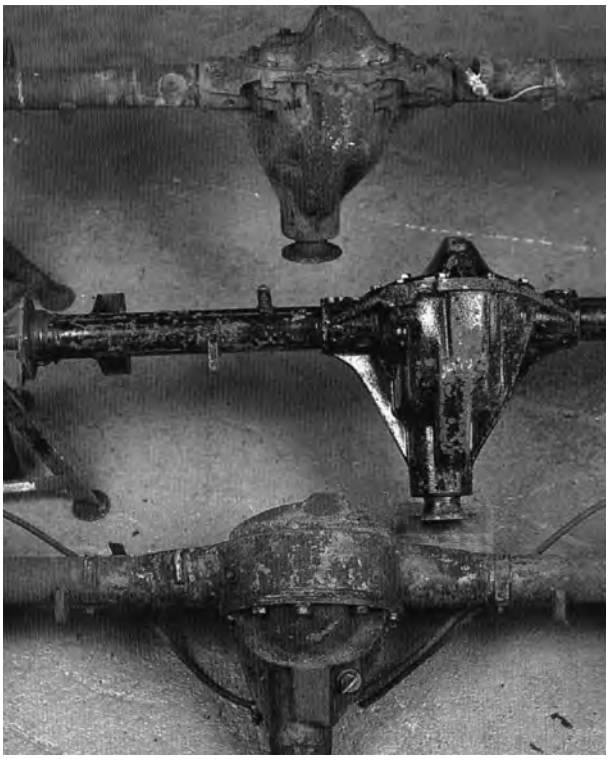
## The Rear Axle

Hopefully by now you've got a good idea of how to prepare your chassis and suspension; don't forget to keep notes on the specification of the parts you are fitting They will come in useful later when ordering any replacement or worn-out parts. More importantly, how will you know what to buy to make suitable improvements if you don't know where you are starting from?

Also at this stage the rear axle needs to be thought about. For early 120 owners with the ENV type axle, not too many options are available. The scarcity of crown wheels and pinions is such that what you have is what you will end up with and, if the condition of the internals and gears is not good, it may be cheaper and easier to look for another unit altogether. This has happened to many early cars as so many now have the later Salisbury type axles. If you are looking to change the disc wheels to wire wheels, you do not need to change the whole axle, as splined adapters are available as a simple bolt-on conversion for the ENV axles.

The first Salisbury axle was introduced in 1952. This was known as the 2HA type, soon to be improved to 4HA by 1953. Again, the parts for 2HA axles to convert ratios or rebuild them properly are very difficult to obtain and you cannot fit a 'Power Lok' limited slip differential into the 2HA casing. So if you are thinking of buying a replacement axle assembly, make sure it is the 4HA type, as this will give you all the possible variations you might need now or later. All XKs are the same track width and all the XK 4HA axles start life the same, with only brackets fitted afterwards to determine 120, 140 or 150 derivatives. Also, the fitting of disc or drum brakes can be done on all Salisbury type axles.



*From lower to upper: ENV 2HA and 4HA.*

So now on to rebuilding the axle itself. This I can promise you is best done by professionals as you will need special tools and measuring equipment to successfully accomplish rebuilding to factory standards. You can determine the ratio of the axle by the small metal tag located on one of the lower bolts holding the inspection pan to the rear of the centre casing. If this has long since gone you will need to remove the rear pan altogether and inspect the crown wheel. Clean the edge of the crown wheel whilst rotating it until you can see some stamped markings. You will see 4HA or 2HA followed by two sets of numbers, for example "46/13". This means 46 teeth on the crown wheel and 13 teeth on the pinion. It now becomes a simple division sum to determine the ratio: 46 ÷ 13 = 3.54; i.e. the pinion must rotate 3.54 turns for every turn of the crown wheel. There are several ratios to choose from and they must in turn work with the type of gearbox - overdrive, non-overdrive or five speed - and also the wheel and tyre size - 15 or 16 inch, and normal or lowprofile. All of these variations will alter the ratio of the axle, so all must work in harmony together. Don't be surprised if, when you change to 15 inch wheels, the engine suddenly revs much higher in top gear and the speedo is showing an exaggerated speed. At this stage of rebuilding, you need to be sure of what the overall specification of the car will be and the type of driving you will generally be doing - short trips on local country roads or continental touring. The right combination can make the car a real joy to drive without putting undue strain on the engine. So, speak to the experts and plan ahead: it's a terrible waste of money to do any of these jobs twice!

If you intend to do any competition work at all, then fitting a limited slip differential is a good idea, but again it is a job for the specialists. If the specification includes disc brakes or 'Power Lok' then very close inspection of the axle shafts is needed. Original axle shafts do have a tendency to break just when you least expect it and, if the shafts are not 100% straight, you will have brake judder when the discs rotate and brakes are applied. This is not so evident in drum brakes as it is not so critical to the performance or feel. New axle shafts are available in better specification material and guaranteed to be straight: this is always good insurance at this stage as any replacement later will very much outweigh the extra cost now.

Always refer to the workshop manual and factory parts book to help you understand the axle workings and correct torque setting when assembling back into the chassis.

So, to recap for ENV and 2HA axle type customers, only gaskets, seals and bearings are available to do a standard rebuild, but for all 1953 onward 4HA type units the choice is unlimited from 2.88:1 ratio for very high speed touring to 4.27:1 for hill climbs or quarter mile sprints with or without limited slip differentials. 'Power Lok' is the name given by Thornton, the producers of this particular style of limited slip unit, so when you see 'Power Lok' or 'limited slip', these are one and the same in Jaguar terms.

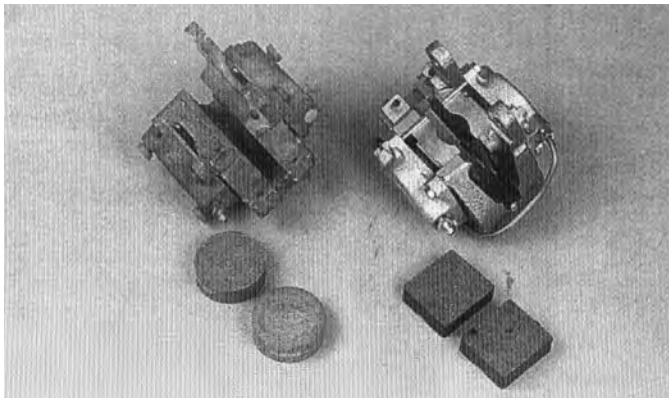
Next month I will cover the choosing and rebuilding of the brakes - in my own opinion, the most important part of the car.

## Braking Systems

One of the most talked about XK subjects, after cooling, is brakes or, perhaps, the lack of them! Making an XK do over 100 mph is easy: making it stop quickly and safely is a whole different matter.

We will start with the 120/140 drum brake system. Whether you have the early 120 non-self-adjusting, or later 120/140 self-adjusting system, they all have the same basic specification, number of cylinders (4 front cylinders for twin leading shoes and 2 rear cylinders), drum diameter, width and size of shoe lining. The performance of each system should be alike, but I have strong opinions on this subject. If all the components in a brake system are not 'as new', how on earth can you complain about its overall performance? Too many people are quick to dismiss drum brakes without ever having driven an XK with correctly rebuilt and, more importantly, correctly adjusted brakes. Many factors can lead to poor quality braking, from incorrect fluid to seized wheel cylinders or wrong shoe lining material or, of course, all of the above.

I'm always a little amused at the comments made when customers or restorers ask for wheel cylinder repair kits (seals and dust gaiters) and we ask, "When was the car last in use on the road?" The normal reply is, "Oh, it was many years ago, but I've dismantled the cylinders and they look in good condition."



*Round pad on left, square pad on right.*

Let's examine what that really means. My garden hose also looked in good condition until I turned on the tap and, unseen by me, a leak became evident from the smallest pinhole, and this is water at only 10 to 15 psi (pounds per square inch). A wheel cylinder can hold up to 400 psi with only a small rubber seal to maintain all that pressure. Any corrosion marks in the cylinder wall at all, however small to the eye, will surely leak with ease. Even if the cylinder looks to have a mirror finish inside, this could be caused by many years' use and, as the cylinders are made of aluminium, this can mean they are now oversize by the polishing effect of the piston seal, again limiting the chances of an effective re-seal by the kit alone. Don't take chances with brakes: do the job 100% - it is, after all, your life at risk!

Once all the hydraulics have been overhauled, you can think about the lining material - this is the part that takes all the heat and the strain.

If you are lucky enough to find old asbestos material in, say, Mintex M20 or Ferodo AM 14 spec., you will have much greater efficiency in braking, as asbestos is the best at soaking up heat and it is also kinder to the drum, both parts lasting longer and wearing better. But, as this dangerous substance has not been in production for some years, the old spec. linings are very sought after. Do try, however, as it is worth it in the long run. The non-asbestos linings available today do fade quicker with the high temperatures that an XK can generate inside 12 inch drums and, as far as my research has gone, there is no competition spec. 'non-asbestos' lining on the market. So this can let the side down even though you have rebuilt the drum system correctly.

If this puts you off spending several hundred pounds on original parts only to be disappointed when comparing the performance to that of your modern, everyday transport, then maybe a disc brake conversion is the best option. For those of you with XK150s, you can say "But I've already got disc brakes, and I'm still not overly satisfied with what I have." You could also be right, as the 150 came as standard with the new "Dunlop disc brakes" for 1957; these early 150s of 1957 and '58 had the first generation Dunlop brakes with the round brake pads that could not be changed without dismantling the whole caliper (not very practical). These soon changed to the square pad type, known by Dunlop as the "New quick change pad" type. As the disc brakes were on front and back, they were considerably better than drums and more than adequate for their day. But, in today's high speed motoring conditions, with most cars in front of you having ABS and servo assistance better than ever before, you are presented with hair-raising moments when the car in front can happily control high speed braking or emergency stops without spilling a drop of coffee. You, on the other hand, become ' white-knuckled' and look for the nearest soft hedge, limiting the possible damage, should you need to!

For average daily driving in a 120 or 140, discs on the front and drums on the rear is adequate. For more strenuous use, discs all round is the best option. Once again, correct pad material and fluid will cope easily with normal driving conditions but you may want to do some mild competition work and merely changing the pads can take you from Sunday afternoon posing to a hardcharging front running rally car.

In our experience, especially with 120 or 140 roadsters, on cars with drums at the back and discs on the front if you require servo assistance, we recommend its use on the front only as the rear drums have a tendency to lock-up quite easily. In any case, we do often recommend trying a 120 or 140 without a servo first to see if you are happy with the feel; if not, it is easy to fit a remote servo later without too much extra work. For you 120 or 140 owners who wish to fit discs to the rear of your car, it is easily possible with Salisbury axles but not on early 120s with ENV axles. In all cases the kits that are available should, in my opinion, be complete with ALL necessary parts to make a simple bolt-on conversion with foolproof components and have a manufacturer's guarantee. Once again, take no chances with brakes: we have seen some terrible "home-brew" conversions that make the hair stand up on the back of the neck.

Next month 1 will continue with brakes, but move on to master cylinders, servos and hoses. Our motto is "Information is cheap, but mistakes are expensive." Make an informed purchase, and you will always be satisfied.

## Steering Systems

This month I would like to move on to steering but, as I have said on many previous occasions, "should you wish to modify or alter in any way from standard fitment, you should expect to make 27 other alterations to accommodate"! I am of course generalising about the number 27 but in some cases it has been known to rise above 50 when things really get out of hand! If you keep this in mind, you will not get so disheartened about altering or modifying from the original.

So, moving on to steering and firstly, as always, looking at the XK120 system which did not change its specification from start to finish. Only two updates were made in 1950: the outer tie-rods became fixed solid units without adjustment and the inner tie-rod ends went from screw type pins to rubber bonded units without need for lubrication.

The steering box itself is a Burman high efficiency, recirculating ball type. This has a worm gear on the inner column with a sliding nut enclosing ball-bearings running up and down the worm. This gave the 120 a very good ratio and turning circle of 31 feet, the Mk.5 and Mk.7 both having 36 foot turning circles. This gave, along with the one inch smaller steering wheel (17in), a good sportscar feel even on the worst of country roads. We often hear how poor the steering is on 120s and the general opinion is that a change to rack and pinion type of steering, as used on the 140s and 150s, will result in a considerable improvement. But I feel that often the problem is due to 120s not being fitted with as-new perfect working steering units. With all steering boxes now being over 45 years old, it is rare to find a car that does not need the steering box overhauled. By this, I mean a proper rebuild with replacement of the whole worm and nut: just ball-bearing replacement and a few shims will not do the job. On many occasions we have seen overadjustment for wear and the hard ball-bearings in the nut have worn through the hardened layer on the worm and pieces of worm metal have been chipped off.

A common criticism of worn steering boxes is a vague feel while driving in a straight line and a vibration at around 50/60mph: the only cure is a new steering unit.

If the rest of the system is in very good overall condition, the 120 steering is light, very positive and is a joy at speed.

A note of caution when considering converting a 120 to rack and pinion type steering. When the rack is in position, the radiator cannot be refitted. This in turn means panel alteration if a 140 radiator is to be used, which in turn means the loss of thermostat housing on the radiator (as the 140/150 is in the inlet manifold), leading to a need for water hoses that do not exist and a flow of water that has no bypass to the thermostat and no position for the water gauge capillary adapter - just to name but a few of the further serious mechanical alterations. If you weigh up the costs of such a job (several thousands of pounds before you are finished), you should really be convinced of any benefit this may give over having the original steering overhauled properly.

