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# Springs & Shock Dampers

# FACTORY

# SERVICE INSTRUCTION LEAFLET

ISSUED BY

BENTLEY MOTORS (1931) LTD.

**BM / 01.**

SB.7/JM.

Subject : SHOCK ABSORBERS
ALL PRE-WAR CARS WITH RIDE CONTROL.

Date of Issue 12th August, 1948.

**IMPORTANT**

THE CONTENTS OF THIS DOCUMENT ARE STRICTLY CONFIDENTIAL AND ARE NOT TO BE TRANSMITTED TO ANY UNAUTHORIZED PERSON.

Deterioration in the efficiency of the shock absorber control may occur in service, but it is exceedingly rare that any fault develops in the system which cannot be put right by the following procedure.

It is obvious, that in all cases, the oil level in the shock dampers and control pump should be inspected, also any serious oil leak caused by a fractured pipe or defective joint, should receive attention.

The procedure for checking and restoring the efficiency of the system is as follows:-

1. Remove the floorboards to obtain access to the control pump on the gearbox.

2. Fill up all shock dampers and control pump with S.A.E. 20 oil.

3. Disconnect one pipe feeding any shock absorber, and connect this to an oil pressure gauge reading up to 40-lbs.

4. Jack up one or both rear wheels and "scotch" the front wheels.

5. Start up the engine, engage top gear and run the transmission at a speed corresponding to 10 m.p.h. on the speedometer.

6. Check the readings on the oil gauge, which should be as follows:-

   In the "MIN" position of the hand control, not more than 4-lbs. If a very soft ride at low speeds is required, the pressure can be reduced to 0-lbs.

   In the "MAX" position of the hand control, approximately 28-lbs. This figure is not in any way critical, and the reading may lie between 25 - 30 lbs. If better high speed damping is required, the control should be set to the higher figure.

   Adjustment is effected by varying the length of the control rod to the lever on the control pump.

7. If the above figures cannot be obtained even remotely, suspect dirt on the control valve in the pump.

   The valve can be removed for cleaning purposes quite easily

   The operations are as follows:-

   a) Disconnect the control rod to the lever on the pump.

   b) Remove the largest of the four recessed plugs located on the underside of the pump body and completely drain off all the oil.

   c) Remove the three remaining plugs, carefully clean the ball valves and their respective seatings, and replace.

d) Replace the drain plug and secure tightly, ensuring that the washer is undamaged.

e) Remove the filler plug and refill the pump body with any of the recommended S.A.E. 20 lubricants to the level of the filler spout thread.

f) Operate the control lever on the pump by hand to expel all superfluous air, the resulting drop in oil level being simultaneously adjusted. When no further alteration in the oil level is apparent, replace the filler plug and secure tightly.

g) Re-connect the control rod to the lever on the pump.

8. In the event of the specified poundages being reasonably obtained, it is most important to bleed the system. In any case, this bleeding operation must be done in all cases of suspected inefficiency of the dampers. Proceed as follows:-

a) Re-connect the shock absorber control pipe disconnected for the above test, and remove the small hexagon headed setscrew which will be found on the top of the valve chamber to which the control pipe is connected on the shock absorber. It is convenient to bleed both rear shock dampers at one operation.

b) Run the transmission at 10 m.p.h. as in paragraph 5 above, and observe the flow of oil from the two vent holes which are now uncovered. Air bubbles will be seen to issue with the oil, and the transmission should be run long enough to eliminate all air from the system which will be indicated by a clean flow of oil free from air bubbles. The two vent plugs should be replaced whilst the transmission is still running.

c) Top up the control pump on the gearbox and repeat the above procedure for the two front shock absorbers, afterwards again topping up the control pump to make good any oil lost.

d) It will probably be observed on trying the car afterwards that there is a grunt from the shock absorbers. This is caused by vibration of one of the valves and indicates that the efficiency of the shock absorbers has been increased, but that some air is present in the valve chamber on the shock absorber side of the bellows. This air will rapidly be eliminated automatically and the grunt will not last longer than a few miles on the road.

NOTE: It is most important to avoid any foreign matter getting into the system, therefore, before carrying out any of the above operations, the casing of the shock dampers or control box, should be carefully wiped down, especially in the vicinity of any filler plug or bleed screw which is to be removed.

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9th October 1935.

DEPOT SHEET NO. Hd.292.

REAR SPRING ANCHORAGE BRACKETS.
Bentley Chassis.

Origin of information:-
BY/Cghl5/G.1.10.35.

One or two instances have occurred where the bolts securing the anchor bracket to the frame at the front end of the rear spring have sheared, causing the bracket to become loose.

In order to overcome this the bolts have been increased from 5/16" to 3/8" diameter.

This change took place at the 1015t chassis in "D" series, i.e., B.1-DK.

In the event of this trouble occurring on earlier chassis the holes should be reamed out to .375" diameter and new bolts fitted.

Hd.

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# Springs & Shock Dampers

# RREC, RROC & Misc Articles

# You Don't Have to Sag with Age

By R. PIERCE REID, MA—VP Tech Pre-War

You have all seen the ads for coachbuilt cars: *"slight door sag, easy repair."*

Not to worry, say your trusty garage buddies. *"You just have to put in bigger screws!" "Use machine screws, they'll bite into the wood!" "Just use epoxy on the screws, they'll never work loose." "Dowels put into the holes are just like putting in new wood!"* And my personal favorite: *"Stuff some matchsticks in the hole before putting in the screws."*

Guess what? Doesn't work. Bigger screws will lose purchase fast. Machine screws also lose grip easily and can break off in the holes as they bind in the taper. Epoxy? Forget it. Dowels give no purchase because screws do not hold in end-grain. And matchsticks . . . stop, please, I'm laughing too hard to breathe.

Left unattended, the doors will not only get worse, but can actually get so loose that they are prone to fly open. If this ever happens to a front-opening door, you have a major wreck on your hands as the door will rip its stops apart and slam into the coachwork. And if you or your passengers are leaning on the door and not wearing seatbelts . . . .

So how *do* you stop doors from sagging? Short of putting in new ash door pillars, there is only one way: plating. Before you rush off to your chromer to ask him how to fix your Wraith or Derby Bentley doors, think of plating not in terms of bumpers but in terms of battleships.

To fix your doors you are going to have to attach the hinges to steel plates that are affixed onto the ash pillars, opposite the hinge. This provides a system of attachment that will never sag or pull free. The process is quite simple, requiring little more than some ¼ inch steel plate, a hacksaw, files, some drills and taps, and some wood chisels. For those who can't resist buying tools, a bandsaw, a milling machine and a drill press all make the process go faster. But they aren't essential for the patient mechanic.

