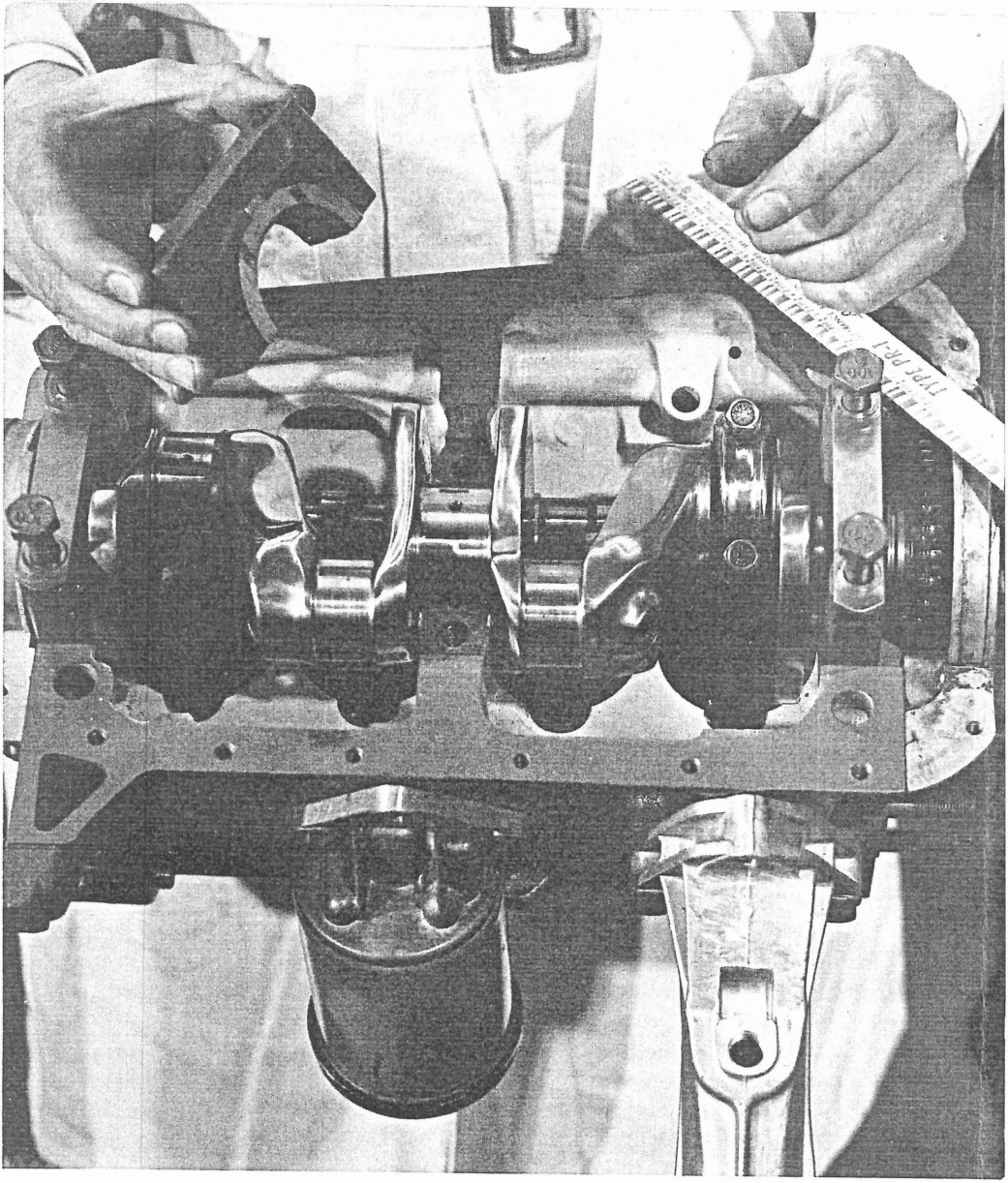
gallon tins where other special lubricants, fuels and even superchargers and special carburetors can also be had.

With the bottom end protected by adequate lubrication and a sound crankshaft, there is but one more consideration in the preparation of a successful Abarth; this is the cylinder head sealing which has always been a problem mainly because of inadequate cooling and improper and infrequent head torquing. Before installing a perfectly sound engine in a car, the radiator should be removed if it has been in service for 10,000 or more miles. The core should be freed from the tanks to be thoroughly rodded out. This attention to the cooling system and frequent torquing of the cylinder head bolts is the best insurance against blown head gaskets. Another operation which is necessary to prevent blown head gaskets in engines with extreme compression is the addition of special copper o-rings to be fitted in grooves around the circle of the bores. This should be done after the block has been bored to its maximum. The grooves should be cut .020″ deep and filled with .040″ copper wire and used only in conjunction with the regular copper composition Abarth head gasket, as it will not seal with any other material. A view of this operation can be seen in photo number 9.

A tune up normally begins with a compression check and a battery and polarity test. On an Abarth, however, it begins at the distributor shaft bush. It must always be inspected for excessive wear before any tuning is attempted. To check for excessive wear in the distributor, remove the cap and rotor. With the points in the open position, observe the gap as you wobble the shaft about. The body of the distributor must be held firmly with the other hand. If the slop is excessive the shaft should be replaced and the distributor body rebushed by a machinist. The distributor shaft to body clearance should be no more than 2/1000 in.

All pushrod Abarths have the same distributor as found on the Fiat 600. They are in most respects identical, although there is an early and late type. However, this has no bearing on tuning as the operation is in all cases the same.

To improve engine performance at part throttle, a vacuum advance mechanism is incorporated to operate in conjunction with the regular flyweight advance mechanism already built into the distributor. This device is operated by the vacuum promoted beneath the throttle butterfly in the carburetor by engine suction. The vacuum hole in the carburetor is drilled immediately next and directly above the idle speed mixture control air bleed set screw. Because of this arrangement, the manifold vacuum cannot act on the advance control during idle speed as the throttle butterfly when closed will be below the vacuum hole. When the throttle is opened, even the slightest amount, the butterfly will then be located above this vacuum hole and the



6. Crankshaft clearance at the center main is critical and should always be checked. Too much clearance or an out of round condition will cause a drop in oil pressure when hot.

diaphragm operated vacuum advance mechanism will then overcome the load of the reactionary springs of the centrifugal advance mechanism in the distributor. In this way an additional 11 degrees of advance is obtained over the original 8 degrees set in assembly. When the throttle is opened a further amount, manifold vacuum will decrease with a consequent reduction in advance until the diaphram returns to rest. Since the engine r.p.m. has gone up, the centrifugal advance mechanism will have already taken over and will reach a maximum value of 30 degrees.

Early type diaphram advance correctors gave 11 degrees of advance but a later type (part #4072073) can be had, which gives 13 degrees. This later type, however, will not adapt to the early distributors as the whole mechanism has been redesigned for better results. The part number of the latest distributor is 4075355, and should it become necessary to substitute distributors, it must be remembered that there are three different lengths of oil pump to distributor drive shafts. The correct one must always be selected, or complications will arise with the tachometer gearbox of the Abarths (which is located between the engine and distributor).