Turning to the subject of right hand drive or left hand drive conversions, many of the major components are usable or adaptable, so it is possible to exchange right hand for left hand and not pay too big a penalty.

Another important fact to remember when trying to set up the steering is to check all the components are undamaged. How will you achieve the correct caster and camber angles if you are working with damaged or incorrect parts? We have had far too many cars in our workshop with customers' complaints of wheels out of balance or worn bushes when actually the car's steering geometry is way out and maybe has never been set up correctly at all. You can take it from me that when you drive a 120 that has been set up right, there is definitely no need for such drastic alterations.

For 140 and 150 models, life is a bit easier as they share the same basic steering system. Again, all that needs to be mentioned is the importance of rebuilding properly. As yet, we have not taken a rack bar or pinion gear out of a steering unit that did not have signs of wear. Sure, replacing bushes and bearings will do a 90% job, depending on the amount of wear, but replacing the rack and pinion gears is the only sure way to own perfect steering units.

There are also power steering rack kits now available for the 140 and 150s but again these are, in my opinion, only to be considered after the customer has driven a car that is right. If you do consider spending what will always be a large sum of money and a considerable amount of labour, do make sure it has the desired effect when finished. It is always well worth having the caster and camber set up properly as you will be amazed at the difference when out on the road.

Well, next month I can't avoid the subject of engines and gearboxes. If you have any questions about anything so far, please drop us a line: we are always happy to try and explain further.

## Hydraulics and Servos

The hydraulic side of the XK brake system is not as complicated as it may at first seem.

Starting as always with the XK120, the single outlet, one inch bore, master cylinder, was fitted from 1949 to June 1952. Then, with the development of the XK120C (C-type) a tandem or twin outlet split master cylinder manufactured by Qualcast and assembled at Lockheed, superseded the earlier commercial master cylinder. This ran from June 1952 to the end of the XK120 model run in 1954 but, having had so much trouble due to the failure of the fluid inlet valves on top of the cylinder, Jaguar reverted to the reliable old commercial master cylinder of 1949 to '52 spec. The theory of the tandem hydraulic system, giving a bias to the front axle, was a breakthrough and of course successful for the Ctypes at Le Mans. But, in everyday practice, a stuck 'tilt valve' - as they are known - would go unnoticed and could lead to no rear brakes at all. This of course only added to the debate about the poor performance of the brakes on later XK120s.

The XK140 used the single master cylinder for the entire production run. The introduction of Dunlop all-round disc brakes with Lockheed servo assistance, in 1957, was the most major change in production braking systems. The master cylinder, now 7/8" bore, fed the servo and then to all four wheels, with no bias. But the smaller diameter of the rear wheel cylinders meant a greater braking efficiency at the front. The only change to the 150 system came with the introduction of a servo vacuum tank and non-return valve. This held a reserve of vacuum to assist the servo should the engine cut out; without this, the pedal pressure becomes very hard and difficult to use. Dunlop also refined the calipers with the introduction of the 'quick change' brake pads (square type pad) in 1959.

All the XK's brake hoses were of flexible rubber type: one from the chassis to a three-way union on the rear axle and one to each front wheel. The drum brake system on 120s and 140s were fed via 1/4" bore steel brake pipes and the 150 disc system via 3/16" throughout. Workshop manuals cover the standard braking systems quite well.

The potential trouble starts when modifications are introduced. As we said in the last article, for 120 and 140, discs on the front and original drums on the rear is adequate for most conditions. If you do decide on discs all round and servo assistance, then do make sure the rear piston sizes are considerably smaller than those on the front or disaster will come in the form of locking rear brakes, and that's always a recipe for trouble!

For servos, it's not the size of the servo that determines its performance. Lockheed manufacture a range of servos in various ratios - 2: 1 right up to 4: 1. This obviously means that your foot pressure is increased by the ratio amount. It is possible however, to over-servo a system which provides no 'feel' to the brakes and can bring about the unbalanced and uneasy feeling of locking brakes at the merest touch.

Servos also have what is known as a 'knee point': this is the point at which your foot pressure overrides the servo assistance under hard braking. Again, the higher the 'knee point', the more continuous the assistance is to the system up to a possible 1500 psi. If in doubt, ask. You may be either buying parts that don't do the job correctly or matching parts together that are potentially lethal on a damp road.

A quick point to remember when fitting a servo is to try to make sure the servo points slightly upwards by 15° to 20°. This will aid bleeding the brake system as air bubbles always rise upwards. Also, if you pump the pedal and get good resistance, this is the pedal 'feel' you should have all the time: keep on bleeding - the air is trapped somewhere inside!

A problem we quite often come across on the telephone is brakes sticking whilst in use, especially on XK150s. More often than not the servo is the culprit. If you have experienced this problem, simply disconnect the vacuum supply from the engine, plug the pipe with a bolt and jubilee clip and then test the car again. Although the brake pedal may feel hard to use, you can determine if the sticking brake problem has ceased. If so, the servo will need attention.

## Gearbox and Transmission

Well, I said we would move on to engines and gearboxes this month and, as this could be one of the biggest areas of the car to cover as an in-depth subject, I think we should break it down into gearboxes and then engines over the next month or so, depending how lost I get along the way!

After 50 years the gearbox, or transmission, is still one of the most-criticised areas - slow and awkward and, once past its best, simply unusable in today's driving conditions. How do I know the condition of my gearbox, I hear you say? Well, if you have bought a car as a non-runner or partly dismantled, you won't be able to tell much by just removing the selector lid assembly. This, at best, will only show the potential wear of the straight cut teeth on the first gear. If there is actual damage to the teeth and the condition is poor, you can be sure the mating gear on the laygear assembly below is also poor. This will lead to a very noisy first gear in motion.

*Photo: Courtesy Guy Broad Parts catalogue*

The main problem suffered once the car is on the road is slow synchro meshing. Once the synchro to each gear is worn, the mating hub assembly will not grip the synchro and therefore will not pick up speed to allow smooth selection to the next gear. The most common time is when trying to select second gear from third: the worn synchro slips inside the hub and the everpresent crunch of the Moss box can be heard three counties away. The solution is simple in theory but today nearly impossible in practice - replace the worn synchro!

When you look a little closer, you will notice the synchro part that is worn is made in one with the gear. So you may be looking at a perfectly good helical gear but a very worn synchro. Yes, very expensive to remake, therefore very expensive to replace and there is of course the potential for all of the synchros within a gearbox to be worn out. So a simple replacement of bearings, seals and gaskets will have little overall effect when out on the road.

For those of you saying, well, why don't the specialists remanufacture these parts at sensible prices, I will give you a little insight into the whole picture. Firstly there are a possible 29 different gears or gear clusters to cover all the possibilities of variations within the XK range, from 120 early SH and JH series to the later JL, JLE, OSL and then the JLS, and even an M series. Oh, and don't forget shaved gear and close ratio variants. The potential investment in time and money to accomplish this is amazing. The very best that may happen is a set of gears that could be adapted to fit the majority of boxes may be made and sold as a complete kit but I suspect even this option would make gold-plated wheels look cheap!

So here we are again looking at fitting and adapting another gearbox unit to take the place of the original. An overall view of the finished car is good to keep in mind at this stage. Do you mind changing from original? If not, how far are you prepared to go? Anything is possible if you put your mind and wallet to it.

For XK120 owners, you need to keep in mind that the central chassis cross member is closer to the engine than on 140 or 150s. This is because the 120 was never available with over~ drive or automatic, although I did hear of an experimental 120 auto DHC in the States but this was never confirmed by my own eyes. So, when choosing or opting for a change, be sure you are aware of the amount of cutting or welding to fit the replacement unit. To my knowledge the XJ6 manual overdrive box needs quite a substantial amount of chassis removed to avoid the back of the overdrive. The same goes for all overdrive saloon or XK units, and don't forget to check the position at which the gear lever enters the cabin area as you will be making new tunnel covers and carpets to accommodate.

In short, do some homework before buying what appears to be a cheap solution, say £250 for an XJ6 or saloon gearbox; but once this has been rebuilt - and the overdrive units can cost upwards of £350 alone without fitting to the main box - together with the other costs already explained, plus adapting the electrics, and you will soon find this to be a lot more involved and expensive than your good friend in the pub told you it would be!

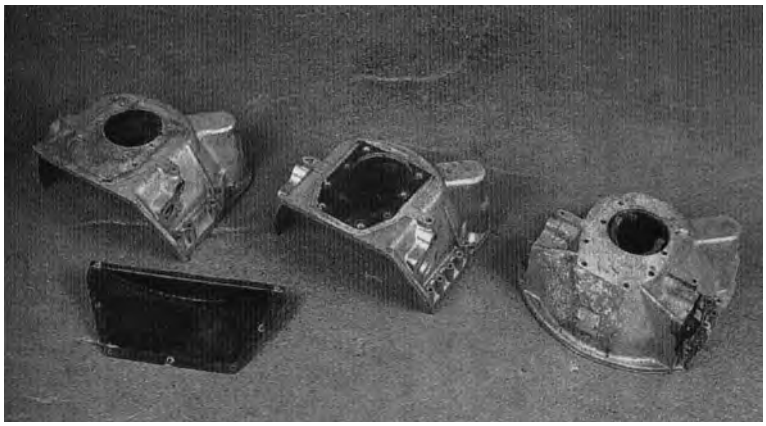
For XK140 and 150 owners, the options do get possibly easier but no less expensive. All the chassis are dual purpose, non-overdrive, overdrive and even automatic, with just a different set of bell housing brackets for autos or a chassis rubber bump stop for the overdrive extension. The same problems still apply for saloon gearbox conversions as to positioning of gear levers or adequate chassis mounting areas. Oh, and another point - if the 4.2 all synchro gearbox is in your thoughts, there is a small problem of the bell housing and first motion shaft seal. For 120/140 owners there is also the added headache of changing to hydraulic clutch mechanisms. There are of course 101 other small problems, so only the most determined and skilled mechanics will see this through to an owner's complete satisfaction. If you wish to change from automatic to manual, all of the above still applies and a lot more: pedals, throttle linkage, handbrake, tunnel, carpets, dashboard and electrical problems await you and some shocking invoices. Again, do some homework and find someone who has done this before. We have told customers before it would be easier to sell the automatic car and purchase a manual version!

I am running out of space so I will continue on this subject next month and take a look at the five speed gearbox option and also explain, amongst other things, how to recalibrate your speedo. It may appear that I have left out huge sections but I will be coming back to more specific problems in later issues (I hope!).

## Gearbox and Transmission

Last month I was tackling the subject of gearboxes and looked at the various options available to you. Continuing that theme, last, but definitely not least, is the five speed option. For most people this is a very suitable option as the overall advantages when finished are substantial: quietness, lack of oil leaks, better fuel consumption and, for 140/150 owners, the engine does not have to come out in future to change a clutch! There are several kits on the market based on 'Getrag', 'Borg Warner' and 'Leyland' gearboxes, but again do your homework first. Ask what comes with the kit and what has to be altered to fit the kit, or what other parts you may need to make or alter - propshaft, speedo cable, etc. In all cases, changing a gearbox should mean a recalibration of the speedo as the cable comes out of the gearbox. This is not a major problem and any time you change the axle ratio, wheel diameter or gearbox, you will need to recalibrate your speedo.

The 'Smiths" solution is as follows. Make sure the tyre pressures are correct. Then find at least 50-60 feet (15-20 metres) of tarmac and, with the speedo cable connected at the gearbox but disconnected at the instrument end, mark the tarmac with chalk at the centre of the tyre. Then push the car straight forward until the inner part of the cable has done six full revolutions, then stop. Mark the tarmac again with chalk (centre lower part of tyre). Now simply measure the distance the car has travelled. This is now the actual distance travelled for a set number of turns of the cable. The instrument restorer can now calculate the number of revolutions the inner cable will make in one mile or one kilometre (same calculations apply). Put a piece of tape on the inner cable to act as a flag type indicator to make counting the revolutions easier. Even for those of you who think your speedo is reading correctly, it's worth taking a few minutes to check. The speedo has on its face a number (ie, 740, 1120, 1050, 1200 etc) This refers to the number of revs per mile the cable will turn. You have to dismantle the instrument to change two cog wheels to recalibrate, so don't be surprised if the estimate to recalibrate costs nearly the same as an overhaul. Don't have the speedo rebuilt until you have the calculation to hand.



*From left to right: alloy 120, ordinary 120, 150.*

So, before we move on to engines, clutch and clutch mechanisms should be covered. The same basic design of components ran through the XK range, even the hydraulic system on the 150 was merely an add-on bracket and slave cylinder linked to a similar drop arm and cross-shaft.

All XKs left the factory with a 10in Borg & Beck coil spring clutch assembly, the strength of which was denoted by the colour of the springs. As the horsepower of the engines increased, so did the strength of the springs. Today this is all a little academic, as only one version of the 10in Borg & Beck clutch is available: this last version was used on 3.8 E-types with a quoted 250 bhp. This cover is easily identified by its bright purple springs; although suitable for all XK engines it does however mean a heavier feel to the pedal. The option I personally prefer is to have the flywheel redrilled to take the 9½ inch diaphragm Laycock type clutch. This was used from 1964 onward and also rated standard for 250 bhp. It is a lot softer on pedal action and, should you think about competition work, an uprated cover and drive plate is readily available which is not the case with the 10in version. If you are having the flywheel reconditioned, it does not cost much more to have the extra drilling included.