## The Patient

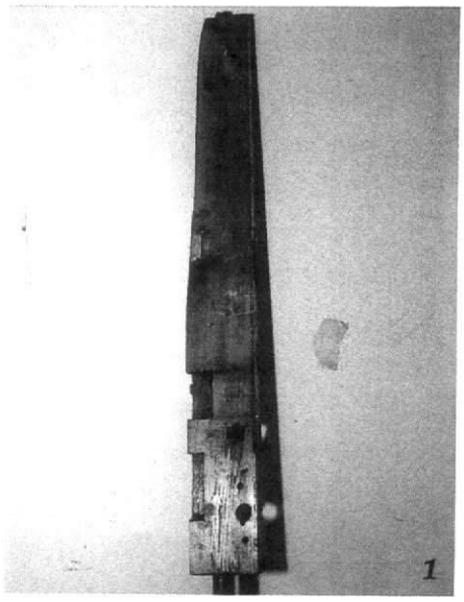
The subject of this article is the venerable B143HM. Its body, at the time of this writing, is basically a pile of sticks awaiting reassembly into something resembling a Hooper Sports Saloon. The doors were badly sagging and all the hinge screws were beyond hope. In fact, the body should have been pressed into a cube and a Honeysuckle replica should have been built. But the author is a glutton for punishment . . . .

To address the saggy doors, plating was the right answer. And the fact that the ash was disassembled meant that a lot of operations could be done right on a machine tool, not in the barely accessible recesses of a fully assembled and skinned body. But the steps apply regardless and access challenges only make the project more impressive to your garage buddies with the matchbooks and epoxy tubes.

**Photo 1** shows the passenger side C pillar. This small piece of white ash supports a rear door that weighs nearly 90 pounds. Remember, though, the principle of the lever arm and with a lot of that 90 pounds hung nearly 3 feet from the hinge, you see that the screws support a massive amount of weight! The photo shows the rear of the pillar, where the plates will go. The front is inlet for the hinges.

## Pass the Plate

To start the plating process, a set of steel plates needs to be made out of 5/16 steel plate. Each plate should be the size of the hinge face that it will support. These can be cut using an old-fashioned hacksaw and a lot of elbow grease or using a power bandsaw (**Photo 2**). Your local machine shop can probably cut you a whole set of plates for a reasonable price if you supply them with the dimensions. This particular saw, by the way, cost only about $180 from MSC Corporation. A good investment for anyone doing personal restoration.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## Chisels are so 20th Century

Before making any cuts, you'll need to mark out the area to be inlet into the door post. Cut a little under and then final-cut the edges for a very tight fit of the plate. You may also be able to "surface" mount the plate if there is enough room behind the pillars. Not likely on the center pillar, but possible on the rear. The author chose to inlet all the plates for added strength.

If your door post is still attached to the car, you won't have much choice but to use a set of wood chisels. This takes longer, but is just as effective and ash is a wonderful wood to work with a chisel. In this case, because the member was removed from the body, the part could easily be chucked in an X-Y axis vice on a drill press (**Photo 3**) which was pressed into service as a light-duty milling machine. Don't use a drill press to mill metal, you'll tear the bearings out. But it does nice work on wood if you take shallow passes.

After chiseling or milling away the wood, your door pillar will be ready to take a plate as shown in **photos 4** and **5**. Note the screw holes in photo 4 that mark the location of the tips of the old hinge screws. Note also the fact that they

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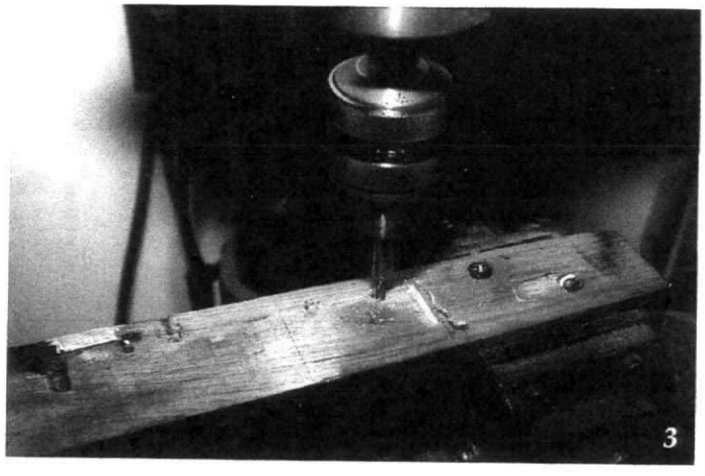
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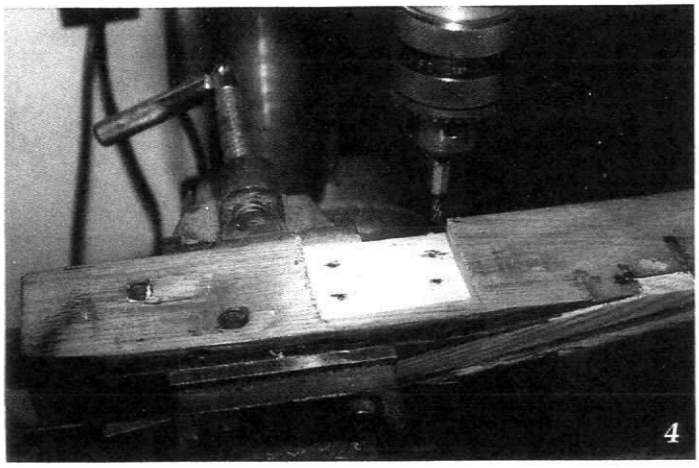
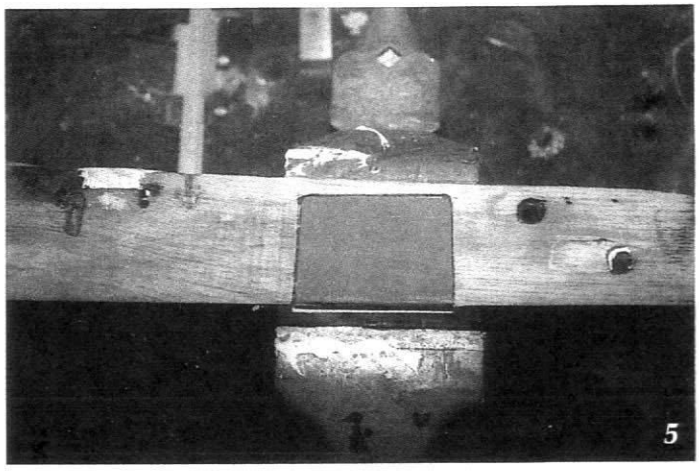




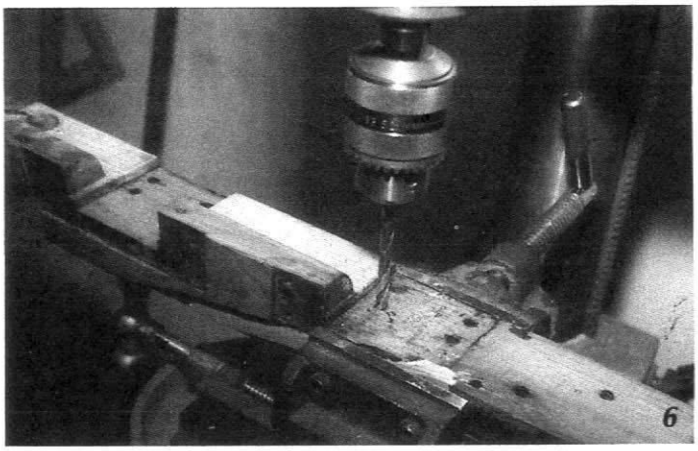
are stained and ragged. The screws had, over the years, rusted in the holes. Since rust is nine times thicker than the metal it replaces, the rust expands the hole substantially. Upon removal, the rusty, rough screws ground out still more wood. Again, door sag is not a trivial problem and old screws can't just be replaced with new screws.