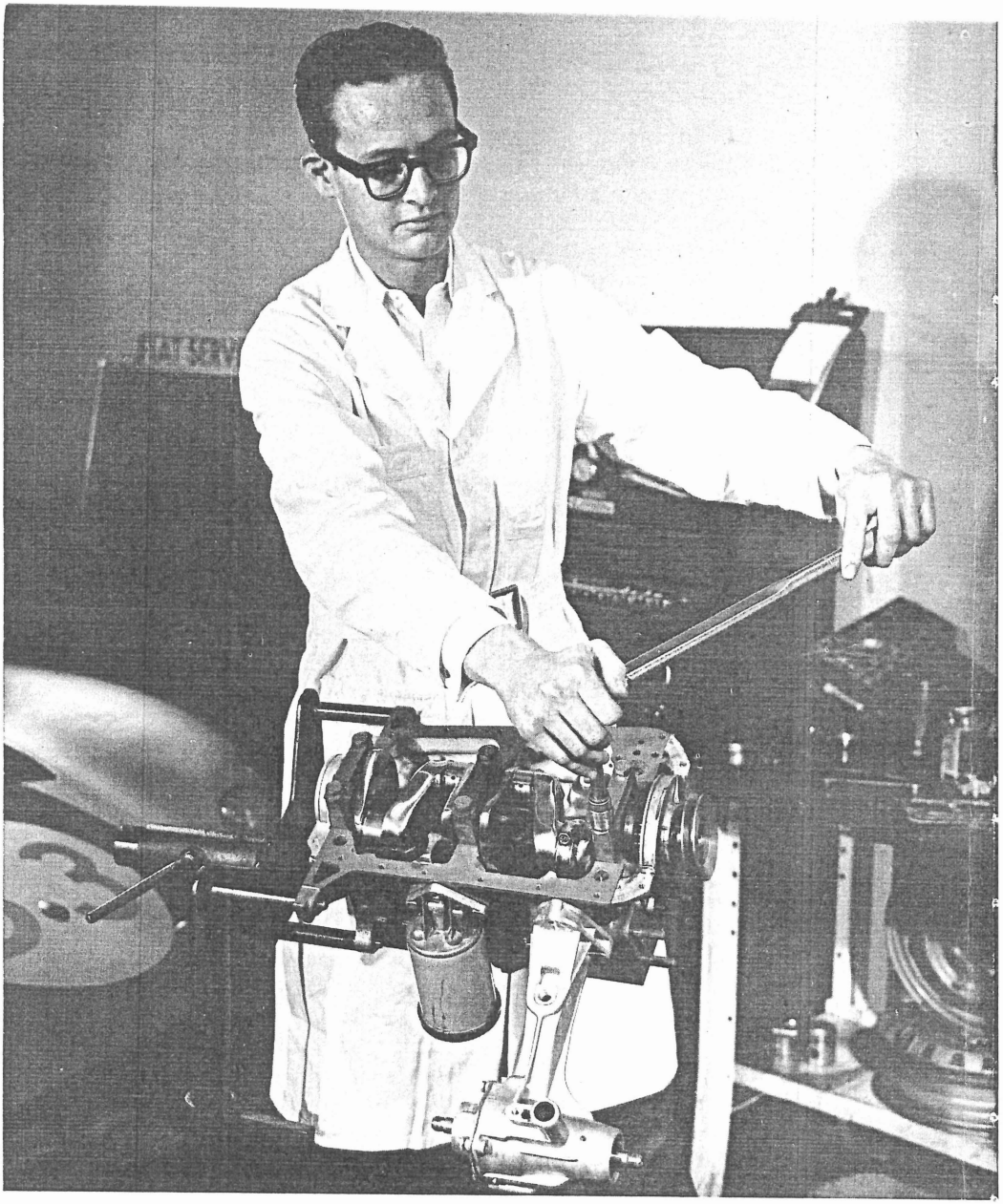
Selection of the proper drive shaft for a given distributor can be determined by engine number and reference to a Fiat 600 parts manuel which lists the various lengths and the distributors they are for.

An engine that is normally in good tune, but which suddenly develops ignition faults can usually be corrected by substitution of the later nylon condenser terminal insulator. This is located on the side of the distributor body. An early type insulator was made of a black material in which unseen cracks would develop, causing the condenser to be blamed.

Ordinarily, the ignition system on the Abarth will give little trouble as long as the center bush is not excessively worn and the centrifugal weight springs are not weak. Just the same, an Abarth owner should avail himself of a Fiat Factory Service Manual for the 600 so that he may periodically give the ignition system a thorough check out on the bench. This Service Manual completely covers such an operation, and sells for only $15.00.

Abarth owners that have modified their engines with compression ratios in excess of 10.1 will have difficulty in finding spark plugs in the proper heat range and reach. In most cases, however, this problem can be corrected with Champion chain saw plugs number HO 3.

Timing of the engine in the car is best accomplished with a timing light or with the special tools supplied by the Fiat factory and obtainable through a Fiat dealer. The best static timing equipment is service tool number A95654 which is threaded into number one plug hole and will indicate T.D.C. on a gauge to give a very accurate reading. This same tool can be used on any Fiat, helpful in other phases of tuning. A less expensive, but



7. Service manager Rod Taylor prepares a special engine for a racing enthusiast. This is an early engine being converted to 850 cc.

still very practical, tool is tester plate number AP5030/2 for the early cars and tester plate number AP5030/6 for the later 600 "D". These tools are inserted in the square hole of the rear engine mount and work in conjunction with the markings on the crankshaft pulley. This gives a static timing, which in all cases should be 8 to 10 degrees B.T.D.C.

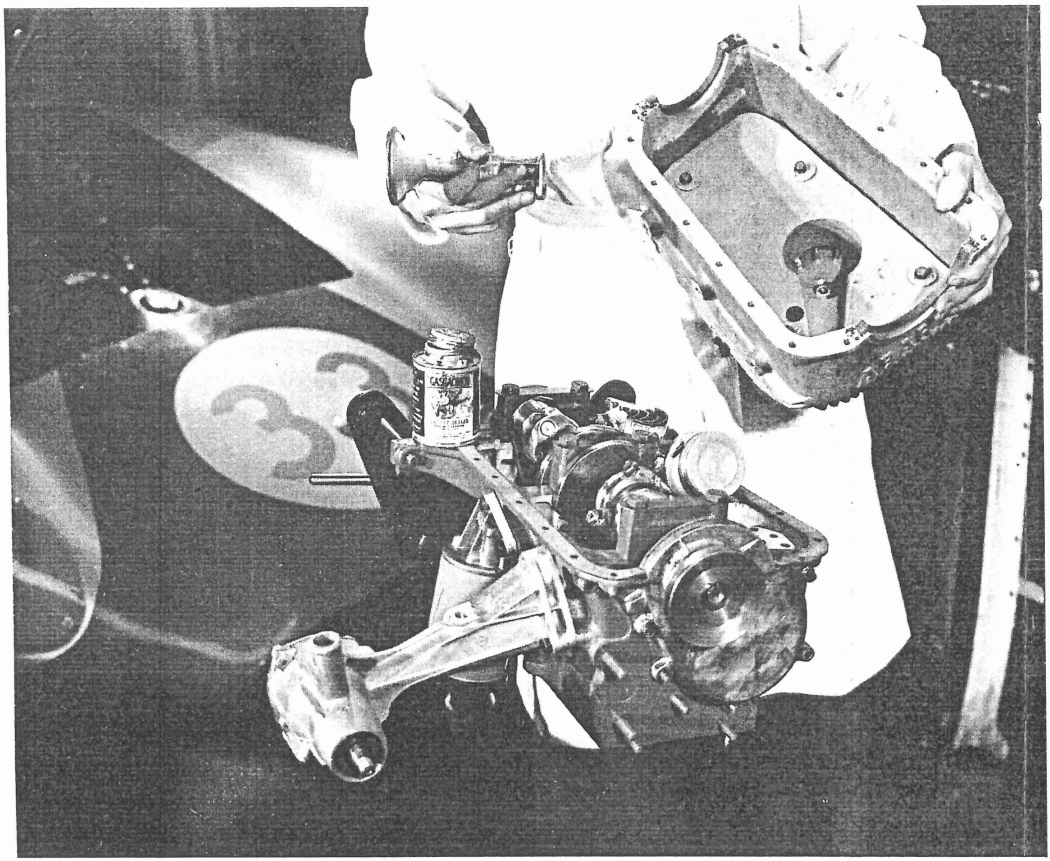
For easier timing of an Abarth the latest type distributor locking plate should be substituted on the earlier cars. This plate is adjutsed by means of a screw that is far more accessible than those on the earlier models and makes timing a far more simple operation. The later type tachometer drive assembly must also be substituted with this later type adjusting plate. This should be done anyway as tachometer gears for the early Abarth tach drive are no longer available.