As has been stated before **ALL** XK engines have flywheels with 132 tooth ring-gears and matching starter motor pinions with a 10 tooth drive dog. Remember, do not mix and match, it always leads to trouble later unless you have done your homework very well beforehand. The important thing when changing clutch components is to always fit a matching set. The release bearing may look the same for either the 10in or the 9½in kit, but the offset (throwout) is different and will lead to big problems when trying to obtain clearance.

A problem we are now beginning to experience is difficulty in obtaining correct adjustment when the flywheel has been skimmed several times. Most flywheels are now over forty years old. The problem is more evident on 120/140 mechanical linkage systems as a considerable amount of the thread on the adjuster push-rod will be needed. It is also not as simple as just adding a longer push-rod: the whole action of the clutch linkage starts to bind up on itself. The only long-term cure is a new flywheel!

Apart from the early 120s (1949 to June 1952) that had an open bottom type bellhousing, all the later XKs shared the same bellhousing. The early 120 housing is not very well suited to competition work as it has no strengthening casting webs inside and suffered cracking across the bolt fixing points. For 120 and 140 owners wishing to change their cars from left to right hand drive or vice-versa, the whole gearbox assembly must come out to extract the crossshaft in the bellhousing and replace it from the other side. For 150 owners, the slave cylinder and mountings all stay on the right hand side; for left hand drive cars it is simply fed hydraulically by a longer pipe. The main point here is - **ALL** the correct clutch hardware components are available new, so there is no need to fit mismatched or worn parts!

We are often asked about converting 120 or 140 cars to hydraulic clutch. Although very simple at the bellhousing end (all 150 parts will bolt straight on), at the pedal end things get a lot more complicated. You must fit a master cylinder and operate it via a push-rod of correct length. Sounds easy until you look closer at the parts you already have: some cutting, fabricating and welding will be necessary - not quite so simple without professional help. We are trying to produce a simplified kit with all necessary parts and diagrams and this should be available later this year.

Well, I can't put if off any longer, so next month we're on to engines: I hope I can make some sense of the subject!

## Engine Upgrades

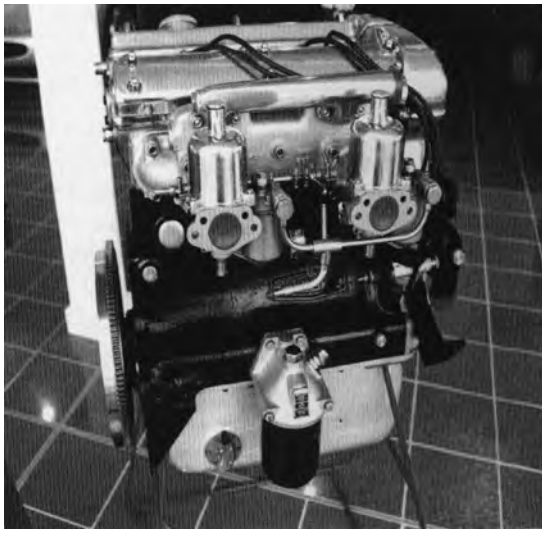
The subject of engines is of course another minefield. The only Jaguar engine worth having in your car is a good one!

The important starting point is to determine if the engine you are looking at is the right one for the car you are restoring, or, if you are upgrading, uprating or modifying, you have selected your components carefully.

Luckily, Jaguar engine components have part or casting numbers to help identify them. So with a parts book to hand you can understand what it is you own. The next, and most important decision to make is "who has the job of restoring my engine?" I know it's tempting to do the work yourself because of the overall expense, but in my experience this never pays off in the long run. With XK engines the key is knowledge and experience coupled with quality workmanship. Accurate machining and measuring is the difference between smooth and efficient, or noisy and oil consuming. My strongest recommendation is to employ a recognised Jaguar engine specialist. This may sound obvious but we have so many conversations with owners who have had their engine overhauled by 'The General Engine Reconditioning Co. Ltd.' who I'm sure can do a reasonable job, but they have little or no experience with upgrades and modifications that at this stage cost very little extra, but do make for a far nicer engine to use - for example, higher output oil pumps, crank oil seal conversions, valve stem oil seals, stronger con-rods, better camshafts and a whole host of other small but important details.

There is nothing more infuriating than having a problem and everyone telling you later this could easily have been solved earlier, but now it's a cylinder head off job and a lot of extra expense and time just to get back to "Square One". There is very little to learn about the XK engine now, but the same problems and mistakes occur with monotonous regularity. The equipment and skills necessary for a good engine rebuild put this job way beyond the limits of the average mechanic or home restorer.

So, how is it prices range from around £2,000 to £15,000? Obviously there is a huge difference in components and specification depending on the customer's requirements. So be as specific as possible when discussing your engine; do you want original and basic spec. or uprated with more horsepower? Do remember some limiting factors though. Low octane fuel and disappearing lead will determine how easy the engine will be to live with. Some basic rules to remember are; when 9:1 compression engines were available you could easily get '5 Star' 100 octane fuel. With average 4 Star or unleaded fuel at around 95 or 96 octane you will have to retard the ignition timing 3 or 4 degrees to avoid 'pinking' (detonation) or 'runningon' when the ignition is turned off.



*Always check you have the right engine for your car! (This is the dear little XK100 engine!).*

This in turn will knock the mid-range performance Jaguar engines are so famous for, not to mention the possible piston damage! Piston prices, incidentally, can range from £200 per set to £1,000 per set, the top prices being for forged pistons for racing use - very strong, light and machined extremely accurately. However, just buying expensive components does not guarantee a good engine and in many cases this is just a plain waste of money if you do not get the extra performance these components can give. Again think of the engine as an entire package - there is little point in fitting 2" carbs. if the small valves (120/140) are still used and no gas-flowing has been carried out. They may sit there looking impressive but no real benefit has been gained for the expense.

So what are the areas worth spending the most on? For a smooth, strong and reliable engine, the following list, in my opinion, gives the best return for your money:

1. Balance all lower engine components together (crank, rods, pistons, flywheel, clutch and front crank damper). This will give the smooth revs. and put less strain on bearings.

2. Oiling system, upgrades in this area are worth the money. With 120/140 early gear driven type oil pumps, the possibilities are more limited but later con-rods and new oil pump gears will be worth it.

3. Lighten the flywheel to around 6kg and redrill the face to accept the later 9.5" diaphragm (Laycock) type clutch (a softer operation type with uprated version available).

4. Cylinder heads need the most work - gas flowing, new seats for unleaded fuel use, enlarged valves (maximum 1 $^{7}/_{8}$" inlet) and the best quality machining work. Camshafts should be matched to the head when final spec. is decided.

5. Finally, choose your ancilliaries to match. Good exhaust system - very important for any uprated engine spec. Carbs. - to give the best performance when matched to the work done on the head. Water pump, dynamo and distributor.

Make sure they are correct for your engine and have them properly overhauled. Many a good engine has been let down by an incorrect or poorly rebuilt distributor (again numbers can be found on all of these items, so no excuses for fitting the wrong ones!).

Always make notes as you go along. Write down all the part numbers and their related parts; it will make ordering and understanding so much easier. If you modify or upgrade in any way, again keep notes. How can you order a distributor cap or rotor arm if you don't even know what distributor is fitted? It is of course impossible to list all the variations of parts and modifications but we do have a few 'fact sheets' to help clarify numbers, which we can post or fax to anyone interested.

## The Chassis

One of the interesting things about an XK is that you can restore a chassis to an almost driving state. Indeed this is also how the XK was built at the factory. A rolling mechanically built chassis had its painted body lowered on to it with wiring and many other small components already in place.

It would seem sensible to do just the same today, and this is what the best XK restorers find to be the most efficient method. For home or amateur restorers this poses some difficult obstacles. How do you restore the body off the chassis? How will it be painted off the chassis? How will it ever go back on to the chassis?

Well, to take one step at a time, I suggest making some bracing bars to go inside the cockpit area to strengthen the front to rear. This should be done before you lift the body off. Whether it be a coupé or roadster, the body of an XK will 'flex' considerably once off the main chassis.

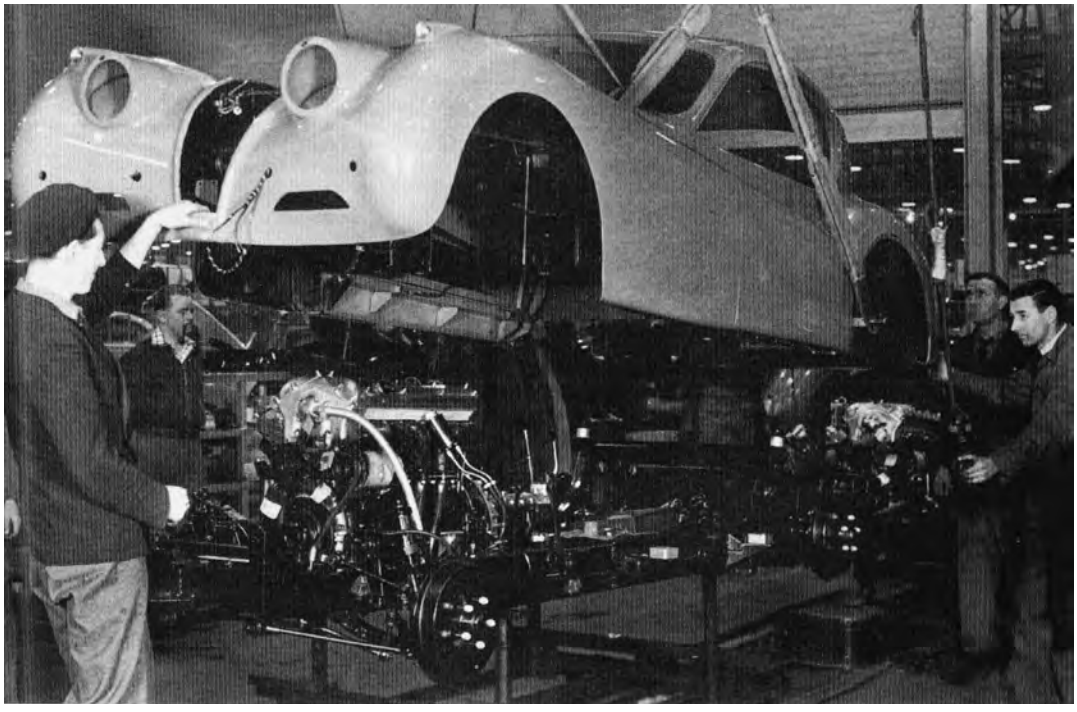
The more prolific XK restorers will have made a body jig to aid transport and the refit when the painted shell is returned. Also with the shell mounted on a body jig, the painter will be able to get inside all the hidden areas to ensure a good coverage and thus protection. Above all else, spend the most time choosing who will be doing the body restoration. I cannot stress enough the pitfalls that catch so many. Do some constructive homework. I can be heard many times telling customers of the importance of getting the XK body right. Get it wrong and all the other good work to mechanical areas will be worthless and, let's face it, the shape of the XK is what makes it such a special car.

If you are thinking of doing the body repairs yourself, be realistic. Very few professionals get it right first time! You will need a very large and well equipped workshop and experience in steel and alloy fabrication - every XK has an alloy bonnet and 120 and 140's have alloy doors and boot lids, with the coupés also having various wood structures. The skills necessary to successfully accomplish a quality lasting finish are considerable. From my own experience, it's also best to have the entire bodywork done as one project. Doing this work in several stages over a prolonged period also seems to cause problems later on in the restoration. My overall advice is to speak to XK bodywork specialists of renown, obtain a quote and, if you can't afford this all at once, save or borrow until you can!

If you can rent a body jig, do so. It will save a lot of time and make many jobs simpler. Once the restored body has returned, do not have it painted until you have try-fitted all the important exterior fittings and locking components. A good bodywork specialist will usually have asked you for doors, bonnet and boot locks so he can assemble the body with these items to check gaps and fits. The more you try-fit, the less damage you stand to do later and the more time you will save not complaining to the panel beater. For Roadsters and especially Drop Head coupés, the hood frame is an area worth putting some time into at this stage. This will also repay you with less complications at the trimming stage.

Once the body is ready for lowering onto the chassis for the final time, make sure you have several friends round, and don't rush anything. Have an amount of packing shims handy and long bolts to aid location. Don't panic yet about door gaps as the body is still very flexible and time spent with alloy packers and fibre shims will get the results. Try to do the final bolting down with the chassis on its wheels and tyres as the chassis will also flex a little once all the weight is on its suspension. Be prepared to spend a long day getting a good overall finish. I know I'm making it sound simple, but it most definitely is the most problematic area. More people give up at this stage than at any other! No two bodyshells ever turn out the same. Be patient. Be realistic in your own skills and above all get professional help. If it sounds too cheap beware. People often ask us what we pay for bodywork and paint (they think we have special inside connections!) and when we tell them we've just paid over £12,000 for the metal and paintwork, their mouths gape and their only comment is "THAT'S NOT CHEAP".

There is no way round it if it's going to be done right - expect to pay the going rate. Next month I will move on to exterior fittings, chroming and rubber seals.