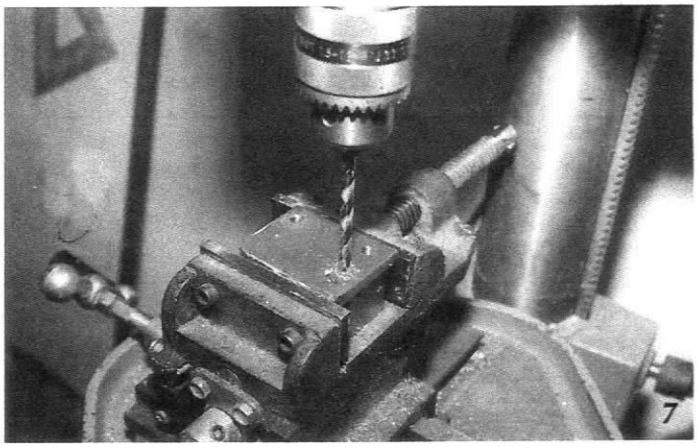
### Drill 'em Straight!!!

With the rear of the pillar inlet for the plate, it's time to turn it over and drill the pillar through. It is very important that the holes are centered exactly over the old holes or your door hinges may not line up. The new machine screws that will hold the door are ¼ inch diameter, so the holes were drilled a fraction under ¼ inch so final adjustments can be made later.

Also at this time, a hole for a fastening screw should be put in the plate. This should be located so as not to interfere with the holes for the hinge screws and should be countersunk. It does not need to be a large screw, as it only locates the plate in its inlet recess.

Using the locating screw, attach the plate to the door pillar and then run the drill back through the holes drilled earlier in the door pillar (**Photo 6**). Don't drill the steel plate all the way through, just put enough pressure on the plate to leave a mark where the drill will be started. Remove the plate from its recess, centerpunch exactly where the marks were made and drill using the appropriate drill for the tap size selected and tap (**Photos 7** and **8**).



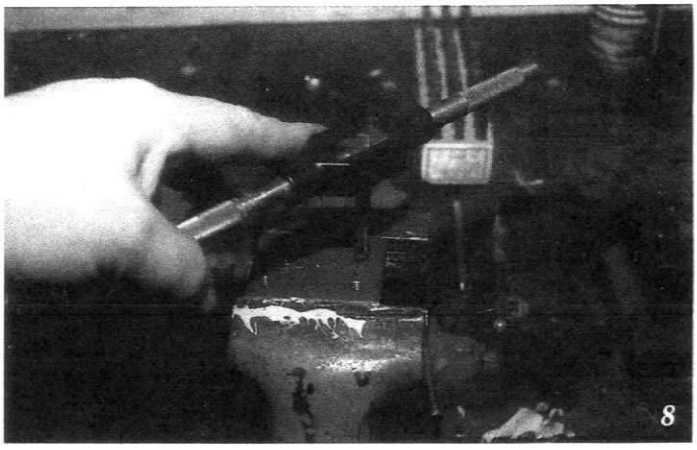


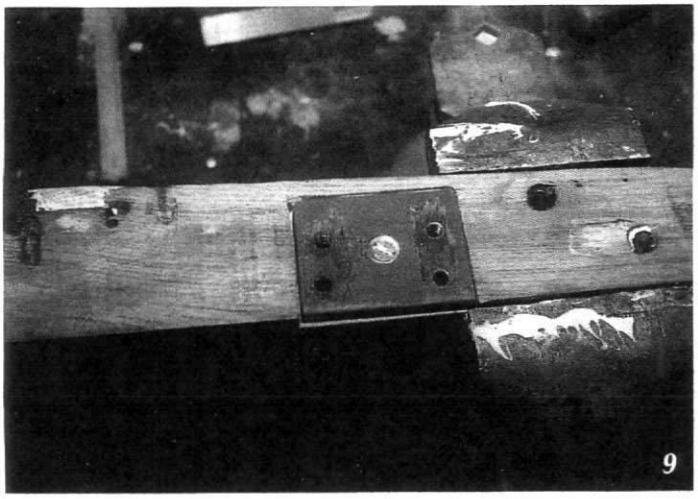
### Some Helpful Tips

Photo 8 shows the plate being tapped in a vise. The author discovered, however, that if the tap can be started with the plate held in place in the door pillar, the alignment is much improved. Once the threads are started it is easy to complete threading in a vise. Also note that the plates were primed prior to cutting and drilling. This was mainly done to make it easier to see marks on the metal, and they will be reprimed after completion. **Photo 9** shows the plate in place with its screw, fully drilled and tapped and ready for its hinge.

How strong will the hinges be? Very! The rear door will be held by 13 fine-thread ¼ inch machine screws. Moreover, these screws will be pulling together a steel plate and a heavy brass hinge plate, tightly clamped together with a thick section of white ash between them. To gauge the strength, the author put a tapped piece of scrap plate and a machine screw in a press. The screw crushed and broke off before the threads stripped. **Photo 10** shows the strength of just one of the plates for the rear doors. Multiply that by three and you can see how strong the plated doors will become.

**Photo 11** shows a completed door pillar. Though this is not difficult work, these plates alone took about four hours to make and install. Both rear doors took an entire day and that was using machine tools instead of chisels. This is a job for the patient and may help members understand