Carburetors on the Abarth will rarely need attention as they are remarkably simple and reliable and in most cases come properly jetted. The needle and seat in the float chamber may sometimes need replacing. However, it is rarely that a carburetor will need major service. The 750 engines all came with a 32 IMPE Weber which should have a .175 needle and seat and the float level set at 9 mm measured in the usual manner (by turning the carburetor cover vertically and with gasket in place measuring between the float and cover gasket).

Weber carburetors on the 750 engines usually have a 22 mm venturi with which it performs best. Solex carburetor number 32 PBIC which are found on most 850 engines are supplied with a larger 24 mm venturi.

It does happen that the original jetting of the carburetor is not adequate and when it is necessary to replace jets the following rule of thumb should be observed.

The main jet which should be our first consideration should always be selected after the proper venturi size has first been established. For best results a venturi of a size slightly smaller than we plan to use should be selected for testing. After the venturi size has been determined, its multiplication by five will give us the approximate minimum main jet requirement. While it may be necessary to experiment with larger main jets we now know that we need not experiment with smaller jets, as plug readings alone will show that we have begun at the lean end of the scale. After the main jet has been selected which should be slightly larger than calculated, the proper air correction jet can then be calculated by the addition of 60 to the main jet size; for example, if the venturi selected is 24 mm the minimum main jet size will be 120. The selection of the air correction jet follows with the addition of 60 to the 120 of the main jet size. Thus, the air correction jet should be 180.



8. An absolute necessity for the Abarth racing engine: the high capacity oil pump and oil sump which are made from aluminum and baffled to prevent surge. These parts are invaluable in providing adequate lubrication.

While most jetting problems can be corrected and determined in this way it must be remembered that this rule is purely theoretical and experimenting will still be necessary. Plug readings should be taken by "cutting clean" as is often practiced to determine if the mixture is either fat or lean at the top end. To lean out the mixture at the top end select a numerically higher air correction jet. To richen the mixture select a numerically lower one which will allow the emulsion of less air.

Tuning an Abarth does not end with attention merely to the engine. The selection and use of proper gears will also be essential for any real success with these cars, as gears offer a unique advantage, everything else being equal.

For this reason gear ratio charts for the Abarth transmission have been included in this book and the selection of proper gears should be considered as important as good carburetion and ignition.

All of the various ratios shown in the charts are still readily available even for the early type transmissions which can be identified by the hand brake location on the rear of the gearbox. Later cars which have had the hand brake relocated on the rear wheels, also have steel instead of aluminum brake shoes and a different braking system. They also have a different cluster and second gear in addition to a different pinion shaft which no longer is provided with provisions to accept a hand brake.

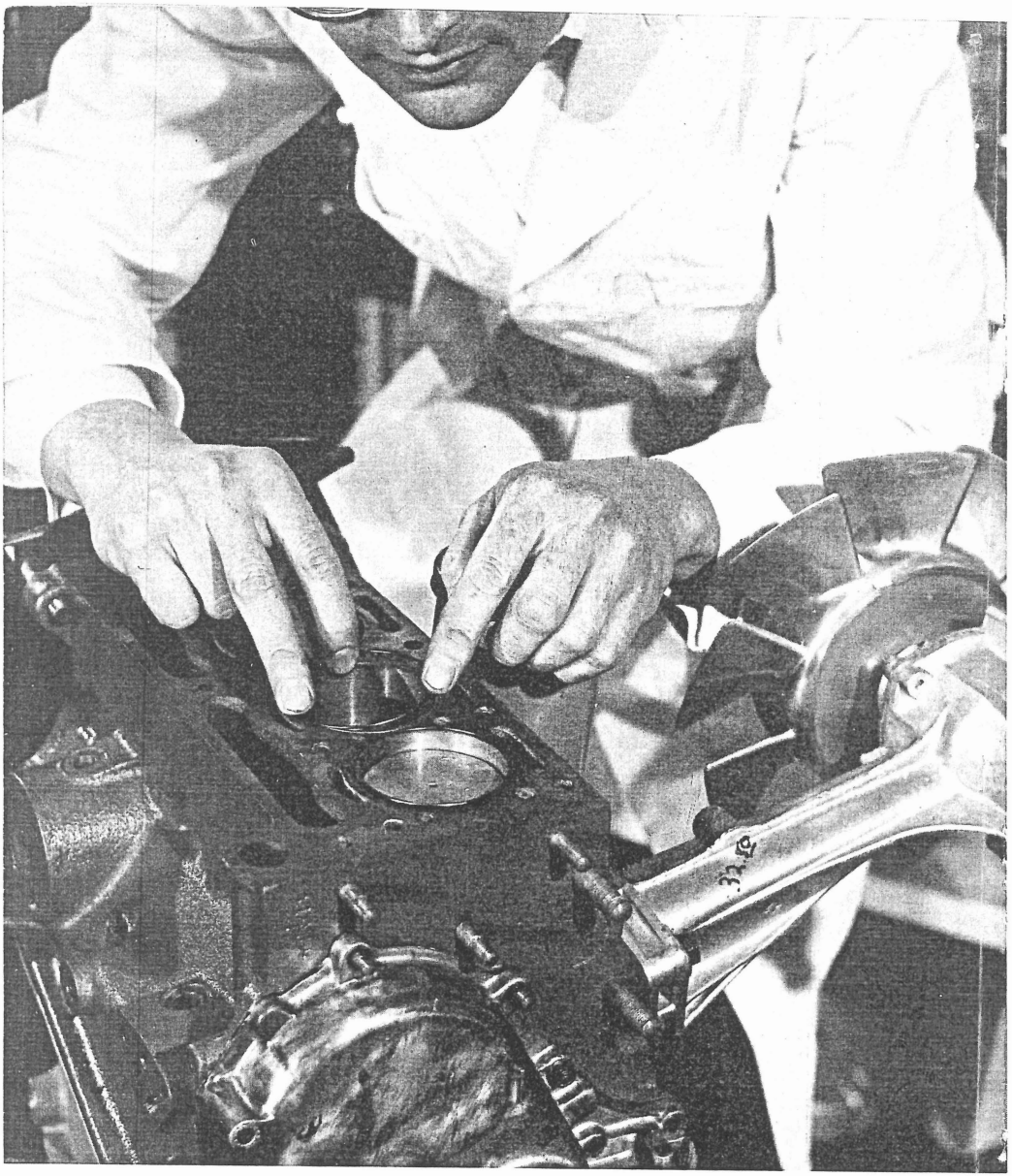
Late type gears can be made to fit into any early gearbox if the later type second speed wheel and gear selector are substituted along with their special locking nut and washer on the end of the cluster. A little grinding of the gearbox case will be necessary to provide clearance for the selector and unless the couple between the first motion shaft and the cluster is modified the later type couple will also have to be substituted.

Late gears for early gearboxes supplied by Rich Motors normally come complete with all necessary parts to make the conversion and can also be obtained separately as a kit which includes instructions.

In all cases of gear substitution or whenever the transmission is apart for repair, the first motion shaft should be checked to see that it is of the latest type which has a larger diameter than found in some early cars.

Most of the Zagato coupes purchased in this country from 1958 to 1960 were originally supplied with a 9/41 ring and pinion. Some were known to have an 8/39 as found in the "Sestrierre" model and the "Derivazion" 750 sedan. The twin-cam versions of the 750 engine were normally supplied with the 8/39 also. The later versions of the twin-cam with engines of 850 and 1000 cc come with a 9/31.