*How the factory did it.*

## Bolting on some shiny stuff

Well, if you really are lucky enough to be looking at a newly painted bodyshell sitting happily on its restored chassis, your wife (or husband) hasn't filed for divorce, and you still have the money and the enthusiasm to carry on, you truly deserve a medal! At this point, more than any other most give up, sell up, or move out.

It now looks like an XK again and the excitement of bolting on some shiny stuff is overwhelming, but which bit first, and in what order to avoid doing every job twice? We have found that many cars, including XKs, have a similar starting point at the fitting up stage - E-types, Healeys and even an old Alfa. First fit the chrome washerjets and tubes. Sounds minor I know but try and get in there when the wiring loom, heater ducts and wiper mechanism are in the way and you will soon thank me for this tip.

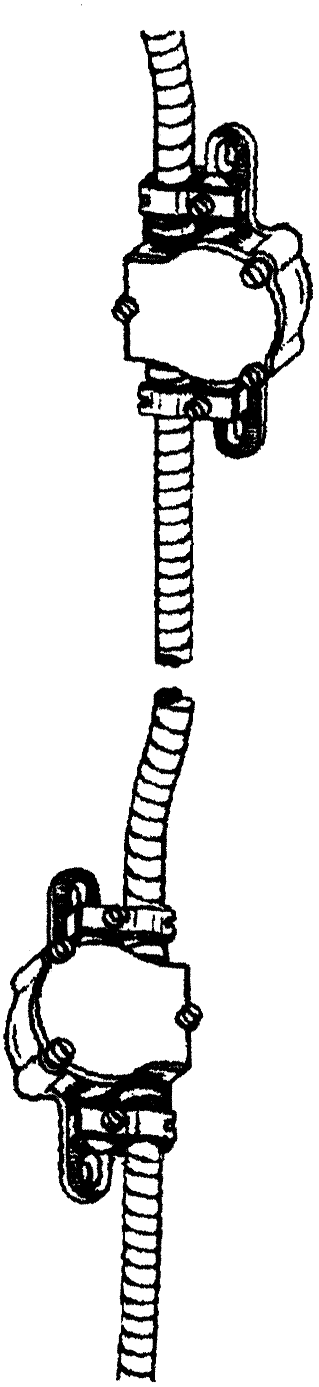
If not already in, start fitting the dash, main bulkhead wiring loom and then the wiper wheel boxes. For 120/140 owners it's important to remember how to fit the wheelboxes correctly or it will be dash out later - ouch! To make the 'clapping hands' action for the split screen cars you need to fit one wheel box 180° to the other, then feed the wiper rack (cable) over the first box then under the next, I've included a diagram to help. At this stage you will have got bored with working in the cramped confines of the cockpit and dash area, so I suggest fitting some headlights, tail lights, and one or two other exterior goodies - it's not essential to the project but it does help mentally! You need to stand back and see the car looking back at you through some glistening lights or the much needed enthusiasm and drive starts to wane.

Now, I know I'm making it sound easy and fun, but believe me even the best of us will get frustrated at the length of time it can take to do what seems to be the simplest of tasks. Treat each small area or section as its own small project, study the fittings and cheek all the necessary hardware before starting. There's nothing more annoying than trying to fit a door handle with the wrong length screws. Be prepared to waste time on a restoration looking for the right fixings or the right tools for the job! The quicker you get into the frame of mind that trial fitting and hand finishing of most items will be needed the less frustrated you will be with each section. Keep a selection of books close by - workshop manual, factory parts book, 'Original XK', etc. A picture does speak a thousand words (if it's the right picture!). For those of you with coupe's, drophead or fixed, the area that always inspires the most colourful language is in the door fittings, window frames, glass, winder and door opening mechanisms. They will try your patience to the limit. Don't expect to do this job in a day. You may need up to a week before you are happy with the results!

The heart-rending tales we've heard over the years would be enough to break a good man's spirit. Take twice the normal amount of time you would expect for each component and don't be surprised if you have to make small brackets or special bolts to obtain a good fit. It is allowed, I promise! We have taken many an original door apart to find various wood packers and bits of sheet metal to shim the door frame into place.

A quick note for 140 Drophead owners; the front opening quarter light frame is a direct descendant of the 120, the only difference being the purposely flattened area of frame edge just below the door top line. Rather than make a new specific item, the factory just gave the delicate chrome edge a few good whacks' with a mallet and 'Hey Presto' the 140 door lock hinge then fitted! It may be tempting but also leave the windscreen out until later as fitting the dashboards and demister ducts will be a lot easier without the glass in the way. It helps to reach both sides at once.

To touch back on the wiring subject again, we are asked many times about the position in which to fix the various parts of the loom to the body. Luckily the new wiring loom sets today are of a very high standard and the overall fit is excellent. My normal response to the question of "Where does it all go?" is, "The factory tried their best to hide the loom, not put it on display", so take a close look at the bodyshell, try each piece of loom to determine fit and correct grommets needed. When you are sure each piece of loom is corresponding to components and wiring diagram, then fix with tape to the bodyshell, keep doing this until all the loom makes sense. Don't forget that, unless **all** your electrical components are of original type, you may need to alter some fittings from 'bullet' to ' spade' type, etc. As soon as you start to try and hide the loom from sight, you will quickly (with a little commonsense) follow the original path. The overall length of each piece of loom will determine the final detailing.



As I have written several times before, most of the chrome, plastic and rubber components are reproduced, originals being long since gone! So be prepared to hand finish, fettle and generally try-fit items two or three times before you are satisfied. Don't always complain at the quality because it's good that so many items have been remade at all! Do ask about fit and quality, not just the price, when buying. Many items have at least three or four different manufacturers and varying quality. Don't buy the cheapest and then complain about the fit; also remember that all of the exterior chromework on an XK fits over a double curvature panel so the panelwork is as likely to be suspect as the fit of the chrome - it's a marriage of the two that wins the day.

## Interiors - the variations and fitments

Moving on to XK interiors, one could fill a book with all the possible variations. Therefore, I will aim to cover the larger and more problematic areas, and the first and most important of these is the seats.

For excellent visual references, see Philip's Original XK book. I will try to detail the internal structural differences and the fitment details.

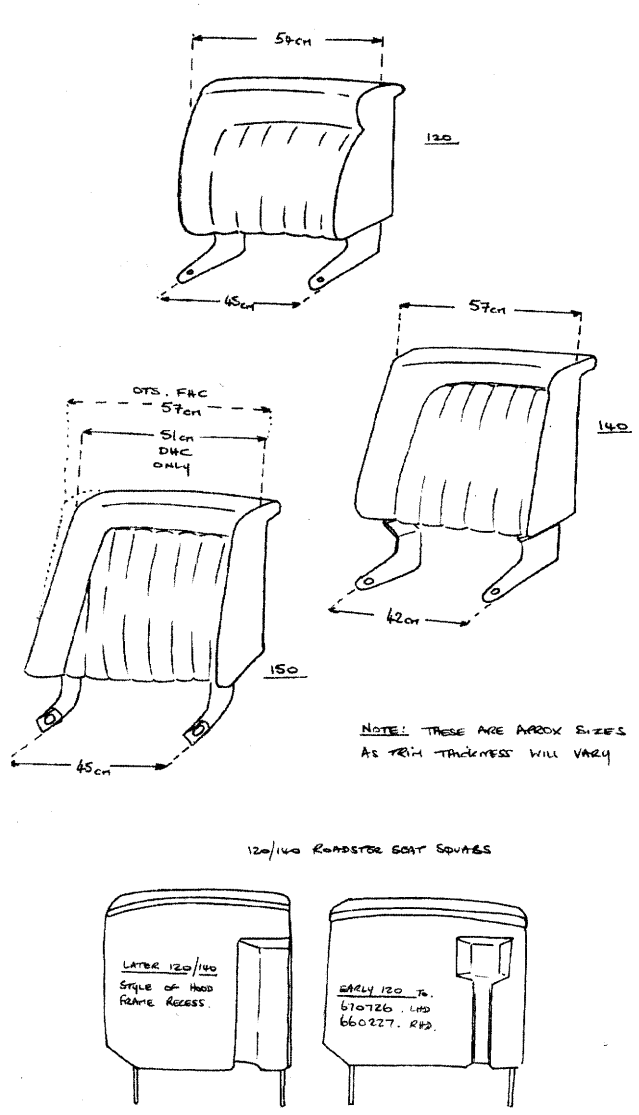
As always, I will start with 120s. The alloy cars and early steel cars up to chassis numbers 660227 (RHD) and 670726 (LHD) share the same chrome-plated seat frames, although on the alloy cars a slightly different shape of seat adjuster lever was used (not noted as a different part no. in the Parts Book). These chassis numbers also coincided with the change from a chromed to a painted soft-top frame. The Roadster's main difference is the provision of a hood frame pocket (or indentation) in the seat back (squab). All Roadsters must have this because, when the hood is stowed, the frame protrudes into a portion of the seat. The shape of the pocket changed at the above numbers from a slim to a much wider opening. After this change the Roadsters seats were unchanged through till 1954.

The FHC were unchanged throughout production. The overall dimensions for 120 seats are the same for all models and the base frame will fit all. It is also possible to change a coupé seat into a Roadster seat by fabricating the hood frame pocket area. The Drop Head Coupe had the same seats as FHCs until 667161 and 678086 when in December '53 the seats became 'flat backed' - a much more bench-like seat, later to appear as standard on 140s. The seats are difficult enough to sit in when cornering, so why they lost the gentle curve is beyond me!

The hardware and runners remained the same throughout, so interchanging is easy. The well-known optional extra was bucket seats, but these were only offered for Roadsters (according to the Parts Book) and were not used with runner mechanisms. The main problems with them are that they were not designed to be used with a hood frame (for racing use, normally in conjunction with aeroscreens) and also, having a fixed position, it makes it very difficult to get to the batteries, etc. However, if you are over 5ft 10in tall, they are a 'must' as, with the thinner base cushions, you can almost achieve a proper 'driving position'.

For the 140s, things standardised from the start, the Roadsters having the cutout in the back to clear the hood frame and the FHC and DHC models sharing the same seats. However, not shown in the Parts Book, but seen several times on late '56 140s is a strengthened seat base and seat back with extra steel braces across the wooden back. This did not alter the basic shape but proved the XK seat evolved, even if not documented in the Parts Book. The 140's main difference from the 120s is that the prop shaft is considerably wider so the base and cushions are slimmer to suit. The cockpit dimensions are similar to the 120 so the back is the same width (approx) as the 120, but the hinged leg on the inner side has a pronounced 'dog-leg' bend to reduce its width.

Lastly, the 150 seats are similar but had a more complicated tubular back frame with aluminium fillets. The base frame was of the same basic construction as the 120s and 140s, but additionally had a longitudinal brace to hold the inner seat runner. This was because the 150 was a wider car but still retained the wider prop-




shaft tunnel (the base was now the same width as the 120). The FHC and OTS models shared the same seats but on the DHCs a small, but significant, change to the squab (seat back) was necessary. The large, complicated hood frame protruded into the seat area where it is attached to the car and with the trim panels fitted, the FHC or OTS seat would foul if you tried to slide the seat back to its maximum. So the 150 DHC seat is tapered on the outside to clear the trim. Lots of 150s have the wrong seats and it's always a quick indication of a FHC to DHC conversion. The 150 Parts Book does list bucket seats with special runners and fixings, though these seats were different in shape to the 120s, with more hip support (originals in cars very rare).

So, has this helped, or totally confused you? We have manufactured all the correct 120 and 140 seats, and the 120 bucket seats. The 150 seats are too expensive to recreate so originals have to be found. For the practically-minded and to suit all types and customers, we have produced our own design of bucket seats. These are the same basic shape as the original 120 ones, but with a hinged back and more substantial base, allowing the full use of the hood frames, battery boxes, rear seats, extra luggage, etc., and there are braces on the bases to accept various seat runners. We think that this does not spoil the original feel and look but makes using an XK just a little more practical.

## Don't lose your head

The question of interchangeability arises when a cylinder head can't be overhauled for any reason: corrosion in the water passageways too bad, frost cracks, warping or skimming too far (and many other good or bad reasons I can't think of!). So off we go looking for a replacement, concentrating only on the area we've just been told is the reason our so-called original head can't be rebuilt. But later we can find out that we've overlooked a small but significant problem, the Rev-Counter Drive and Adaptor. Basically, we can interchange all cylinder heads from any 3.4 or 3.8 litre engine. Inlet Manifolds will interchange, as will exhaust manifolds and front breather housings. As for cam covers and revcounter adaptors, we need to look a little closer.

**CAMCOVERS**

To start with cam covers, the early XK120 without the three front mounting studs (known as 'studless') can be fitted to the later heads even though the gaskets have three holes. It's still continuous on the outer edge, thereby creating a seal. The main problem with the early cam covers leaking is from overtightening, warping the covers slightly so not sealing completely. (The same goes for any cam cover). After the "studless" covers, the later 120 through to the earlier 3.4 150 will interchange, the Type "C" Badge being only riveted through the standard cam covers on the XK140 SE cars.