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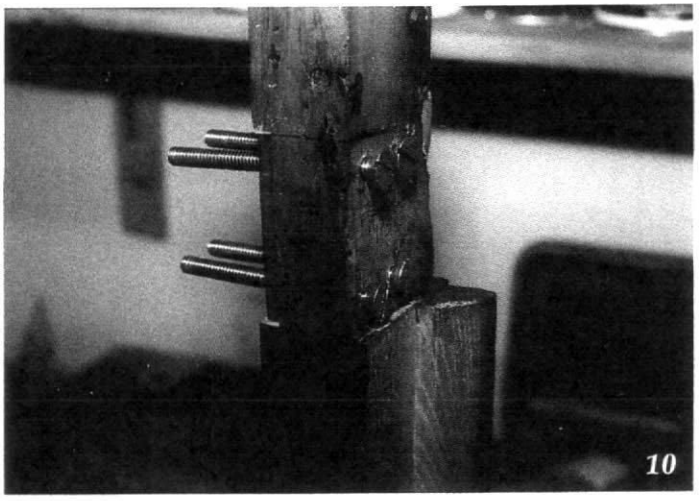
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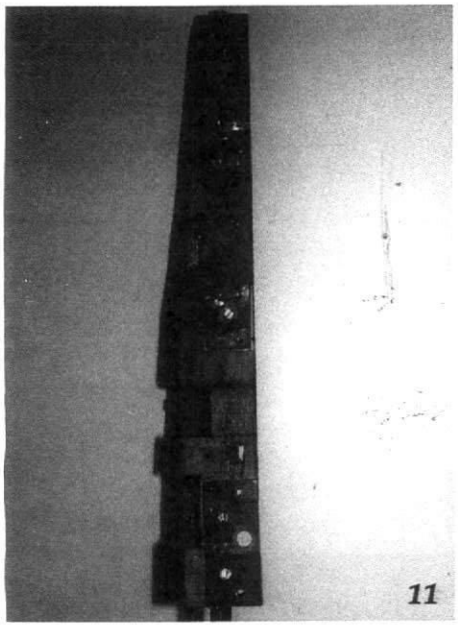
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why the bill they get from a restorer has so many zeros. That's the price of quality and the low bidder has probably just stuffed your door hinges with matchsticks.

There is one other thing that has to be taken into accounts: some door hinges are drilled for door stops, dome light switches, and similar accoutrements. **Photo 12** shows the bottom hinge on a rear door pillar with a larger hole drilled for the door stop. The punch marks above and below the large holes are for machine screw holes that are drilled and tapped to hold a plate that is part of the door stop.

### Back to work!

Now that the rear doors are done, it's time to turn attention to the front doors. Because there are a lot of body styles, not all will be the same. Some cars use steel door pillars, for example, and hinge attachment arrangements are different. In the case of B143HM, the pillar is ash with a very complex aluminum skin. **Photo 13** shows the top hinge location. Note that the opposite side of the hinge is not readily accessible because the aluminum skin is wrapped around the back.

The author debated removing a section of skin and then rewelding it after the plate was installed. But this would have been difficult to get right and smooth. Instead, it was decided that a slot would be cut in the middle of the pillar and a plate inserted. The dotted area on photo 13 shows the area to be cut out.

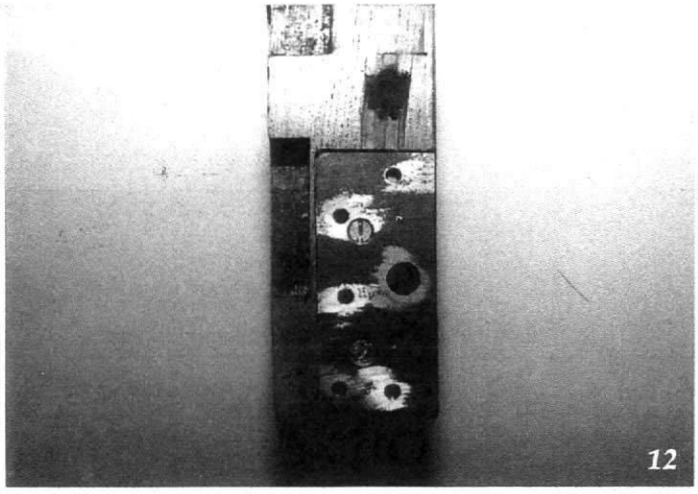
But how does one cut this slot out straight and at the right depth? Time to make another tool! **Photo 14** shows a drill guide used to rough out the hole. The plate is screwed onto the door pillar. The round knob then locates in the slot on the guide plate and keeps the drill exactly straight. The drill is a close running fit through the knob and once depth is determined, a small piece of masking tape on the drill sets the depth. **Photo 15** shows the drill guide in place. This tool is available from the author and will find its way into the Tool Loan Program.

Once the hole is drilled and chiseled smooth, the plate is slipped into place (**Photo 16**). A tight fit ensures it will stay in place during drilling and while starting the taps.

**Photo 17** shows the screws fitted. These will be cut off when the hinge is fitted. Again, the inherent strength of this arrangement is evident in **photo 18**.