On the west coast where the 750 Abarth was raced with more success, the most popular gear was the 27/28 low 4th with either the 9/41 or 8/39



9. Engines with compression ratios in excess of 10:1 should have the special o-rings installed as shown —these rings are necessary on supercharger engines also.

ring and pinion depending on the length of straightaway. This combination gave maximum acceleration on extremely short courses and is satisfactory in most cases for speeds up to 85 and 90 m.p.h. The engines with these gears were usually wound to at least 7200 r.p.m.

While there are other pieces of equipment that will increase the performance of the Abarth such as disc brake assemblies, specially thin head gaskets, etc., this equipment at this writing is not legally allowed in 750 cc production racing. (This being the interest of most Abarth owners.)

Nevertheless, there are some minor changes that can be done to improve handling and insure reliability. One of these is the substitution of the rear shocks for double action and adjustable Gabriel units. This will help in preventing wheel lift as the result of roll in corners.

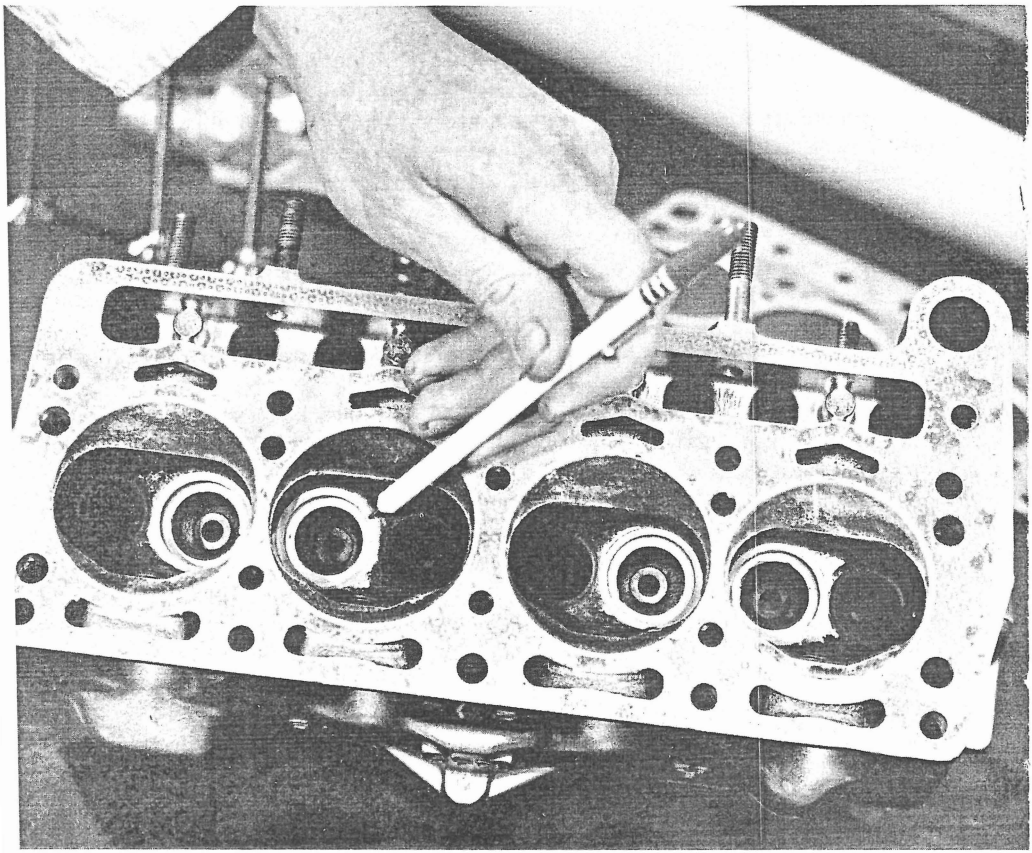
Another important consideration for racing is to keep on hand an extra rear panel from a 600 sedan. In the course of a racing weekend, it often happens that the rear of the car will get pranged which will usually cause the generator belt to fly off. This particular weakness of the Abarth is quite well known and drivers of other cars approaching from behind will sometimes disable an Abarth by pranging from the rear just enough to push the rear panel into the crankshaft pulley and cause the belt to come off. If this should happen on a Saturday, an Abarth owner could be sure to race again on Sunday if an extra panel is carried along as a spare.

It is not generally known but the Fiat 600 sedans can also be obtained with special Abarth engines and racing accessories that can compete very well with the lighter coupes and roadsters. Although Abarth, himself, has yet to put a 1000 engine in a sedan, John Rich in California has already converted several new 600 D's to 1000 cc that perform as well as a hot MGA.

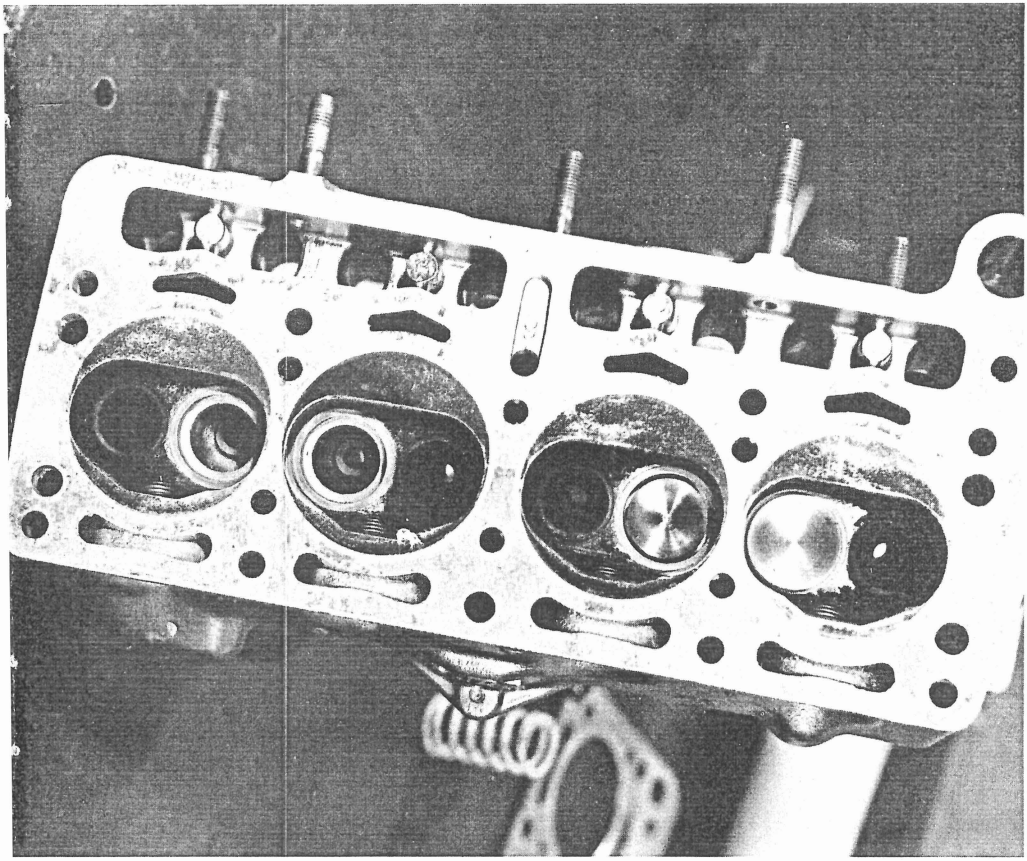
These sedans can also be obtained with special 888 cc engines which are bored out 850 TC's and are available with a complete instrument cluster similar to the Zagato. So if you don't have a special bodied coupe or roadster to race, don't forget the hot little sedans which also have a practical value.

In closing it should be remembered that the 750 and 850 Abarth as a production race car, will have to practice and race even before the women's race, due to its class! As practice sessions are usually too brief for any real tuning value, all work on the car should be done weeks before and the practice sessions given over completely to the driver along with the evaluation of competition. Preparing an Abarth at the last moment, at the track, can only lead to grief and unsatisfactory performance.