The real problems occur on the late XK150 heads when an electronic generator was fitted to the inlet camshaft. This created a whole new design at the rear of the cylinder heads. XK120/140 Rev. Counters are driven by direct cable from the exhaust camshaft. This causes little problem to change to any later 3.4/3.8 head, and a special blanking plate for the inlet cam can be obtained from 68/69 saloons, or easily made. When all installed, only a keen eye would be able to detect any change. For XK 120/140 owners, an immediate power increase can be obtained by fitting a well rebuilt 3.4/3.8 XK150 or MKII head. For XK150 owners, swapping cylinder heads needs far more in-depth knowledge if time and money are to be saved as well as achieving a satisfactory answer.

As already said, all 120/140's are direct drive from the exhaust cam. This means at the REAR of the engine both cams are rotating anti-clockwise, which is not a difficult fact to grasp, but as all 150 rev. counters rotate clockwise you can now see where our problems start. To see why this happens we need to look at production.

**CABIN ROOM**

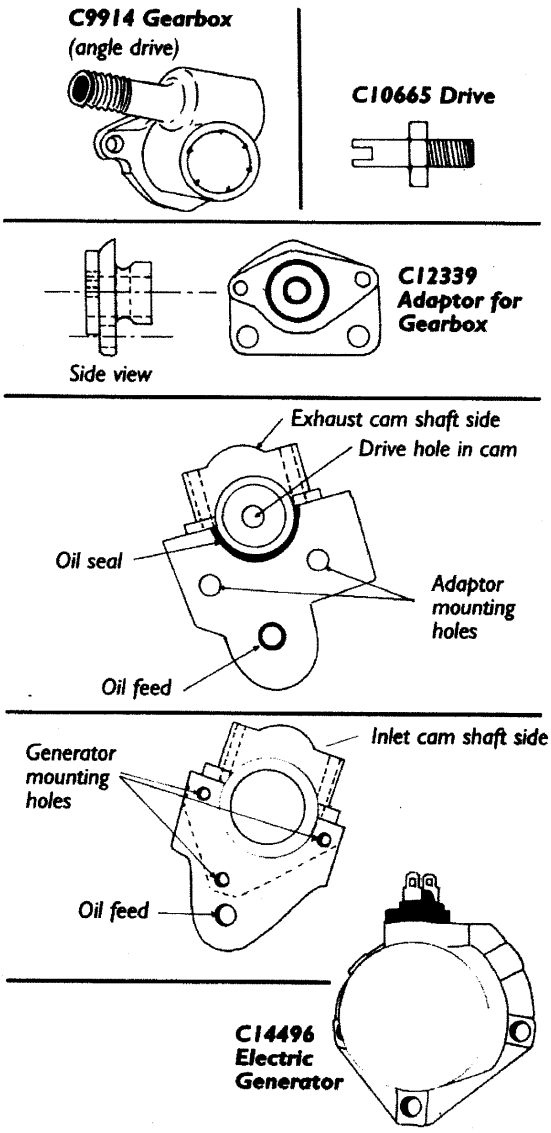
To create more cabin room, the bulkhead of the XK150 was moved very close to the engine; in fact, it actually surrounds the rear of the engine. With the lack of room for bulkhead wiring, heater and demist ducting, routing a mechanical cable straight from the engine was not viable without sharp bends and no mechanical cable revolving at speed will work with acute angles. (Early breakage normally follows). So to overcome the problem, an angle drive (gearbox) was fitted to the INLET camshaft drive, sending the cable out at 90˚ to the engine, so allowing a steady curve to the cable through the bulkhead. The angle drive also converts anti-clockwise rotation to clockwise. So now we can see that earlier mechanical type Rev-Counters are matched to their relative components. (i.e. early 150 head to angle drive adaptor, to angle drive gearbox, to cable, to clockwise rotating Rev-Counter).

As the faces of 120/140, and 150 Rev-Counters differ so much, any swapping of these is an obvious mistake and will not suit the other instruments. Later 3.4/3.8 150s were introduced with electronic Rev. Counters and new head casting designs accommodated the generator (still driven from the INLET cam shaft). The cam cover for this inlet side of the head was also redesigned for this new instrument and earlier cam covers do not interchange.

We hear very often that the head from, say, a MKII has been fitted on an earlier XK150 and the customer is now looking for the matching electronic XK150 Rev. Counter. As this instrument is unique to the late (1960/61) XK150 and 150 'S' models, it is extremely rare and therefore expensive. In fact, it is easier to find the correct cylinder head (type) than to find the instrument. The earlier type angle drive is not pictured in the factory parts book, so, I have tried to find some diagrams to help with identifying parts if not already fitted to the engine. Also, there follows a list of part numbers to be found on the underside of cylinder heads. These are raised letter castings, NOT stamped by hand later.

**HEADS**

C2242 & C2242/1 Early Studless Type
C6733 & C6733/1 Standard XK 120/140 1952 to 1956
C7707 & C7707/1 Type "C" Special Equipment XK140
C12500 Early 150 3.4 mechanical rev-counter
C12600 Early 150 3.4 mechanical rev-counter (straight port)
C14956 3.4 150 electronic rev-counter (not 'S')
C 14958 3.8 150 electronic rev-counter (not 'S')
C14957 3.4/3.8 150 'S' with electronic rev-counter (straight port)



## Getting going - overcoming starting problems

This month seems to be yet another during which we have been besieged with 'Getting Going" problems - lots of electrical faults and poor first journey syndrome.

The area again for my attention has been the very poor state of carburettors that show up in our workshop, sure, all seem to have nicely polished dashpots and the odd new fibre washer, but, most are so far away from factory spec. that it's no wonder these cars are struggling to make one decent journey over 20 miles.

The most common problem, before even stripping a carburettor, is often the amount of play in the butterfly shaft. Any play will allow air to pass into the carb throat and fuel/air balance is all but lost for good. If this is coupled with badly worn or incorrect needles, why bother to even try to tune at all!

It's very rare we find the need just for gaskets and a main jet, yet we sell far more service kits (just a basic kit) than the full overhaul kits (includes spindles, butterflies etc). For most home restorers there is a basic need to stop the myriad fuel leaks, but there seems to be a lack of knowledge to progress any further.

For those of you that have ever used a rolling road tuner, you will have noticed that most of the work centres around carb. settings, ignition timing and plug gaps - more often than not the owner can see 30/40 bhp appear before his eyes with little more than a change of needles and a synchronising of all the above mentioned areas. We have, of late, seen far too many good engines - some with very large spec. sheets and invoices to match - perform worse than standard due to poor carburettors and ignition. As all the parts are available to properly restore any combination of carburettors, there is no need to suffer.

The S.U. H and HD Type carburettor is an excellent piece of simple engineering, but once an amount of wear on critical components creeps in, you are on a very steep downward slope. If you are confused, then leave well alone and take to the nearest expert. You could be very surprised at how well your XK might run.

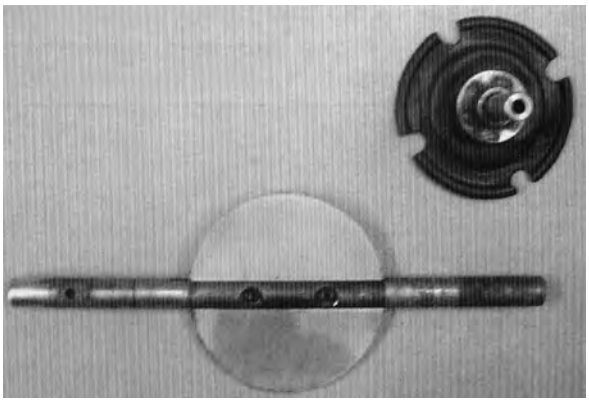
The pictures show H Type carb. (H6) 1.3/4" as fitted to XK 120/ 140, also HD6 Type 1.3/4" fitted to XK150 3.4/3.8 non- 'S' Spec. cars. All 150 'S' models had 3 HD8 - 2" units. "D" denotes diaphragm type main jet. Also pictured are a 'spindle' and "butterfly" - showing signs of wear.

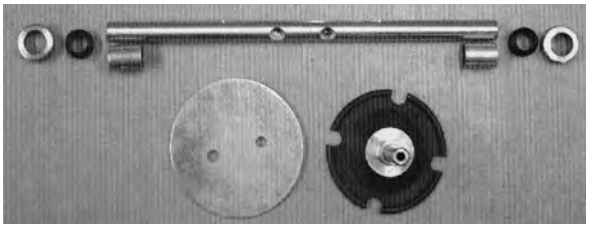
If you are restoring your engine as original, then the workshop manual will cover just about everything you need, but as so many owners are looking to performance related modifications, you will need to tread ever more cautiously - don't guess! It could do a lot of damage. Too weak or too rich a mixture will not do your expensive engine any good at all.

There are several books available about S.U. carbs. and the tuning thereof. If you intend doing the work yourself, then I recommend plenty of homework first. The possible needle variations and settings could fill this magazine alone! Also remember, just changing your air filters to a different type could dramatically alter the mixture of fuel/air. Chrome 'pancake' air filters may look great, but will they de-tune your car?

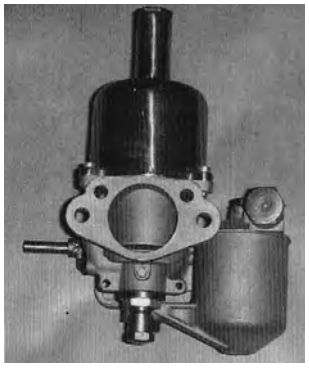
*Carb rebuild kit.*

*Worn butterfly spindle.*

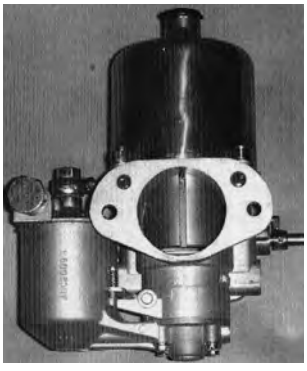




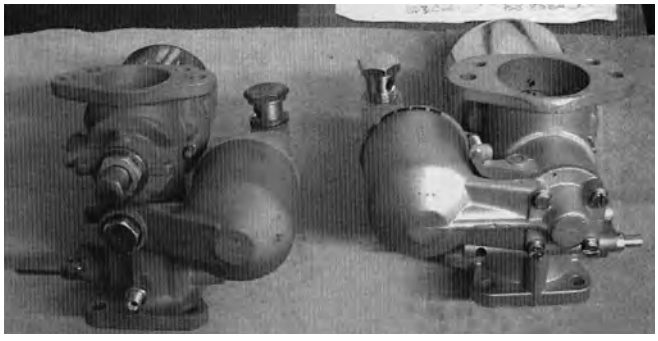
*New butterfly spindle.*



*H Type*



*HD Type*



*H Type on left and HD Type on the right.*

## Common faults with clutches

We have briefly touched on the subject of clutches before but in this digital age, thankfully, a picture can explain what a thousand words cannot. There are several problem areas with clutches, the first being a mismatched set of components. Try to be sure to always buy a three-piece clutch kit, i.e. a cover assembly, driven plate and carbon thrust bearing. As a lot of clutches look very similar, it is easy to confuse parts if purchased from different suppliers.

One of today's common complaints is a heavy feeling clutch, by that I mean that a very strong left leg is needed to fully depress the pedal. This is so because only one version of the cover assembly is available today - the last version that was fitted to 3.8 E-types with 250bhp and an hydraulic clutch operating mechanism. Originally the 'Borg & Beck' type cover assembly was available with differing spring strengths based on the power output of the engine. The differing strengths of springs had a colour code - yellow, white, brown are common throughout the early Jaguar range. Since the late 1970s though, only those with a distinctive bright purple spring set could be purchased new. This is fine if you have an uprated 3.8 engine and a strong left leg, but can be difficult and uncomfortable in a standard XK120. There are some companies still in existence who can rebuild a cover assembly with suitable softer springs, but I'm not sure that this is a very exact science in today's world.

The option that is most suitable, even on a competition car, is a later diaphragm type clutch, 'Laycock Style'. This was introduced on the last 3.8 engines and later on all 4.2 engines. It is still used on Jaguars today. This is a 9 1/2" unit as compared to the 10 inch original type, but has a much softer pedal feel without compromising performance. To fit this unit though it is necessary to have the flywheel re-drilled with a new set of mounting holes. So, if you have a choice to make when rebuilding an engine, I suggest having this modification done. Once done you can then either fit the 10" or 9 1/2" type clutch as the two sets of holes do not interfere with each other. Also a diaphragm type unit is readily available from any good auto parts stores and an uprated version is still available for competition cars, so there is a variation to suit most needs right up to full-race spec. 'off the shelf'.

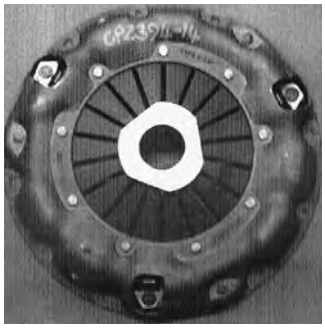
The second most common problem is adjustment or 'lack of'. For 120 and 140 owners this is far more critical as the system is purely mechanical, unlike the 150 which is hydraulic. The problem even with a new clutch kit fitted and correct adjuster rod, etc., is that there seems to be little in the way of adjustment for wear as the operating lever is already near the end of its travel. Again very difficult to explain properly in words, but if you find that this is the case on your own car then the problem I'm afraid is elsewhere. By this I mean it's the flywheel that is now at fault!