### The Best Laid Plans of Mice and Men

So far, eight of the ten hinge plates have been made. The lower hinge plates of the front doors are going to present a larger challenge. **Photo 19** shows the location of the lower hinge and it is easy to see a major obstruction in the form of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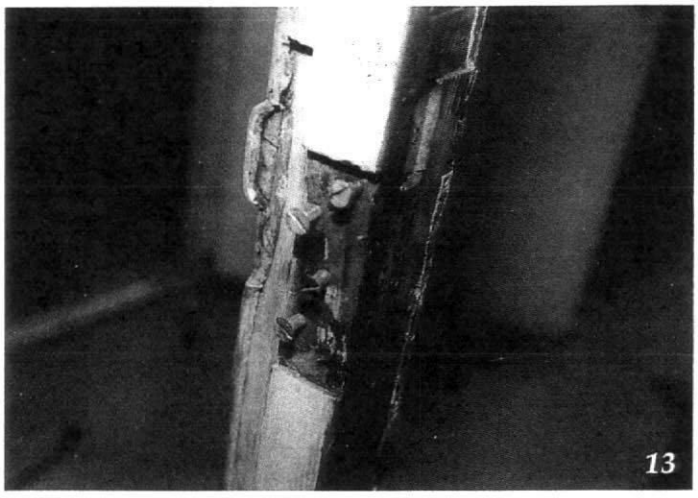
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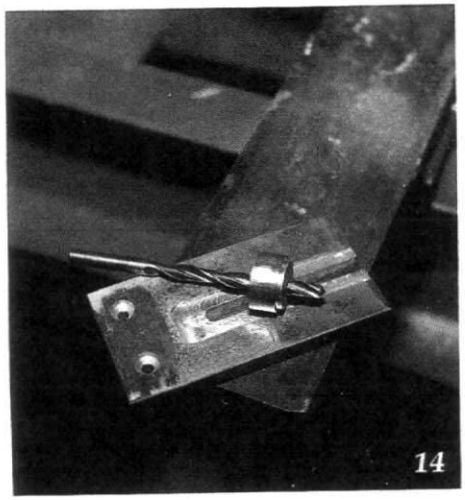
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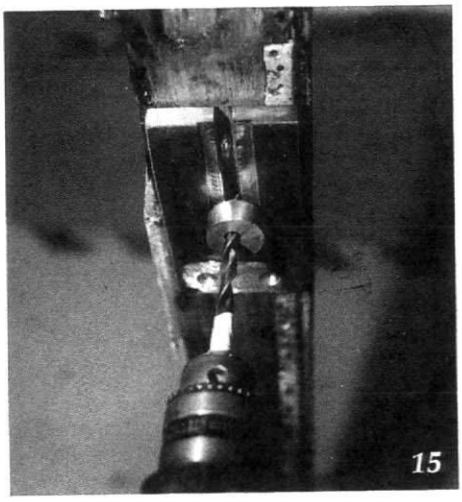
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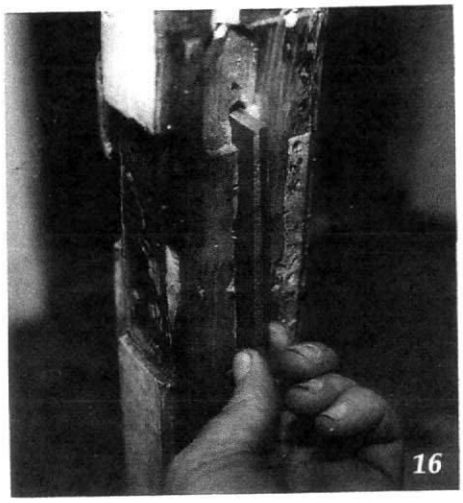
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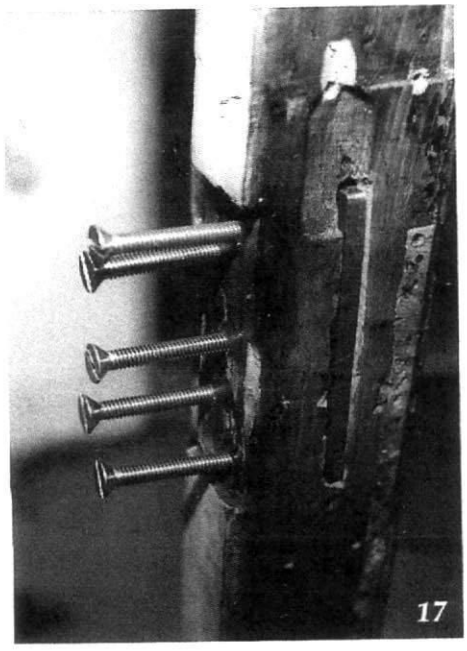
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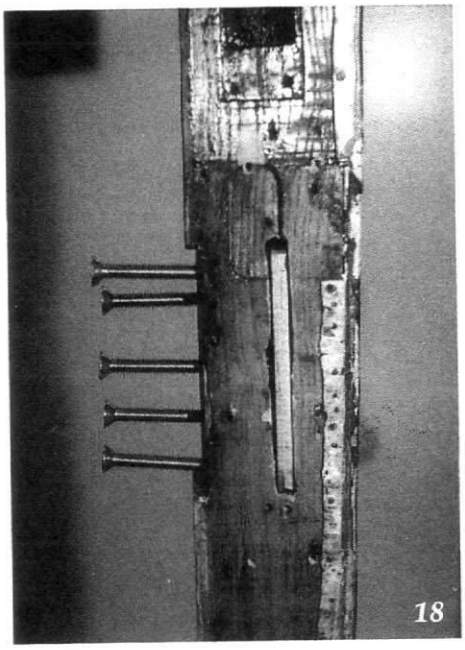
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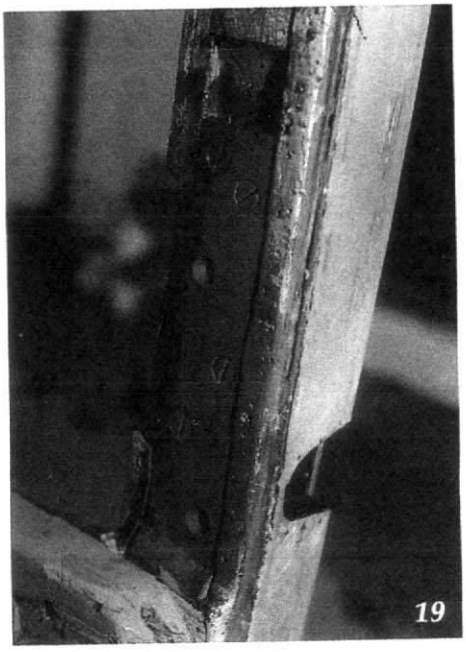
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a bracing member attaching the center pillar to the main frame rail. This prevents a plate from being inserted and the wood screws that extend far into the pillar also will interfere with machine screws, preventing them from passing through the pillar. And on the far side of the pillar, a recess for a SilentBlock door stop prevents a plate from being installed easily on the rear of the pillar under the skin.

The solution will be to put the steel plate right at the front of the pillar after chiseling the ash flush with the leading edge of the brace. With this arrangement, the hinge will be bolted right to the steel plate. The plate will then be welded to the front edge of the brace. For added support, the far side of the plate will be secured using two long ⅛ inch machine screws that will extend through the pillar and fasten under the aluminum skin on the rear of the pillar. To reach the nuts, half-inch square sections of skin will be peeled back and inlet. Then the skin will be re-welded.

**Ka-Chunk!**

Plating hinges is not difficult and is well within the capabilities of most owners. It requires only patience and some basic wood- and metal-working skills. But it is time consuming, even with power and machine tools. So far I worked on eight of the required ten hinge plates for a Hooper Sports Saloon along with a specialty tool for cutting the center pillar. These took about 16 hours of focused effort. Whether for an owner or a restorer, this is a lot of work!

And on some very worn bodies, just plating the hinges is only half the task. If the hinge pins have not been lubricated over the years, there is a good chance that they will be worn and loose. Inspect and check for hinge pin wear. Though an article in itself, hinges can usually be restored by driving the pins out and line-boring slightly oversized. Then new stainless steel hinge pins are fitted. Milling a shallow keyway down the pin as a channel for oil is also a good idea. See Ray Gentile's article in *FL*84-2, p. 2857.

Finally, when re-hanging doors, some shimming is almost always necessary. Thin card stock or shim brass may be needed under the hinges to perfectly align the doors.

But no good deed goes unrewarded. The investment results in a set of doors that stays in perfect alignment forever. You won't ever find paint scraped off the door frame. You'll never have to lift a door over the running-board rubber. And if you ever ask someone who has had a door fly open while driving about their experience . . . and the cost to fix it . . . you will realize what a good investment this is.

Remember that when new, the doors on quality coachbuilt cars closed with the authority of a Mosler safe. When properly hung and aligned, you will be able to close the doors on your pre-war or early post-war coachbuilt car with a solid "thunk" using just finger pressure. That was how your coachbuilder intended it. That's how you should enjoy it.

***Figure 1:*** *Rear semi-elliptic spring from Phantom III, 3BU86, still gaitered, and prior to disassembly.*

# Renewing Semi-Elliptic Springs

*by John Dennison and Richard Frawley*

*Photography by the editor*

*John Dennison, proprietor of Dennison Motors, Inc., restores pre-V-8 engined RR/B cars mechanically and electrically. At National Meets, he can be found at the diagnostic tent, giving members' cars a quick check to see where obvious mechanical attention is required. Trained initially at Crewe, he is especially proud of his machining skills. John is a licensed pilot and is a challenge level square dancer. Dick Frawley works with John, and wrote the re-wiring article on FL2876 et seq. Together, they are running the Small Horsepower School at Toronto on behalf of the RROC Foundation.*

One aspect of Rolls-Royce motorcars to which the Company always paid substantial attention was their springing. Yet over time, the constant flexing of a spring—especially if dirt and water are added and lubrication is absent—is likely to lead to a poor ride. Since this process is a gradual one, it may have escaped your notice, but returning the springs to 'as new' condition will provide a surprising improvement in riding comfort, that silkiness for which a Rolls-Royce car is properly noted.