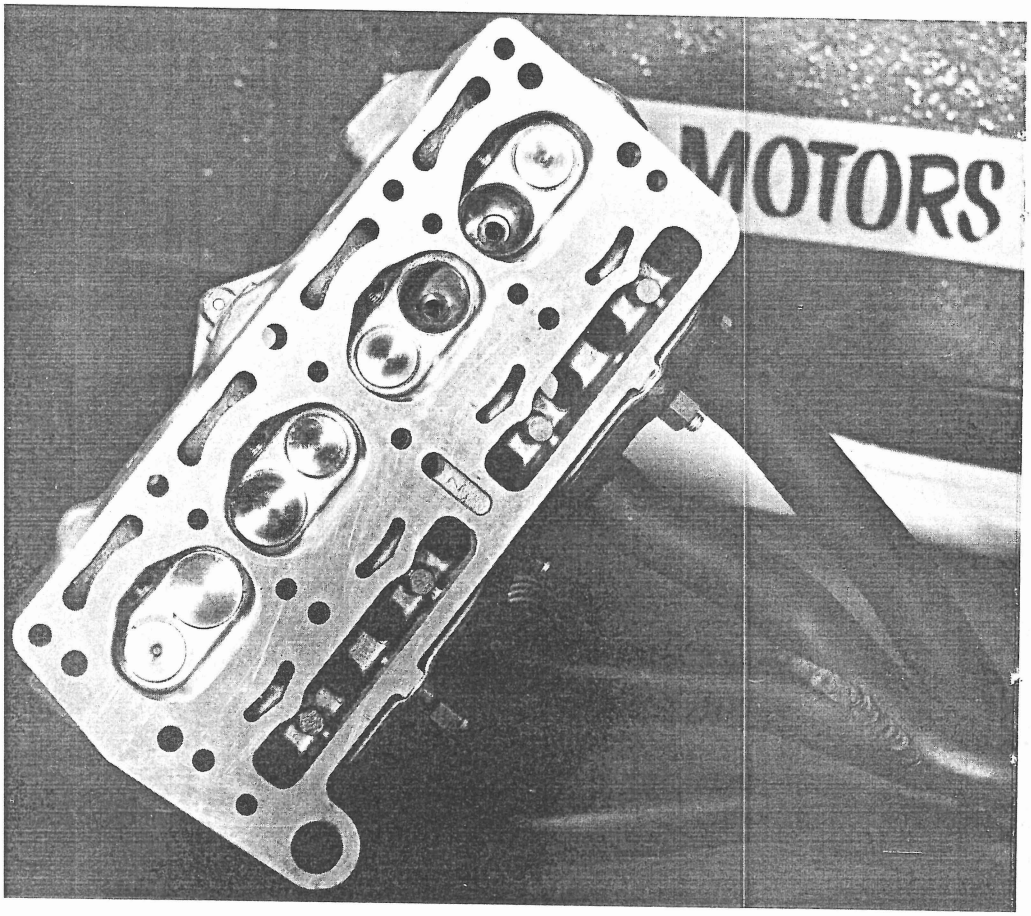
Enjoyment of the sport should be as important as winning and unless the car is brought to the track ready to race, there will be neither trophies nor satisfaction.



10. A late type cylinder head with inlet seats being modified to accept 1⅛″ valves. The white inner circle is material yet to be removed.

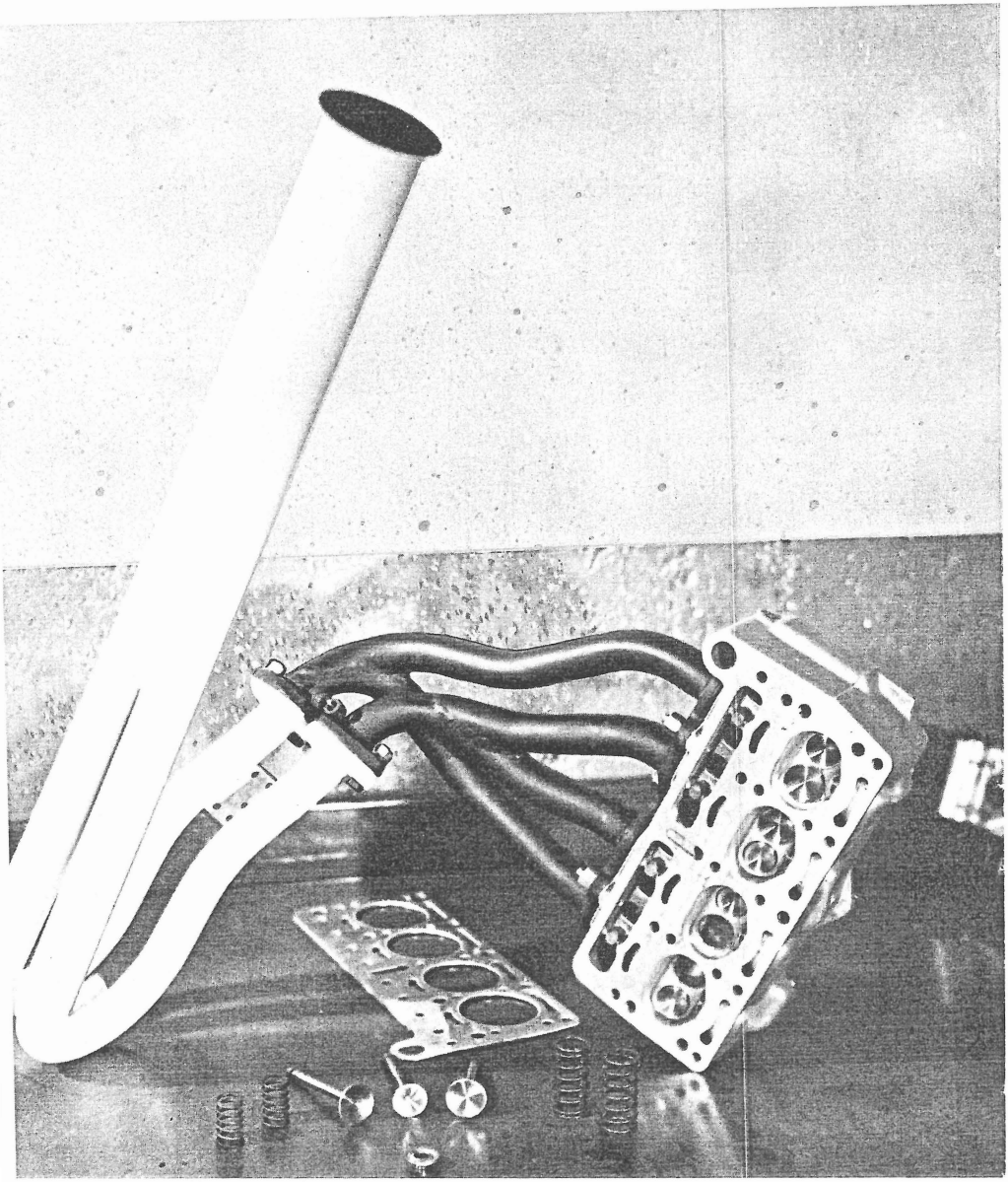


11. A comparison of valve size. Note the area around the 1″ valve in No. 2 cylinder. Large valves are necessary for all engines as a 20% increase in performance can be obtained from the Abarth with this modification alone.