What we now see, in early XKs especially, is that the flywheel face may have been skimmed (machined flat) several times in the past. This now causes the clutch cover unit to be physically closer to the engine when bolted up tight. You may be thinking how is this possible when so little material has been removed from the face of the flywheel, but I can assure you that as little as 40 thousandths of an inch (0.1 mm) can alter the adjustment by up to 1/2 an inch (12.5mm) on the outside of the bell housing. For some cars the only way that you can obtain the correct settings, as per the workshop manual, will be to replace the flywheel altogether!

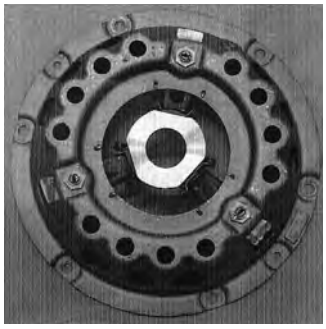
We commonly see a variation of 'homemade' adjuster rods to try and overcome this scenario, but often this makes the clutch operation even worse. If you try to fit a longer rod, it will only push the main operating lever over its centre too far and start to bind up on the adjuster rod itself, a situation that just goes from bad to worse. As with all mechanical things, you can't keep taking metal away without it having a detrimental effect further down the line.

For 150 owners the common mistake leading to poor clutch operation is the incorrect master cylinder (main cylinder unit attached to the pedal lever). The correct unit is one with a 3/4" (0.75mm) internal bore size. Often, because Girling uses the same alloy casting for the cylinder, we have people assuming that because they look identical then it's OK, but look again! The common fault is to fit a 5/8" (0.625mm) cylinder which leads to the problem of when the foot pedal is completely depressed you still have trouble in selecting a gear smoothly. This is because the piston inside the cylinder has not moved enough fluid to fully disengage the clutch, as opposed to the problem, if you fitted a bigger bore 7/8" (0.875mm), of moving too much fluid, usually resulting in popping the piston right out of the small 'slave' cylinder attached to the bellhousing.

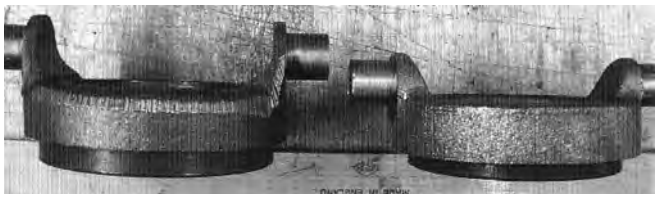
These are the common complaints we hear about most often. I hope some of the photographs help to explain better what my words do not. Again, I must warn that before you do any modifications from original, be sure you fully understand why, and be sure to use an expert - it will save money and heartache later!



*9 1/2" clutch*

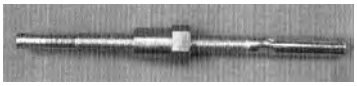


*10" clutch*



*9 1/2" thrust bearing* *10" thrust bearing*

*9 1/2" cover* *10" cover*



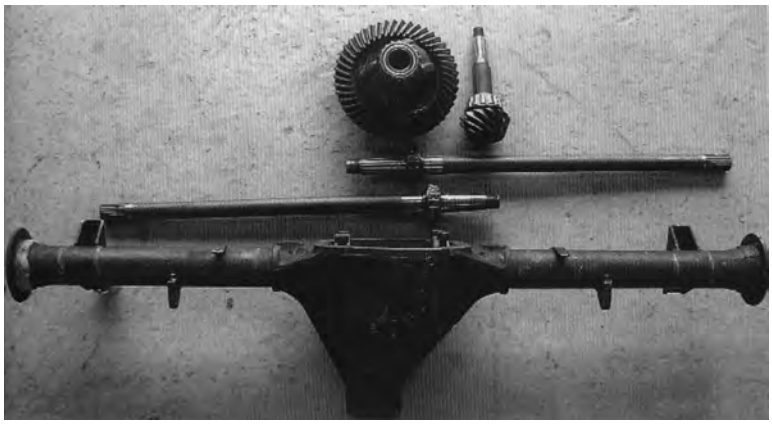
*above: 150 pushrod*

*left: 120/140 lever*

## Axle horror stories

In the last two months we seem to have had a flood of calls and panic over axle problems. These have ranged from a simple need to re-build as standard, to full racing requirements with ratio changes and fitting the desirable 'Power Lok' limited slip unit.

Although changing a ratio may sound simple, in some cases even this can cause untold headaches. Differing carrier units and special bearings are needed if you try to use a crown wheel and pinion from a later Salisbury differential. With the need for special tools and experience in assembly methods, this is definitely a job for an expert. It can be expensive but done properly, and with the occasional oil change, the axle unit could easily last ANOTHER 40 - 50 years!



*The main components.*

One such axle is in our workshop at the moment with the brief that the customer would like us to rebuild and fit the Salisbury 'Power Lok' unit, as the car is used for the odd rally, and maybe he would like to start getting a little more serious about his sport.

When the axle arrived, the first noticeable difference from a standard XK120 spec. axle was the addition of disc brakes and, to keep the standard bolt-on wheels, the owner had obviously commissioned two special hubs and two special caliper mounting plates to be made. Very professional it all looked but was not actually necessary as standard Mk.9 rear hubs and standard 150 caliper mountings would have been a lot less work and money!

Judging by the cleanliness of the parts I was curious as to why the axle was now back out of the car before any of the new parts had had any use at all. Our suspicions were confirmed when we tried to dismantle the axle. One axle shaft pulled out quite easily and the other will not budge. We can also see that it has two new heavy duty axle shafts and new outer hub bearings. When the shaft does let go and the differential carrier unit can be removed, our initial fear about the cause of the stuck axle shaft is confirmed when we place a straight edge across the axle case and tubes.

*Worn crown wheel and pinion.*

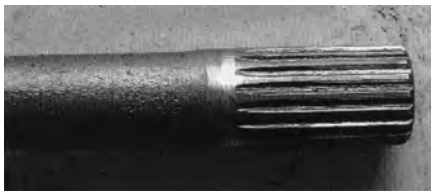
The left hand axle tube is obviously bent, and the recently fitted new shaft must have been a real problem to line up correctly when fitted. This tells us that the last mechanic either did not know any better or did not care! The axle has also been driven in this condition. The mis-aligned shaft has put an incredible pressure on the differential gears and the whole lot has 'Moaned and Groaned' its way along until the owner realised axles should not sound like a Siamese cat trapped in a tumble drier.

Luckily he did stop before damaging any of the new parts, but the crown wheel and pinion have been badly run out of line and they, along with their associated parts, are now scrap. It is also obvious that the differential carrier bearings are very old, if not original, and we are quite sure that the internals have not been disturbed for many years. Now, interestingly, I have not been told any of the history of this axle so, when all this is explained to the customer, he soon fills in some of the missing details.

The bent axle tube possibly occurred on a rally when returning home with a broken lever arm shock absorber (when a pot-hole had been traversed at over 60mph!) and may have been the start of the downfall of this unit. The cure for this had been to fit a telescopic damper conversion as on 140/150 models, but now the axle was on self-destruct mode. This was only made worse when the fitting of disc brakes and new axle shafts was carried out by a non-XK specialist and a considerable amount of money had changed hands. Soon after approximately 100 miles, the noise from the axle was enough to tell the owner that all was very unwell indeed. Understandably he is upset at the information, but also a little angry at the last mechanic who must have had to 'bash' one axle shaft into position when the other simply slipped into place without any aggression. The customer now realises that the only way to rebuild this axle is to start by repairing the first problem of the bent axle tube, then the rest will all go together as it should.

It is always interesting to me that so many owners and customers are reluctant to pass on the history of their car's activity or recent works. We must often assume the role of detective to determine how we should proceed. If little or no work has been done, then we can hardly blame 40 or 50 year old components for failing, but if recent work fails to deliver the desired results, or worse in the case of this axle, then we need to know why.

I guess the moral of this tale is, before asking a garage or mechanic to do any work, discuss first the history as you know it.



*Chattering on half shaft splines.*

## Mix and match mix-ups

There is still a lot of confusion and heartache over the interchangeability of Jaguar components. So many parts seem so similar yet in practice things can, and do, go terribly wrong.

To explain my point - very few components from the Mk.7/8/9 and Mk.1 saloons (sedans) will interchange with the XK. More often it is better and cheaper in the long run to keep searching for the correct XK part. I know that it seems incredible that at the same time that the XK range of cars were moving along one assembly track and the comparable saloon on another, so few of the parts actually carry the same part number as each other. Even when some of the front suspension components appear to be the same, look again. Subtle changes were made between the models. Fitting top wishbones from a Mk 9 on to an XK150 will give you all sorts of problems, yet you would swear the parts appear to come from the same mould!

Swapping parts between the XK models can give enough problems and if you have no comparison to make, fitting a slightly differing part could send you off down a very dark road indeed, where everything you touch now seems not quite as it should be.

I am not trying to spread doom and gloom, but trying to prewarn the unsuspecting that what may appear to be a cheap option may be the worst option. We have all made these mistakes to our cost and we should pass on only correct information based on true experiences. Many phone calls are along the lines of, “Can I fit one from a Mk 7 because I know where I can get one at half the price of the XK part?” My response is always. “Of course it will fit, you can make anything fit if you try hard enough. But if you are asking me if it the same as the XK part, only half the price, then I’m sorry but you already know the answer to that”.

If it were true, we would have a field full of Mk.7/8/9s and Mk. 1s all being slowly picked apart, and for those of you that have ever visited us, you will know that only XKs surround us for parts or recycling. Dismantling an XK to sell off in parts can and does become very expensive. First, to buy a complete XK will cost several thousand pounds (not hundreds) and then waiting for phone calls for each separate part will take several years (not weeks). Don’t forget that from one car you can only sell one steering column or one handbrake. As I have written before, as a business plan it’s ludicrous, but to keep XKs alive it’s essential.

We have all bought a car that was supposedly complete and original only to find that several important components are either missing or have been swapped for incorrect items. It would be nice to pick up the phone and order new parts from Jaguar, but now we all have to join in the hunt for good used or reproduced parts that are good in quality and fall within budget.

This is how so many customers and owners fall into the trap of buying saloon parts for their XKs. I actually had a restorer tell me the other day that we were asking far too much money for a part that he obtained easily from a Mk.1 saloon, and after a small amount of machining, Tig welding, fabricating a bracket and a modicum of bending to make it fit, it was perfect and when painted black, no-one would ever tell the difference!

We were asking £75.00 for the genuine XK part and he had paid £40.00 for the Mk. 1 saloon part. I’m sure in this gentleman’s mind he has saved his customer £35.00, but we would need to see how many hours labour were charged at what price to confirm if this were true. If you own a lathe or a milling machine and a Tig welder, then maybe this kind of masochistic pleasure is all part of the hobby. If, however, time is money, then this train of thought is foolhardy.

Only this month we have learned of another XK owner who has only waited eight years and spent £100,000 pounds on a standard XK restoration and, as with every story before this, it was certainly not projected to cost even half of the final tally!

Why then are these stories more common than ever? I’m sure each individual case would need to be looked at separately, but my own opinion is that so many can get caught up in the word “restore”. If you ask a restoration company to restore your car, or part of it, then that can be exactly what happens, and the very reasonable labour rate quoted makes you feel that all is well. If the restorer is well versed in the business of XKs, then this can still go well. If, on the other hand, he chooses to spend five hours cleaning and painting a part that is available NEW for £30.00, then it is easy to see how £100,000.00 can be spent doing the same overall job. As always, homework and common sense should prevail.

I hope the pictures show how easily you could be mistaken and the consequences are disastrous.

*XK*

*Mk. 7*

*XK*

*Mk. 7*

*XK*

*Mk. 7*

*XK* *Mk. 7*

## Over-wintering and Oil Leaks

As the nights get longer and the colder weather closes in (for those unfortunate ones who never experience cold weather this doesn't apply), we turn to thoughts of hibernation. Putting the old cars into a four or five month slumber is now quite common, but also remember that leaving an old car standing for such a long period of time can and does lead to all sorts of problems.

It is quite amazing how so many working parts seem to cease, being just through lack of use. Old electrical components with points contacts corrode, wiper motors seize up, hydraulic brake seals leak after the first use and all manner of locks and latches give up the will to live.

If you are going to lock 'her' up for the winter, try to think of all those areas and how best you can prevent deterioration. We use and recommend the car 'Bubble' capsule type storage; it is by far the best and safest way to store a car. The constant air flow over and through the car stops condensation, mildew and all manner of ailments, not least the dreaded mouse. The benefits of one of these storage systems far outweighs the cost of damage and even in the darkest garage can offer total protection for very little in the way of running costs. In our own workshop we use 'Carcoon' units as they also offer superb resistance to accidental damage if something should fall against the car - the bubble type qualities defend the paintwork brilliantly. Try one and you will never go back to old bed sheets and tarpaulins. If you do have one of these units, then don't forget to put a drip tray or two inside as the consequences are dismal for successful clean-up - we know from experience!

Oil leaks seem to be another longterm subject or, to be more precise, the curing of them. Engines are one half of the equation with gearboxes being the other. The gearbox subject came to the fore again in our workshop recently with a local 150 which for many years has had a problem with leaking its oil from the selector shafts protruding through the alloy lid (cover assembly). Now this is not something that normally troubles an XK owner as front or rear main seals are the usual suspects, but here we had a real mystery.