This article sets out the procedures for removing the springs and curing some of the most common spring problems. It deals neither with re-arching nor with replacing broken spring leaves. While the spring illustrated comes from a Phantom III, virtually all of the information applies usefully to other semi-elliptic springs as fitted to RR/B chassis, whether lubricated by the centralized Bijur system or not.

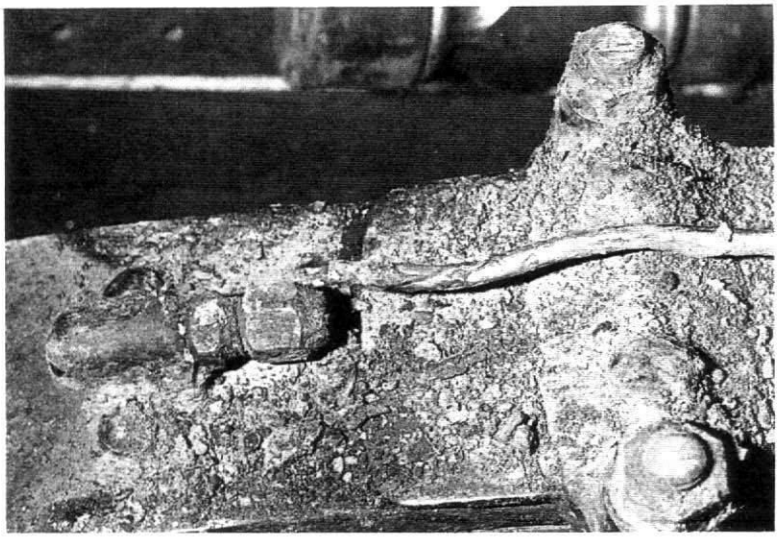
The general arrangement of a semi-elliptic spring is simple: a master leaf is shackled to the chassis by two pins (shackle pins), one front, one rear. The axle (front or rear) is attached to the approximate center of the spring assembly by a saddle and bolt arrangement. The spring receives its lubrication via the centralized chassis oiling system, or grease cups on earlier cars.

## Spring Removal

To remove the springs from the chassis, support the vehicle by the chassis frame so that the axle hangs free. Find an appropriate spot under the frame to place jack stands, bearing in mind the center of gravity of the vehicle. Chock the wheels, jack the vehicle to a comfortable height, and position the car on the jackstands. Shake the car from side to side and fore and aft. If the car didn't fall off the stands, remove the wheels. If it did, this job is not for you! We recommend that you attend to the front springs first. This way you have only one end of the car elevated at a time and you are obtaining great practice for taking out the rear axle.

To remove the front axle, disconnect the brake ropes, shock damper connections, and the side steering tube. Remove the cotter pins in the nuts which secure the spring saddles

***Figure 2:*** *Even under the gaiter, you may find dirt or a broken Bijur line. No wonder these springs required overhaul.*



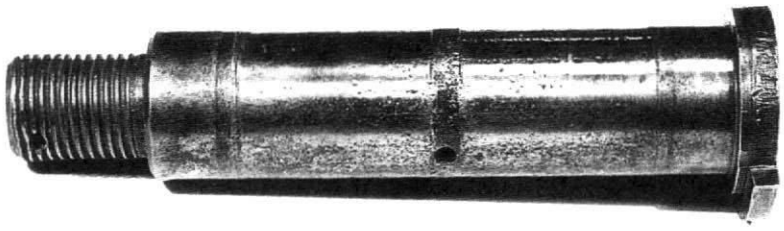


***Figure 3:*** *Typical shackle pin that has not been receiving adequate lubrication. Note the worn areas where the bushings were, and the slightly damaged thread where the pin was driven out (with the nut on, please!). The center oil hole was so blocked that it had to be drilled out.* ***Figure 4:*** *End of shackle pin after cleaning and removing the solder that sealed the screw. A well-fitting screwdriver and heat, used together, are needed to remove it.*

to the axle. Disconnect the spring and front axle Bijur fittings from the chassis.

Support the axle with a floor jack: you are going to have to move the axle once you have unbolted it so be prepared—do not plan to carry it! Remove the four castellated nuts from each side and lower the axle slowly. The axle is going to want to rotate rearwards so plan for it by placing a sturdy piece of board about 18" x 12" fore and aft on the jack and find the approximate balance point of the axle. Note that you must use a rolling jack: do not try to balance this lot on a small screw or hydraulic jack. Set the axle aside.

Remove the nuts from the shackle pins and tap the pins out, being sure to support the spring before removing the pin. Spacer washers will be found on each side of the spring eye. Keep these and note which side of the eye the spacer comes from because the thickness will vary, and the washers must be returned to their original position to provide proper alignment of the spring.

The rear springs and axle come off the chassis as a unit. With the car secure on its jack stands, remove the brake cables, shock damper connections, and Bijur connections; then disconnect the propeller shaft. Place the floor jack under the center of the rear axle. Remove the shackle pin nuts. Tap the shackle pins out. Again, note and record the position of the spacer washers. Slowly lower the rear axle and attached spring assemblies. Once you have moved the axle/spring unit out from under the car, you can separate the springs from the axle.

## Spring Disassembly

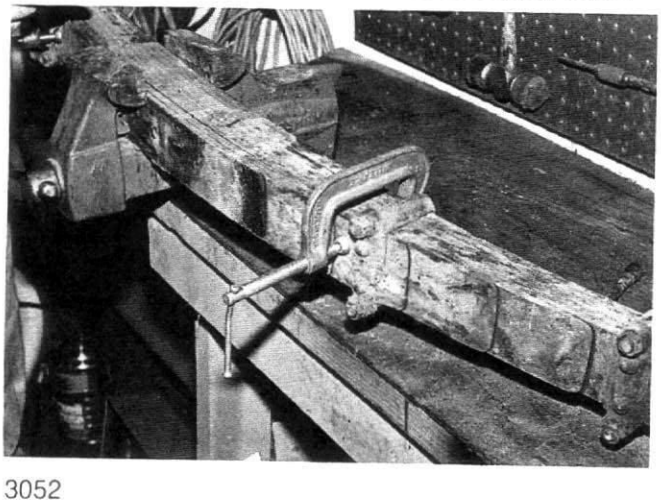
Remove the gaiters and clean off the worst of the external dirt and rust. Place the spring in a strong vise so that the wide portion of the spring leaf is against the vise jaws and the whole spring is slightly off center. This will enable you to remove the center bolt. Attach a C-clamp midway up each of the leaf halves to control the release of the spring tension. Witness mark the edge of each leaf to ensure proper reassembly. Loosen the nuts on the spring clips and the center bolt. Remove the center bolt and release the tension by opening the vise. Remove the lower leaves. Place the spring back in the vise and remove the spring clips. Release the tension again. Sudden release of the spring tension can be dangerous, but with this methodical approach, taking them apart is quite straightforward, removal of the rusted bolts being the most difficult part of spring disassembly.