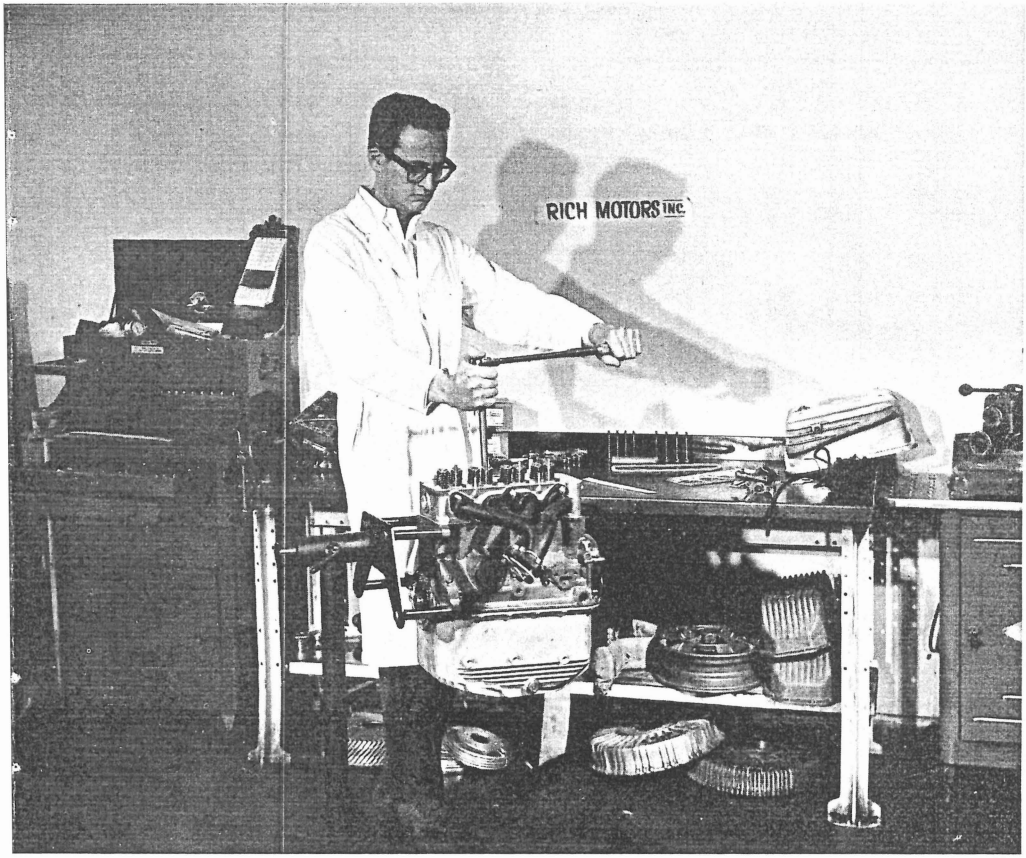


12. A completely finished cylinder head with polished ports and lightened valves. Note that the chamber has also been relieved around the inlet valves.

13. Cylinder heads modified to accept the 1⅛" inlet valves have been extensively flow tested by John Rich. It is not enough to simply increase the displacement of an Abarth; the engine must also be made to breathe.



14. An exhaust system of the type allowed by the California clubs for production racing. This unit has been tuned to give maximum extraction with the "E" cam grind.



15. Cylinder head torque is important and should be done at least twice after engine has been run. For best results engine should not be broken in with detergent or racing oils.

Listed are the many bore and stroke combinations for which pistons and crankshafts are readily available for either the early or late block. Some of these combinations, while very advantageous, are nevertheless not legally acceptable for production racing.

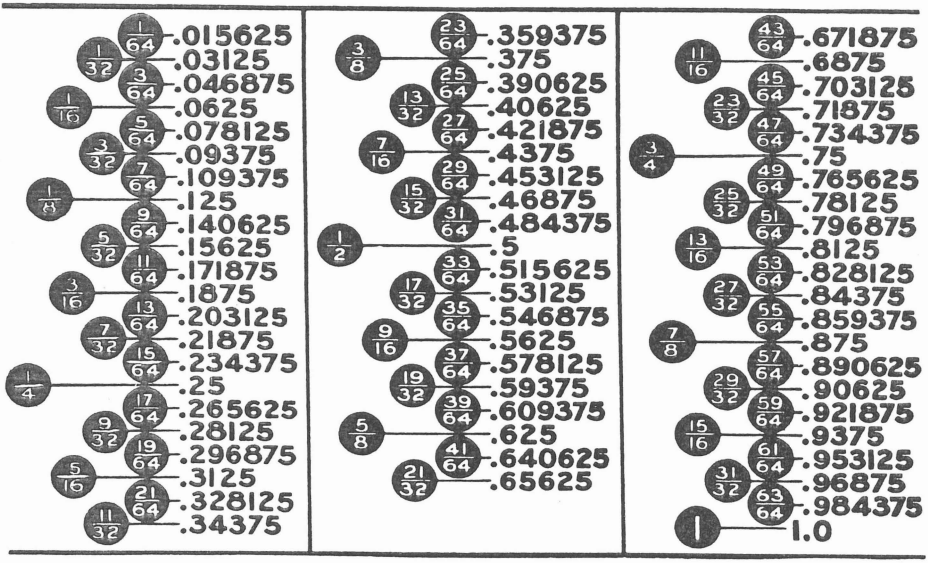
Block	Class	Bore & Stroke	Pistons	Mains	Rods	Compression Ratio
early	750 cc	**61.0 x 64 mm**	3608	VP348	VP347	9.8:1
early	750 cc	61.8 x 63.5 mm	3814	VP348	VP896	10.1:1
early	850 cc	62.0 x 69 mm	4034	VP897	VP896	8.5:1
early	850 cc	62.5 x 69 mm	3994	VP897	VP896	9.2:1
late	850 cc	64.0 x 64 mm	4183	VP348	VP896	10.1:1
late	900 cc	64.5 x 69 mm	3994	VP897	VP896	9.8:1
late	1000 cc	65.0 x 74 mm	4167	VP897	VP896	9.8:1

While it is possible to install any crankshaft or stroke into any block, certain modifications are necessary to the lubrication system of some combinations and special pulleys are required in others for racing application.

The special pistons, pulleys, seals and instructions for any of these and other combinations can be obtained in a kit from Rich Motors and will greatly facilitate any possible conversion.

Supercharger kits of the Rootes type complete with special pistons and carburetor are also available for any engine with 64 or 69 mm strokes. These kits are manufactured by John Rich himself and are the last word in power for the Fiat or Abarth Engine.

DECIMAL EQUIVALENT TABLE



MILLIMETER CONVERSION TABLE

Millimeters	Equivalent in Inches	Millimeters	Equivalent in Inches	Millimeters	Equivalent in Inches	Millimeters	Equivalent in Inches
1	0.03937	26	1.02362	51	2.00787	76	2.99212
2	0.07874	27	1.06299	52	2.04724	77	3.03149
3	0.11811	28	1.10236	53	2.08661	78	3.07086
4	0.15748	29	1.14173	54	2.12598	79	3.11023
5	0.19685	30	1.18110	55	2.16535	80	3.14960
6	0.23622	31	1.22047	56	2.20472	81	3.18897
7	0.27559	32	1.25984	57	2.24409	82	3.22834
8	0.31496	33	1.29921	58	2.28346	83	3.26771
9	0.35433	34	1.33858	59	2.32283	84	3.30708
10	0.39370	35	1.37795	60	2.36220	85	3.34645
11	0.43307	36	1.41732	61	2.40157	86	3.38582
12	0.47244	37	1.45669	62	2.44094	87	3.42519
13	0.51181	38	1.49606	63	2.48031	88	3.46456
14	0.55118	39	1.53543	64	2.51968	89	3.50393
15	0.59055	40	1.57480	65	2.55905	90	3.54330
16	0.62992	41	1.61417	66	2.59842	91	3.58267
17	0.66929	42	1.65354	67	2.63779	92	3.62204
18	0.70866	43	1.69291	68	2.67716	93	3.66141
19	0.74803	44	1.73228	69	2.71653	94	3.70078
20	0.78740	45	1.77165	70	2.75590	95	3.74015
21	0.82677	46	1.81102	71	2.79527	96	3.77952
22	0.86614	47	1.85039	71	2.83464	97	3.81889
23	0.90551	48	1.88976	73	2.87401	98	3.85826
24	0.94488	49	1.92913	74	2.91338	99	3.89763
25	0.98425	50	1.96850	75	2.95275	100	3.93700