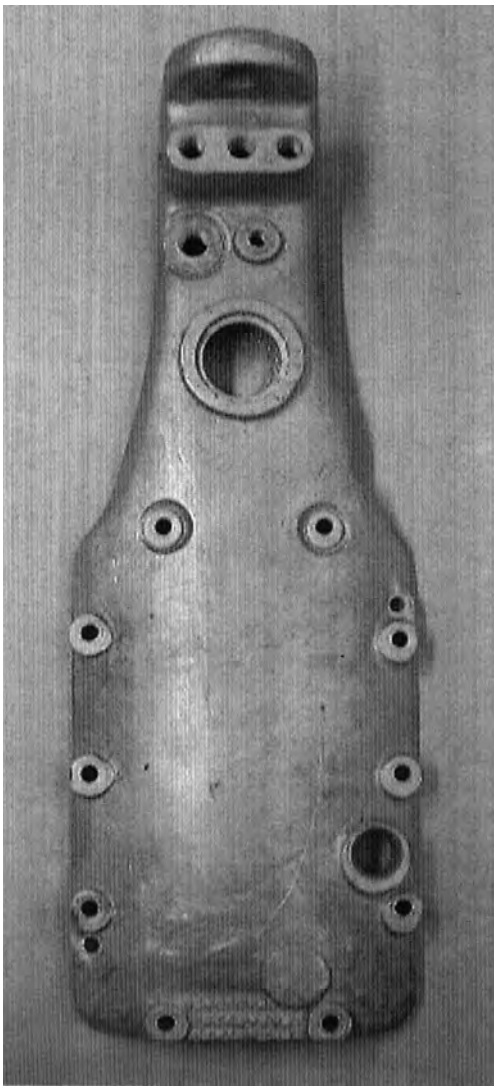
Before the car came to us, for other more serious work, the recurring niggly problem had been attacked by replacing the old gearbox lid with another unit, the theory being that any wear in the selector rods and alloy casting may be overcome with another unit. It didn't work!

So on to Guy Broad's and while the engine was out another attempt would be made at a solution. After removing the breather unit and checking it was free from obstruction, we also selected a very good condition replacement lid assembly. After fitting three new selector rod felt seals, we attached the new lid and sealed with new gaskets. We then left the gearbox overnight on its output flange to determine any seepage in the morning - 'Hey Presto' a chalk dry floor in the morning and no sign of any oil weeping from any seals. With confidence abounding, in went the gearbox and after all the other work the car went for a maiden voyage to XK Club Day at Philip's house.

All seemed well until after a few hundred miles, and, back came the pungent smelling gearbox oil oozing from the same place. By now we were all very confused as it is not something that I have heard of as a common complaint (please tell me otherwise if you have a similar tale). So what next? Drastic measures were called for off with the lid assembly and inspect with a view to restricting oil reaching the weakest link. Because the lid and selector overhangs the gearbox casing by several inches this causes a void in the lid which is fed by splashing oil from the gears. Also some pressure is built up when hot and especially on a long or fast journey, hence the need for a good and clear breather.

The drastic solution we came up with was to block the two oil feed holes to this area, remove the rear core plug in the lid and pack the cavity with grease. This, we believe, will give more than adequate lubrication to the selector rods and will prevent oil from filling this cavity and finding its way out (we hope!). By the time you read this, we should have learned whether this is a satisfactory conclusion to such an annoying leak.

We are often asked about gearbox leaks but there are several things to take into account. The castings that make up the gearbox are in some cases over fifty years old and quite possibly have been dismantled and reassembled several times. The gasket mating faces are often less than flat and true. This is only half the problem for cars with overdrive as, for these owners, the problem is far greater. The overdrive unit is a complicated high pressure unit running at between 400 and 600lbs psi in good working condition! With many mating surfaces in the assembly, it's not difficult to see that a dry overdrive is nearly always a distant dream rather than a reality, so please don't ask us - we can't give any guarantee!



When you think that many Alfa Romeos have no gaskets at all in their gearboxes, you can also soon see that Jaguars are dealing with something a little more, well, agricultural, dare I say? Also, don't forget that oil leaks can often and do save some Jaguars from extinction. It is said that without oil leaks many XKs would have rotted away completely. Every cloud has a silver lining, if you look long enough!

## Hot Heads and Thermostats

I have been reading with keen interest, as I'm sure many have, the great 'overheating' debate. Many good and interesting points have been raised and some good ideas have been passed on by long-suffering 'Hot Heads' (excuse the awful pun)!

Here are some of my own thoughts, ideas, and experiences with this problem. I'm all for fitting 'Add-on' extras, such as electric fans, expansion tanks and secondary water pumps, so long as they are not helping to mask a basic problem within the cooling system. We are often asked to fit an electric fan kit before we know anything about the history of the engine or ancillaries. It sounds obvious, but having a good cooling system starts with a clean, sludge-free engine block, an efficient and sludge-free radiator with correct pressure cap, well set-up ignition timing and carb. settings. Without any of these areas being in correct condition, any additional cooling accessories may only mask a basic fault.

Common and simple faults can be wrong or incorrectly fitting radiator caps. For instance, the original cap fitted to later XK140 and 150s was a 4lb long reach cap. This was later superseded by a 7lb long reach cap. In many cases this 'long reach' style cap is not easy to obtain and can often be mistakenly replaced with a 'short-reach' cap, which in turn provides no pressure seal to the water system. This leads to water pushing out of the neck overflow without restriction as soon as the temperature reaches a rather lowly 75 - 80˚C.

Also, if you have replaced the original radiator with a new alloy variety or any other replacement, take note that all the more modem units we have seen are made with a short reach style neck. To fit the original style long reach cap of 4 or 7lbs to this neck fitting will have the disastrous consequence of a totally sealed pressure system. I'm sure you can imagine where this pressure cooker may blow off its steam!

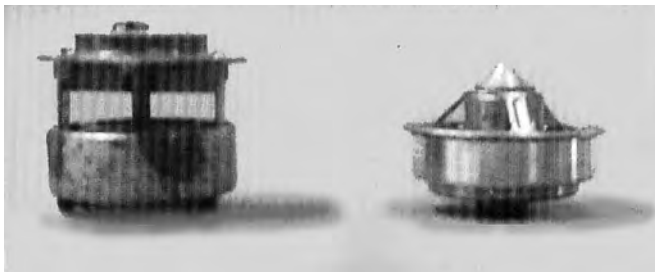
Another common fault is the wrong thermostat, as has been covered by several jottings before mine. The important thing to remember is that the thermostat should have a band that closes off the by-pass hose once it is fully open. A standard common thermostat does not do this and so 25 - 30% of the pumped water keeps taking the short-cut avoiding the radiator and recirculates constantly around the engine block getting hotter and hotter.

Again, fitting an electric fan or electric water pump or an expansion tank will not cure this basic fault, but merely hide it for a little while.

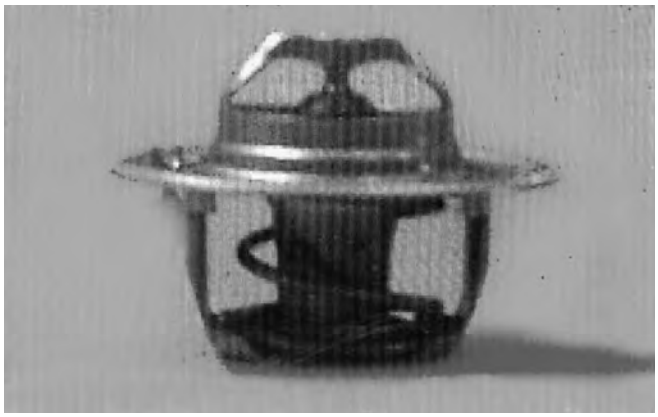
Please don't get me wrong, all of these add-on accessories work very well in the right conditions. However, a side effect of an electric fan can be the strain put on the battery and charging system because of the drain of power to run the fan motor. The next time your fan is switched on keep an eye on the ammeter and you will see that on tick-over, the gauge needle sits a fraction above the zero mark, but as the fan kicks in, a drop of 14 to 15 amps can be seen and bringing the revs up to 2000 RPM will only bring the needle back to zero charge rate. Now you can see that if you have your fan operating through a thermostatically controlled switch that allows the fan to run on after the ignition is switched off, a battery can run down in a matter of a few minutes.

I know quite a few of you have experienced this particular side effect. For some this leads to a complete re-vamp of the electrical system, starting with an alternator conversion - more expense and more work! Of course, none of these ideas are new to the motor industry. Just look under the bonnet of any more modern car and you can soon see all of these additions and more.

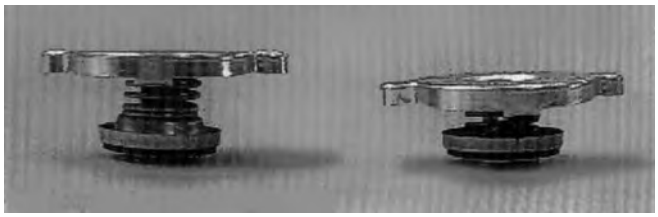
For Jaguars you only need to look under the bonnet of a 1985 XJ6 4.2 to see, with basically the same straight six engine, the amount of extra radiator capacity and electric fans necessary to keep your mind off the temperature gauge. There are of course many other modifications, from larger water pumps to extra cooling passages within the block and head that all help in extreme conditions. Are we all trying to turn our engine bays into XJ6 variants I ask myself? Copying the combined might of the Jaguar design team would seem a good place to start. Maybe we are all spoilt with modern motor cars.



*Thermostats: old-style Beehive (no longer available) and the new Superstat type, both having the band to cut off the by-pass hose.*



*A standard thermostat with no band.*



*Rad caps: short and long reach.*

At the moment we are building an XK150 Coupé for a customer in Spain that has power steering, air conditioning, electric windows, central remote locking and remote mirrors, a fancy stereo system and an uprated 3.8 litre engine on triple Webers! This kind of car has to start with altering the entire concept of the car and we will be pushed to the limits to try and blend XK charm with modem components and still finish with a practical and reliable car. Crazy it may be but it does lead to many ideas that can be of benefit to other XK enthusiasts. Keeping this car cool inside the cabin and the engine bay will test all our ideas to the extreme, especially in mid-summer Valencia! We will keep you informed - if we haven't had a collective nervous breakdown before then.

## Gearbox and Carb Conversions

Firstly, may I say thank-you to Robert Schuerenberg for suggesting topics that should provoke interesting discussions. This is exactly what is needed to help many owners make educated decisions concerning the running and modification of their XKs. To help kick things off, I would like to pass on my own thoughts on Robert's two topics - 5-speed conversions and SU Carb. additions.

Our first foray into 5-speed gearbox conversions was back in 1995 with a Jaguar (actually Leyland) gearbox, as used in the XJ6 and Rover SD1. This went well as we took all the parts from this Jaguar conversion and installed it into an XK. Many other small and not so small modifications were necessary to complete this, not least the cutting of a large piece out of the centre crossmember. This is all fine if you have experienced mechanics at your disposal, and you are quite conversant with the surrounding components to understand all the small details to make a smooth transition from one gearbox to another. As a parts company we knew this was a no-go situation to sell the gearbox to the general XK owner - cheap gearbox but expensive conversion. Then came a good friend from Germany with a BMW Getrag 5-speed, light weight alloy 'box with a good history for excellent service over 200,000 Kms. The rest, as they say, is history. We have sold and fitted over 260 since that first encounter! However, as I say monotonously, if you want to convert one area of your car, be prepared to have 27 other modifications to make that one conversion work correctly.

We have tried many other 5 -speed gearboxes. TREMEC, Borg Warner T5 and Toyota Supra all have good and bad points - not with the 'box itself but again it's the surrounding components that need to be looked at. With any of the above 'boxes you will need to change the propshaft, spigot bush (pilot bush), speedo cable and maybe even the clutch unit. No problem, as I'm sure this is expected by most mechanics, but once you are in this area, you can be sure that other work will seem to 'pop-up' from nowhere.

As with many things in life, expectations can be the biggest downfall. If a gearbox swap is to make all your dreams come true, be warned, gears and axle ratios are partners, so mixing the wrong ingredients could leave you with a bad taste in your mouth. To help clarify this, most 140s and 150s came with 3.54:1 axle ratio if a NON-overdrive gearbox was fitted (0h, and don't forget 16 inch wheels) and a ratio of 4.09:1 if an overdrive unit was installed. 120s are common with 3.64:1 or 3.77:1. Now, as we see or hear quite often, the problem can be magnified (in either direction) by fitting 15 inch wheels with lower profile tyres and a 4.09:1 axle ratio axle. This, with most 5-speed conversions will give you a gearbox that now has virtually unusable first and second gears, but will generally drive everywhere in third and fourth all day.

The interesting thing to note is that the actual gears in the original Moss XK gearboxes do not change ratio between overdrive and non-overdrive units, just the rear axle ratio. This is why first gear in an overdrive car can also feel as though its only there in case you need to pull a friend's car out of a muddy ditch!

Quickly you can see my point about the need for an all-round conversion not just a 5-speed gearbox transplant. The good point, and may I say it's a huge point, is that ANY gearbox that works quietly and smoothly is a major bonus compared to a bad noisy XK gearbox. The torque of a Jaguar engine is legendary, so being able to select gears quickly and smoothly is what brings all Jaguar engines alive, to be able to down change from 4th to 3rd, and again down to 2nd letting the torque act as a braking system is one of the keys to releasing an XK's potential. Likewise to effortlessly cruise at 100mph (160kph) showing 3000rpm on the clock can be one of the great smile-inducing tonics of XK ownership.