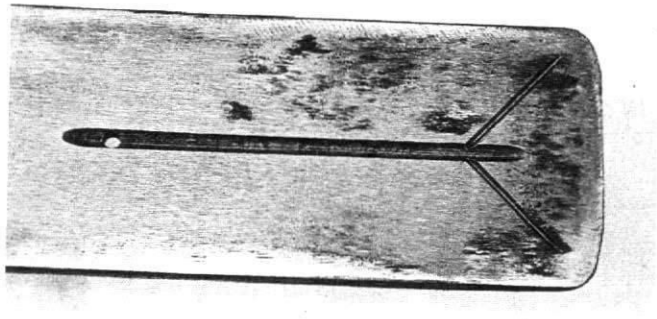
Clean the spring leaves thoroughly with solvent and a wire brush. Give the shackle pins the same treatment. Now that the grease and dirt have been removed, you will be able to see the condition of all metal components. It will be clear why the springs needed attention.

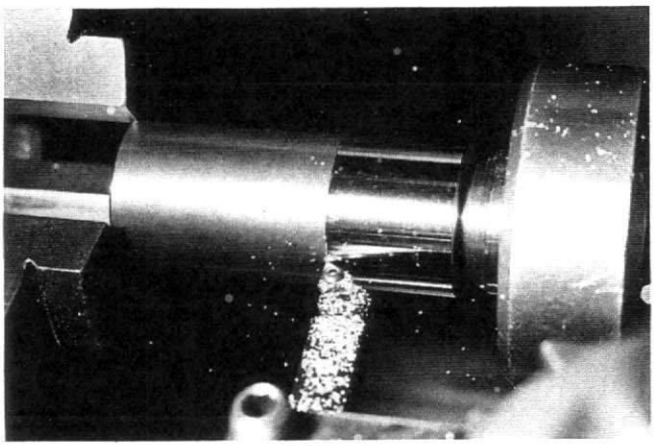
## Shackle Pins & Bushings

Wear on the shackle pins will be self

***Figure 5:*** *When you take a spring apart, be careful. Use a vise and C-clamps to control the release of tension.* ***Figure 6:*** *Spring leaf oil tracks. These channels distribute oil to the springs, the oil being fed by the Bijur system. Note the oil hole at the long end of the center groove. If you have a broken spring leaf with one of these 'bird tracks' in it, after you have a new leaf made, the grooves can be cut in with a small carbide milling cutter.*







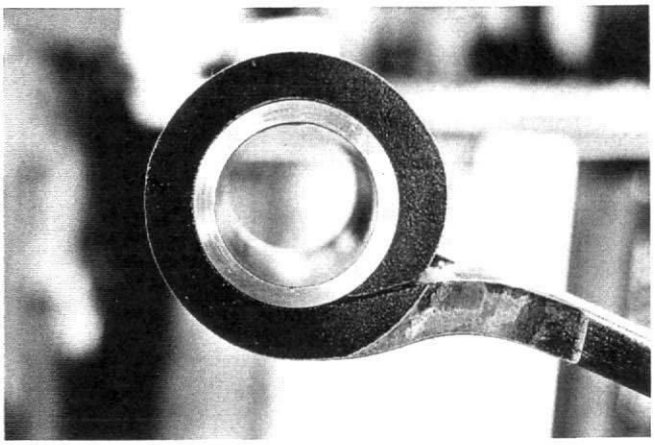


***Figure 7:*** *New stock bronze bushing being turned to size. The little white dots all over are not dust on the negative, but tiny granular chips of bronze spraying off the cutting tool.* ***Figure 8:*** *New bushing in spring eye. Some spring eyes are forged, i.e., there is no gap where the eye curls over to meet the top of the spring. Others are rolled as on this Phantom III spring. When making new bushings, take care not to make them so large that they open the gap in a rolled eye.*

evident. The shaft portion of the pin should be the same diameter along its entire length. If ridges are present, the proper diameter *must* be restored, either by replacing the pin or by building the pin back to correct size. Since the spring receives its lubrication from the Bijur system, proper fit of the pin in the bush is essential for adequate lubrication of the spring.

The shackle pin has a blind channel drilled into one end. Oil passages are drilled to connect with this inner channel. The blind channel is sealed from the head end of the pin with a screw which has been soldered in place. If you plan to re-use the old shackle pins, direct a torch at the head of the screw to melt the solder and give access to the screw head. Heat the screw head again and remove it from the pin. Clean the interior of the pin and open all of the oil passageways. If the pin is to be re-used as is, replace the screw and re-solder. If the pin needs to be built up, leave the screw out for now, replacing it after the pin has been repaired.

Now direct your attention to the spring eye bushing. The bushing is located by a screw in the center of the spring eye. Remove this screw. Remove the bushing from the eye with a suitable bushing driver and note the presence of oil holes and grooves. These will have to be duplicated in the replacement bushing.

## Spring Leaves

Examine the working surfaces of the spring leaves. These areas will probably be covered with surface rust and hard-packed grundge. The three longest leaves are lubricated by an arrangement of oil grooves which employ surplus oil from the spring eyes to lubricate the ends of the leaves. Minor excavation work will uncover the characteristic bird track oil pathways. Clean these grooves thoroughly and open the oil holes at their ends.

The area where the end of the spring rubs on the adjacent leaf above will probably be galled. Steps may even have been worn into the surface where the rubbing contact takes place. Your mission is to polish the working surface of the spring leaf. This is best done with a disc grinder—the type used in auto body repair. Wearing a dust mask, lightly pass the grinder over the surface to remove the rust. The high and low spots in the leaf should now be readily apparent. It is neither necessary nor desirable to remove all of the depressions from the surface of the leaf. The idea is to grind the abrupt ridge caused by the lower leaf having rubbed against the upper. A few passes with the grinder should leave the surface sufficiently smooth to allow the end of the adjacent leaf to slide over the surface. If the ridges are very deep, use the grinder to taper the edge of the ridge enough to permit the lower leaf to slide over it with minimal effort. Oil the surfaces after grinding to inhibit the formation of any rust.