DECIMALS OF AN INCH TO MILLIMETERS

Inches	Millimeters	Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
0.001	0.0254	0.008	0.2032	0.060	1.524	0.400	10.16
0.002	0.0508	0.009	0.2286	0.070	1.778	0.500	12.70
0.003	0.0762	0.010	0.254	0.080	2.032	0.600	15.24
0.004	0.1016	0.020	0.508	0.090	2.286	0.700	17.78
0.005	0.1270	0.030	0.762	0.100	2.54	0.800	20.32
0.006	0.1524	0.040	1.016	0.200	5.08	0.900	22.86
0.007	0.1778	0.050	1.270	0.300	7.62	1.000	25.40

TECHNICAL CHARACTERISTICS 850-1000 PUSH-ROD

	850	850/S
Piston diameter and stroke	62 x 69 mm.	62,5 x 69 mm.
Total capacity	833 cc.	847 cc.
Compression ratio	8,5	9,2
Maximum power	52 HP	57 HP
Corresponding to	6000 r.p.m.	6300 r.p.m.
Consumption: according to Cuna rules	16 Km.p.litre	
at maximum speed	13,8 Km.p.litre	
Tac horsepower	11 hp	

DISTRIBUTION

Inlet valves:	opening	30° before T.D.C.
	closing	70° after B.D.C.
Exhaust valves:	opening	70° before B.D.C.
	closing	30° after T.D.C.

Clearance between valves and rocker-arms for setting the timing . . . . . 0.20 mm (0079")

Working clearance between valves and rocker-arms (both inlet and exhaust, with **engine cold**) . . . . . 0.20 mm (0079")

FUEL SUPPLY

SOLEX carburetor type PBIC
Special air-cleaner with silencer.
Carburetors data:

		SOLEX PBIC
Diam. of choke	mm.	24
Diam. of main jet	mm.	1.30
Diam. of slow running jet	mm.	0.45
Diam. of pump jet	mm.	0.50
Diam. of starting jet	mm.	1.10
Emulsioning tube		T 2

IGNITION

Initial advance	8°
Contact breaker gap	0,45 mm. (0.0177")

SPARKING PLUGS

Marelli 240 or LA-10
Plug gap . . . . . 0.60 mm. (0.0236")

TEST DATA

VEHICLE .....Fiat Abarth 1000 cc
PRICE (as tested) ....$2,600 in Italy
MODEL .....Monomille
OPTIONS .....N.A.

ENGINE:

Type: .....Fiat 600 bored out to 1000 cc, 4 cylinders water-cooled
Head: .....aluminum 3 ports
Valves: .....Overhead valves
Max. bhp .....64 @ 6,000 rpm
Max. Torque .....67½ ft lbs. @ 3200 rpm
Bore .....2.56 in. 65 mm
Stroke .....2.91 in. 74 mm
Displacement .....59 cu. in. 982 cc
Compression Ratio .....9.8 to 1
Induction System: .....single double throat Webers or Solex
Exhaust System: .....3 into 2 headers, twin exhaust
Electrical System: .....12V Morelli

CLUTCH:

Single disc dry diameter: .....6 in.
Actuation: .....Cable

TRANSMISSION: ..4 speed forward — synchro top three
Ratios: 1st .....3.384 to 1
2nd .....2.055 to 1
3rd .....1.333 to 1
4th .....0.896 to 1

DIFFERENTIAL:

Ratio: .....4.75 to 1
Drive Axles (type): .....2 joint open half-shafts

STEERING: .....Worm and Sector
Turns Lock to Lock: 3
Turn Circle: .....28 ft.

BRAKES:
Drum diameters: .....9 inches front, 8 inches rear
Swept Area .....261.4 sq. in.

CHASSIS:

Fiat 600 floor reinforced
Body: .....all aluminum
Front Suspension: .....independent unequal wishbones & leaf springs
Rear Susepnsion: .....swing axle and coil springs, telesc. shocks
Tire Size & Type: .....Michelin X 5.50 x 13

WEIGHTS AND MEASURES

Wheelbase: .....78.75 in.
Front Track: .....45.25 in.
Rear Track: .....45.63 in.
Overall Height .....47.5 in.
Overall Width .....55 in.
Overall Length .....135.75 in.

Ground Clearance .....5.63 in.
Curb Weight .....1230 lbs.
Test Weight .....1600 lbs.
Crankcase .....4 qts.
Cooling System .....8 qts.
Gas Tank .....10/12 gals.

PERFORMANCE:

0-30 ..... — sec.
0-40 .....5.5 sec.
0-50 .....8.0 sec.
0-60 .....11.2 sec.
0-70 .....15.0 sec.

Speed								
Error	30	40	50	60	70	80	90
Actual	30	40	50	61	70	79	89

Fuel Consumption
Test: .....20 mpg
Average: .....25 mpg
Recommended Shift Points (6,200 rpm)
Brake Test: .....70 Average % G, over 10 stops. Fade not encountered

0-80 .....19.6 sec.
0-90 .....25.1 sec.
0-100 .....35.4 sec.
Standing ¼ mile 18.4 sec. @ 78 mph
Top Speed (av. two-way run) 106 mph
Max. 1st .....30 mph
Max. 2nd .....55 mph
Max. 3rd .....80 mph
Rpm Red-line .....6,500 rpm

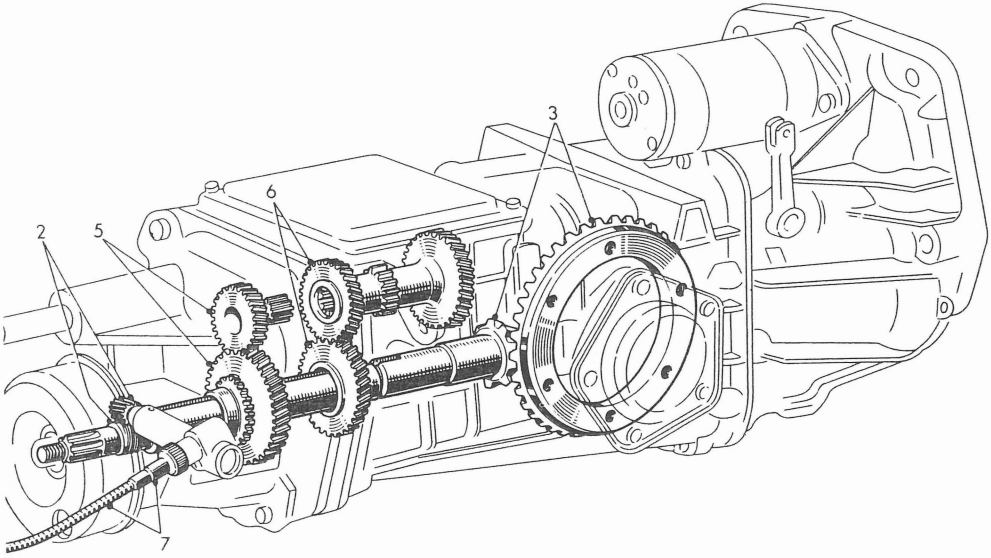
REFERENCE FACTORS:

BHP per Cubic Inch 1.06
lbs. per bhp 19.2
Piston Speed @ Peak rpm .....2910 ft/min.
Sq. In. Swept Brake area per Lb. 0.212

ENGINE ASSEMBLY SPECS.

Torque specs.

Main caps all	44.8 ft. lbs.
Rod caps early (offset type)	16 ft. lbs.
Rod caps late	25.3 ft. lbs.
Flywheel	25 to 28 ft. lbs.
Sprocket to camshaft screw	38.3 ft. lbs.
Pulley to crankshaft nut	72.3 ft. lbs.
Rocker arm towers to cyl. head	14.5 ft. lbs.
Cylinder head, 8 mm bolts	20 to 22 ft. lbs.
Cylinder head, 10 mm bolts	38 to 40 ft. lbs.