The overall secret is in the whole package, i.e.; wheel and tyre size, axle ratio and 5-speed box to work together. A mismatch may only bring half the benefits.

Now carb. conversions - another great subject as I'm sure most of the lady members will agree. Men often believe two bigger ones have got to be better but, as with most things in life, age and condition can be the deciding factor (as for three bigger, that's just plain showing off!). Seriously though, the statements are correct, two 1.3/4" SU original carbs. (known as H6 type for 120/140 and HD6 for 150 non 'S' spec. cars) in perfect, as-new condition will give as much performance as you need on the road. Jaguar did not need to increase the carb. size even on the larger bore 3.8 litre XK150 until the cylinder head had been modified. This is still the 'rule of thumb' today.

To fit two or three HD8s (2" SU units) in poor condition will have a dramatic affect, but I'm afraid only in the area of fuel consumption. This in turn could lead to bore wash, which could lead to worn out valve guides and cylinder bores (sounds awful, you would agree?). To gain the full advantage of any carb conversion you need to look at your cylinder head first. When was it last rebuilt? To what specification? What size are the inlet valves? What camshafts are installed? Lots of questions to be answered first.

If you follow Jaguar's pattern of development, you won't go far wrong. Try and re-invent the wheel and you could be in deep trouble. For Jaguar, the only road going cars to be fitted with 2 inch carbs. (double or triple) were those with a straight port head. In basic terms the whole cylinder head casting was redesigned first! Wow, I'm back to 27 other modifications again, aren't I? For 120/140 owners with standard cylinder heads (very small exhaust valves), you are merely wasting time and money on a carb conversion that will have no benefit whatsoever for road use. Spend the money on a cylinder head conversion first. This does not necessarily mean swapping the head, but having a revamp of your existing head could be enlightening. For 150 owners with a head in good overall condition, two 2 inch HD8 carbs should give considerable extra pulling power.

There are still basic problems to overcome; for 120/140 owners sorting out linkage operation (HD8's open the butterflies opposite to HD6 units), air bleed screw additions and, if three carbs are your desire, inner wing and bonnet edge clearance will be a problem. If you take in more fuel and air mixture on one side of the engine, how will you deal with the burnt gases on the other side? What exhaust system will work the best?

Think logically and use common sense, try to understand the workings of the engine and try to picture what areas of weakness will hinder any improvements you are trying to make - what air filters can you use, which are the best to draw clean cold air (the kind of air that carbs. like the best), what will you do with the ignition system, what carb. needles will give the best overall performance (very different for each specification). We are only scratching the surface, but as you can see it is once again, buyer beware!

## Blowing your Gasket

It has been a very interesting last two months at Guy Broad's. I don't know if it is fate or a 'greater-being' at work, but since we have been more involved with an engine machine shop the phones and incoming work have concerned engine problems or engine upgrades.

It has actually been six months since our formal involvement with the machine shop (Chesman Motorsport) but the learning curve for the detail work has been very steep indeed. To go into specifics of all aspects of engine machine work can and does fill many books, and the variations of thought and beliefs are quite extreme. Suffice to say, that this area can contain more "Bull Sh*t' than any other! Stories of ludicrous horsepower and mythical secret parts are aplenty for any ill-informed owner.

The truth is, very little has been re-invented since the Jaguar factory ran D-types at Le Mans in the 1950s. If I could build engines that produced a true 295bhp with around 300 ft Ibs of torque that could last 24 hours of racing with speeds reaching 175mph, I too would be at the top of the engine building tree! I suspect not many engine builders would like to guarantee these figures today some 45 years on.

So why is it so difficult to copy what happened so long ago? There are many reasons but quality of parts and quality of build are the two main ones.

To catalogue why an engine fails may serve to explain some of these areas. The XK racing series of late has been a great testing area for all these theories of horsepower and reliability. Now in its fourth season and with owners taking things a lot more seriously, it has been interesting to see development and disaster take its winding path through the field. Blown head gaskets and holes through piston tops seem to have been far more common than one would think, let alone the basic deterioration of what an owner is led to believe is a 'competition engine' that often lasts little longer than two or three fifteen minute races!

Now, not all things bad are to be blamed on the engine builder. We should first start with the driver in charge of the engine. While he or she may believe they are gentle with the right foot, in practice this is often not the case. A revlimiter is all fine for going up through the gears, but a severe down change will have the rear wheels driving the revs to dizzy heights, unseen by the amateur driver. That moment of snatching third gear at the end of the long straight is when so many engines seem to tire of the abuse. We are all guilty of this (except a few very experienced drivers who always know how to extract the best out of a car and still bring the engine home in good condition), and this has shown up other weak areas of engine assembly. The stresses that an engine goes through are quite immense. Even for road users, the same basic rules apply.

Why does a gasket blow? Even on a recently rebuilt engine this can be common. The main reasons can be re-use of old head studs, poor machine work on the block or head face or just lack of care in final assembly. On a road car these symptoms may take longer to show up but in competition the simple faults appear extremely quickly. An overheating engine can make an aluminium cylinder head warp or expand to a greater extent, which in turn stretches the already weakened head studs which in turn releases the pressure on the head gasket; the ever decreasing circle thereby takes over rapidly. Just the same can be said of connecting-rod bolts - it is very rare to have a 'con-rod' break unless it already has an old unseen fracture. The weakest point is the bolt itself. To re-use old ones can, and does often, lead to disaster.

The problems that can befall an engine are limitless, but so often the basic rules are the most common. We see so many engines that have been put together with many new parts only to be let down by small details, such as cleanliness of build, incorrect machine work, and confusion with assembly procedure. All easily avoidable! But, time is money and without very accurate machine work the rest is just a matter of time before the gremlins catch up. As I said, no-one is re-inventing the wheel, but so much can be learnt from what has already passed.

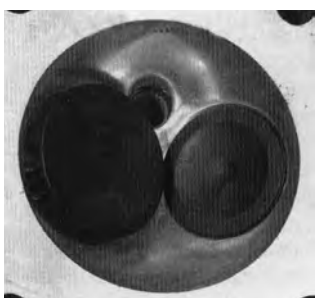
So, what can we learn from our friends' upsets? Quality and time does pay back in the end.

Buy the best you can afford, but don't waste money on fancy racing parts and then use the cheapest studs, nuts and bolts. I once read an article from a U. S. expert that a nut loses 20% of its torque strength after its second use and up to 33% if used 8-10 times. Remember, studs and bolts stretch with use; their lives are limited. Take more care over the small details. These tend to be the areas that start the chain reaction toward failure. Trying to produce unrealistic horsepower figures may cloud your vision of reliability - you can't win anything if you can't finish. The last race meeting for the XKs at Snetterton proved that extending a race from approx. 15 to 30 minutes soon found even more gremlins than anyone could imagine. Heaven help us if we should ever attempt a 24 hour race!

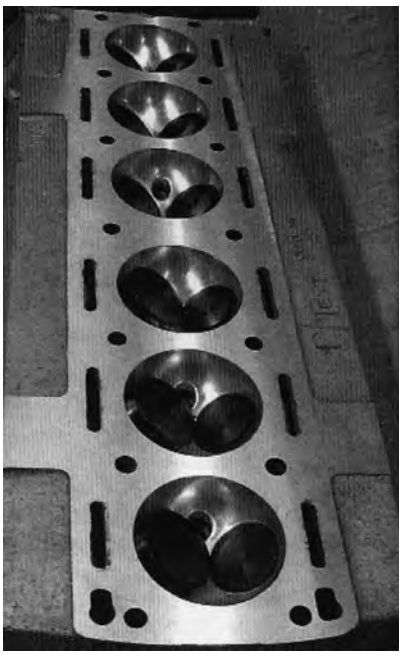
Another interesting story came out of this race. Brian Arculus racing a Class 'C' 120 (full race 3.8 spec. engine) had a mishap on lap 2 of practice. The engine crankshaft damper actually came off completely, rattled out underneath the car and away into the long grass. Brian, not noticing anything amiss with the performance of the engine, pressed on hard for another five laps before being told in no uncertain terms to get off the track and go and retrieve a large important part of his engine. Now, this goes to prove two things: that a well-machined and balanced engine can work well without any vibration damper attached and also with a well-balanced engine you may certainly not need an expensive race spec. damper! Well done to Brian; without all these willing test pilots how else can we learn such things?

To cap off this month's scribble, the most important thing I can pass on is basic quality of parts and quality of build this is the start to a good engine. Without the basics, performance is a far away dream. An engine is complicated with many fast-moving stressed parts, so much depends on all things working well together - one weak link and failure is a moment away. On a lighter note; remember the best thing about a Jaguar engine is that it is a Jaguar engine, one of the most reliable engines ever designed. **Long Live the XK Engine!**

*Blown piston!*



*Precision machining*



*Machined head*

## The real costs of Restoration

It is with a great deal of worry that I have to report the ever growing trend of 'underquoting' in our industry. I will explain.

The costs of restoring XKs are high; I'm sure most of us have experienced escalating invoices and budgets, some expected and some most unexpected! The business of drastically 'underquoting' to get a job into the workshop is a more disturbing one. It is extremely easy to lure a naive owner into believing his car is not as bad as other folks say and that, with some dismantling and investigation, a more detailed quote could be drawn up. However, as too many of us know, once an XK is dismantled, the likelihood of us then gathering all the parts and transporting them to another restorer is highly 'unlikely'.

Many times we are confronted with an old rather unloved XK that somehow retains a roadworthy certificate (M.0.T), and the glassy-eyed owner dreaming of bringing fresh new life to old leather and panelwork, to see perfect lines around doors, mirror smooth paint, gleaming engines giving that humungous straight six sound (to be fair that's what most of us are dreaming of!). In reality, simple but hard truths must come first - the cost and the time to be taken, the two most fought over subj ects. If either one of these are drastically underquoted, tears are not far away. It is not just classic car restorers that commit these (dare I say it?) crimes, but we all know of other trades such as builders who also 'underquote' to secure work.

I have touched on XK restoration costs before, but with a little homework and a calculator most owners could quite easily determine a total restoration for £35,000 is impossible. Something has to go wrong before the job is finished or, as in many cases we see, large parts of the restoration have to be done again - far more time and far more money for the unhappy owner. Why?

As I have said, there are two ways of underquoting, money being the most common one. This can be also done in two ways - total overall costs or by hourly rate, the latter being the most used today. As you read this now, it may seem almost crazy not to use common sense when asking a garage/restorer his hourly rate to also ask the length of time predicted for the jobs in question. I have to smile each time I'm asked, "How much per hour do you charge". I reply, "£40.00 per hour", which is often greeted with a frown and a sharp retort of, "That's expensive"!

As neither the customer nor I have discussed any work to be done, I'm always left a little bewildered by these remarks. I have now learned a follow-up reply to this, and that is to immediately say, "You're right. I'm sorry. I should only charge you £20.00 per hour" (this now really throws them off). I let this slowly sink in, some soon get the joke and some persist in having an explanation.

There are of course good and bad restorers, fast and slow restorers, but the real truth is that by the time an XK has had a total rebuild to a good and suitable standard, the end figures seem to show a similar outcome (bloody expensive!). My own personal philosophy in this area is, it is far less painful for a prospective customer and myself to fall-out before work commences rather than midway through. I see no gain for anyone when a restoration project is pushed into the darkest corner of a workshop with a limp plastic cover, awaiting legal outcome or more funds from a disheartened customer

It is true to say that not all quotations for work are done only to deceive. In many cases it is in pure ignorance on behalf of the restorer who quotes unrealistic prices and times. If he or she has never done such a restoration, how can you possibly obtain a realistic quote?

I can also add that the companies advertising in this magazine do, I believe, know the true costs and recommendation in this business is everything. It is a very small world we are in, but the stories that still unfold daily do often get me down a little. Do not be fooled by the idea you can find a restorer who works for next to nothing, just for the privilege of working on your XK. It always, always ends in tears!

On a far lighter note, by the time you read this, my father and I will hopefully have secured the purchase of an old friend, the 1951 Le Mans 120 Roadster driven to an XK best of 11th overall that year, AEN 546. First rescued and rebuilt in the early seventies by our good friend Bob Kerr in Scotland, he sold it to a new Scottish owner after having some fun hillclimbing, my father Jeremy sharing a drive back in the late seventies.


As the car has not seen the light of day for over 10 years, do you think it a little presumptuous of me to gain an entry for this year's Le Mans Historique? Well that's exactly what we have done. As if we were not already overworked (and underpaid) we now have no time at all to prepare this old 'war-horse' for battle. I'm told the new biannual classic race on the full road circuit will be held over 24 hours with separate categories having four 40 minute races within the 24 hours. (Does anyone remember me saying anything about XKs dying in over 30 minute races?). So with an unrealistic deadline and no funds left to do the job properly I'm just about to become my own worst customer. Oh, and don't please tell anyone in my workshop that they have just had their holidays cancelled, overtime is now mandatory and wages shall be paid weekly (very weakly!).

***STOP PRESS!***

***AEN 546 came through the 'Le Mans 24 Hour Classic' with flying colours. 3rd Overall Team Championship and 3rd Overall, Index of Performance. Well done, Team BroadSport.***