## Renewing Pins & Bushings

Replacement shackle pins and bushings are still available for some RR/B cars. If your search does not turn up a replacement, you will either have to make new pins or have the old ones returned to original size. The pieces used as examples in this article were rendered re-usable by means of metal spraying, a process that literally adds metal. Look in your local telephone

## Springing: From the Archives

**3AZ66:** Special attention to springing—customer does not want it harsh.

**3CP158:** Car set up for fast touring, but springs to be as soft as possible consistent with safety at speed.

**3CM105:** Very special attention to springing as customer suffers from car-sickness.

**GGP29:** Springs with incorrect weight fitted to rear—correct springs with gaiters to follow.

**GNS20:** Car for use in UK on bad local roads.

**GMU23:** Low rated springs to give the utmost luxury in riding.

**GMU70:** Special note from retailers to RR: 'What we are particularly anxious about is that the springing should be light and soft so that the car really floats, as it will be principally used with only two passengers and is not required to do excessive hard speeds, but quietness and comfort above everything. As your Works well know, we had to return chassis GBT35 to have the springs altered, and to our mind, after they were altered, they were never quite as good as they ought to be, so we are raising this point to prevent having to make any alterations later. Doubtless you will give consideration to these remarks when springing the chassis.'

**GHW40:** Special attention to springing to ensure maximum of comfort: customer commented on trials car GAU32, but remarked that that car appeared to roll perceptibly when cornering; this must not occur on her new car.

**GHW41:** Customer is very satisfied with the springing of her present car, GTR38, and also commented favourably on the comfort of trials car GKT22.

**GAW26:** Customer is very particular in regard to springing: car will be used mainly in the country with occasional trips to the south of France. (Car completely destroyed by fire 1/37.)

directory under 'Metal Spraying' and tell them what you need. Nowadays, nearly any metal can be sprayed; for this job, you need someone properly equipped who is willing to spray a high-chrome stainless steel with a Rockwell Hardness of about RC33. This metal has a slightly porous surface which holds oil well. The finished piece will be of the same size and hardness as the original pin.

The bushings were turned from standard bronze bearing stock, SAE660 cast bronze, then bored and honed to size. The bronze is a composition of copper, tin, lead, and zinc having a tensile strength of 14,000 psi and a hardness of 72BHN (Brinell test). We obtain these from Precision Component Sales, Inc., 49 Front St., Bridgeport, PA 19405. It is most important that all the original oil holes, grooves, oilways, etc., in the original piece be maintained.

When the bushings are made, the outside diameter must be of sufficient dimension to allow for an acceptable press fit in the spring eye. Once the bushing is pressed into the eye, check for proper fit of the shackle pin. The bushing closes up slightly as it is pushed in and will require honing to obtain a proper fit.

The oil hole which allows for lubricant from the eye to pass to the spring leaves must be drilled once the bushing is in place in the eye. Extreme care must be taken when drilling these holes through the bushing. First, do not drill out the thread in the outer part of the eye. Secondly, the drill must be fed in very carefully and right in line with the oil tube. Failure to do this will certainly result in a drill breaking off in the oil tube. This is very hard to fix. So be careful. This is a 'one shot' operation.

## Reassembly

Oil each of the leaves thoroughly with 20 wt. motor oil and re-assemble them in their proper order by noting the witness marks made prior to disassembly.

Install the old gaiters if they are serviceable or order new ones. The effect of your work will not last long if the spring is left to endure the elements unprotected.

Reinstall the springs and axle. Reconnect the components previously undone. Test the Bijur plugs which service both pins and springs for proper operation. Top up the shock dampers and go for a test drive. The difference in suspension performance will be obvious and welcome.

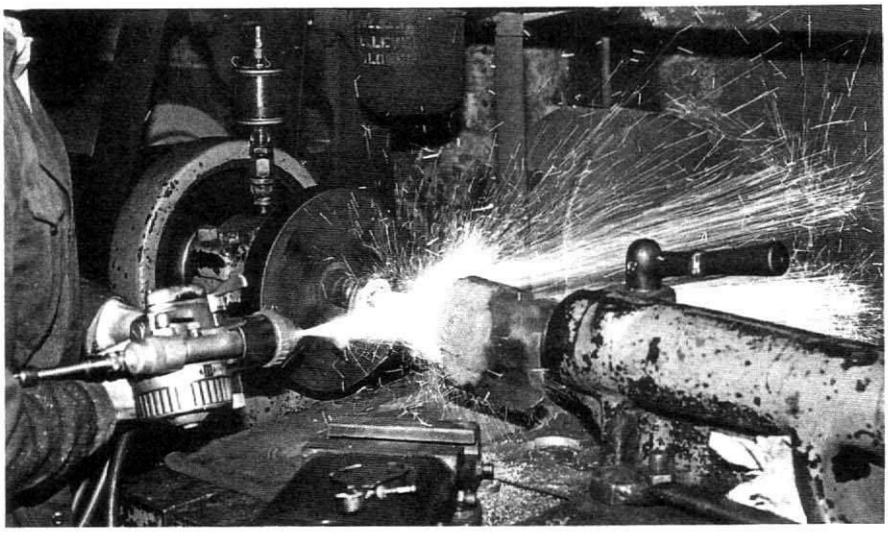


***Figure 9:*** *Spraying the shackle pin. The shackle pin has been cut approximately .060" undersize, leaving a small shoulder at each end of the original, unworn portion. Here, the molten metal is sprayed on at a very high temperature in a fine stream as the lathe in which it is held rotates slowly. During this process, the oil holes have been blocked off with small pieces of carbon to which the sprayed metal will not adhere. Threads were protected with Dykem Steel Blue marking fluid. The metal is sprayed on about 1/32" thicker than the required finished size. The excess is then turned off with a carbide tool, leaving the pin still about .025" oversize, ready to be machined to its precise final dimension. Thanks are due Wayne Hall of Reneuxit, Inc., metal sprayers, 250 S. Franklin, West Chester, PA 19382, 215-696-4115, for allowing the process to be photographed in his shop.*

R.R. 80 (10H) (59115. 5-2-34) Bm 3/770. **CARRIAGE SPRINGS.**

Series No. B3 8 · Code No. B48A · Chassis No. 3BU86

| | Drawing No. | No. of plates | Thickness over all | Initial unloaded Camber after test "Z" dimensions | Normal load Camber | Load for normal load Camber | Length "L" at normal load Camber |
|---|---|---|---|---|---|---|---|
| Front "near" | Springs | G83692/8 | Packings | 1G84715 | 1ea G84716/7 | | |
| Front "off" | Springs | G83692/8 | Packings | 1G84715 | 1ea G84716/7 | | |
| Rear "near" | F89066 | 10 | 2 13/16 | 6·55 | ·4N | 1290 | 66 |
| Rear "off" | — | — | — | 6·54 | — | 1290 | — |

Springs fitted to drawing Nos. Front ... Rear F89066/F89066

Date fixed on chassis 7-12-34 By G Saunders

Thickness of buffers, rear 2 13/16 front

Makers of springs Jeffco Gaiters

Inspected by A Ancott Date 7-12-34

***Figure 10:*** *The documentary record: the construction and test card for 3BU86's springing.* ***Figure 11:*** *The archaeological record: the metal spring plate for the left rear spring, as excavated from the rubber block at the center of the spring.*