Phantom view of the very reliable Fiat transmission. Cluster and 2nd speed wheel shown (5) are of the early type which has been discontinued. Late type gears, however, can be fitted in the early cases.

TABLE OF VELOCITIES Km/h

RATIO 1st GEAR 13/44 (SERIES RATIO)

engine r.p.m.	Series bevel couple 8/43	Differentials with modified couples				
		8/41	8/40	8/39	9/41	9/39
4000	22,4	23,5	24	24,7	26,4	27,8
4200	23,5	24,6	25,2	25,9	27,7	29,1
4400	24,6	25,8	26,4	27,1	29	30,5
4600	25,8	27	27,7	28,3	30,3	31,9
4800	26,9	28,2	28,9	29,6	31,6	33,3
5000	28	29,3	30,1	30,8	32,9	34,7
5200	29,1	30,5	31,3	32	34,3	36,1
5400	30,2	31,7	32,5	33,3	35,6	37,5
5600	31,3	32,8	33,7	34,6	36,9	38,9
5800	32,5	34	34,9	35,8	38,2	40,2
6000	33,6	35,2	36,1	37	39,6	41,6
6200	34,7	36,4	37,3	38,2	40,9	43

TABLE OF VELOCITIES Km/h

RATIO 2nd GEAR 18/37 (SERIES RATIO)

engine r.p.m.	Series bevel couple 8/43	Differentials with modified couples				
		8/41	8/40	8/39	9/41	9/39
4000	36,9	38,7	39,7	40,7	43,5	45,7
4200	38,5	40,6	41,6	42,7	45,6	48
4400	40,5	42,5	43,6	44,7	47,8	50,3
4600	42,4	44,5	45,6	46,7	50	52,6
4800	44,2	46,4	47,6	48,7	52,2	54,9
5000	46,1	48,4	49,6	50,8	54	57,1
5200	48	50,3	51,6	52,8	56,6	59,4
5400	49,8	52,3	53,6	54,9	58,8	61,7
5600	51,6	54,2	55,5	56,9	60,9	64
5800	53,4	56,2	57,5	59	63	66,3
6000	55,3	58,1	59,5	61	65,2	68,6
6200	57,1	60	61,5	63	67,4	70,9

TABLE OF VELOCITIES Km/h

RATIO 3rd GEAR 24/32 (SERIES RATIO)

engine r.p.m.	Series bevel couple 8/43	Differentials with modified couples				
		8/41	8/40	8/39	9/41	9/39
4000	57	59,5	61	62,5	67	70,5
4200	59,5	62,5	64	65,5	70,5	74
4400	62,5	65,5	67	69	73,5	77,5
4600	65,5	68,5	70	72	77	81
4800	68	71,5	73,5	75	80,5	84,5
5000	71	74,5	76,5	78	84	88
5200	74	77,5	79,5	81,5	87	91,5
5400	76,5	80,5	82,5	84,5	90,5	95
5600	79,5	83,5	85,5	87,5	94	98,5
5800	82,5	86,5	88,5	91	97	102
6000	85	89,5	91,5	94	100,5	105,5
6200	88	92,5	94,5	97	104	109

TABLE OF VELOCITIES Km/h

RATIO 3rd GEAR 25/30 (MOD. RATIO)

engine r.p.m.	Series bevel couple 8/43	Differentials with modified couples				
		8/41	8/40	8/39	9/41	9/39
4000	63	66	68	69,5	74,5	78
4200	66,5	69,5	71,5	73	78	82
4400	69,5	73	75	76,5	82	86
4600	72,5	76	78	80	86	90
4800	76	79,5	81,5	83,5	89,5	94
5000	79	83	85	87	93	98
5200	82	86	88	91,5	97	102
5400	85	89,5	91,5	94	101	106
5600	88,5	93	95	97,5	104,5	110
5800	91,5	96	98,5	101	108	114
6000	95	99,5	102	104,5	112	118
6200	98	102,5	105	108	116	122

TABLE OF VELOCITIES Km/h

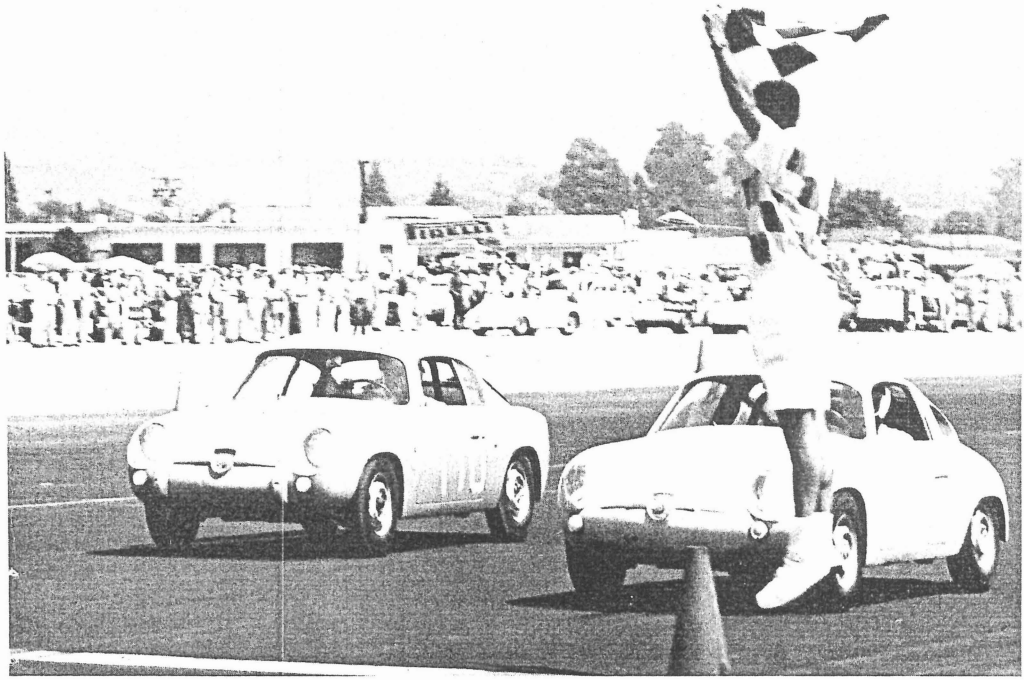
RATIO 4th GEAR 29/26 (SERIES RATIO)

engine r.p.m.	Series bevel couple 8/43	Differentials with modified couples				
		8/41	8/40	8/39	9/41	9/39
4000	84	89	91	93	100	105
4200	89	93	95	98	105	110
4400	93	97	100	102	110	115
4600	97	102	104	107	115	120
4800	101	106	109	112	120	126
5000	106	111	113	116	125	131
5200	110	115	118	121	130	136
5400	114	120	122	125	135	141
5600	118	124	127	130	140	147
5800	122	128	132	135	145	152
6000	127	133	136	140	150	157
6200	131	137	141	144	155	162

TABLE OF VELOCITIES Km/h

RATIO 4th GEAR 30/26 (MOD. RATIO)

engine r.p.m.	Series bevel couple 8/43	Differentials with modified couples				
		8/41	8/40	8/39	9/41	9/39
4000	87	92	94	96	102	108
4200	92	96	98	101	107	113
4400	96	100	103	106	112	119
4600	100	105	108	111	117	124
4800	105	110	112	116	122	129
5000	109	114	117	121	127	135
5200	113	119	122	125	133	140
5400	118	124	127	130	138	145
5600	122	128	131	135	143	151
5800	126	132	136	140	148	156
6000	131	137	140	145	153	161
6200	135	142	145	149	158	167



GOOD LUCK!