"Citromatic Magic"

by Donald "Red" Dellinger - as printed in Volume 10 #3 of Citroën Quarterly

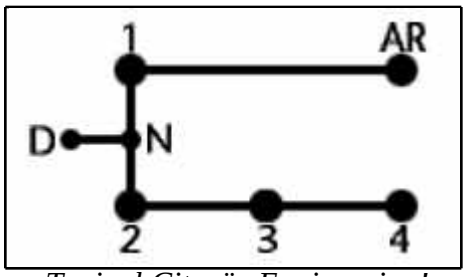
An automatic transmission that gets the same fuel mileage as a standard shift has been the dream of many automakers for years. The trick is to eliminate the clutch, but retain a direct drive with no slippage. This was invented years ago by Citroën. The transmission was not fully automatic, but it could have been if they had so desired. It is what we now call an automatic stick shift or semi-automatic transmission and it is even more wondrous than their famous hydropneumatic suspension.

As with most of the problems that owners have with their Citroëns, 99% of the problems that develop come from simple and avoidable causes. The single biggest problem with Citroëns is caused by mechanics working on the car when they do not understand how it works! They never fail to put the entire car out of adjustment and cause more damage than years of normal wear could cause.

The following article will help you put your Citromatic back in adjustment, no matter how screwed up some previous owner has made it. Follow the instructions step-by-step ...

Please remember one thing: check the simple things first! If your Citromatic sounds like it has marbles in it, bleed the centrifugal regulator at the bleed screw provided at the top. The Citromatic will not work correctly if there is air in the brakes, so bleed the brake circuit with the bleed screws at the centrifugal regulator and carburettor as well. If the gears grind, check to be sure that the clutch release lever is moving forward far enough. If it is and the gears still grind there is obviously something wrong with the clutch and pressure plate, not the Citromatic! The gears would grind even with a standard shift. Many people get confused about the Citromatic, especially if they have never had any previous experience with this type of shift. Most owners who have driven them for years do not understand the workings of this hydraulic marvel. When I think of it, it must be as close and effortless as you can get to a fully-automatic transmission without the undesirable aspects of the fully-automatic transmission, such as loss of power, loss of control, flexibility, economy, etc.

The Citromatic is quick, positive, safe, economical, effortless ... IF ... all units are working and are adjusted properly. No four-speed shifts faster or more accurately than a DS with Citromatic. No de-clutching manually; no wait for synchronization; no foot slipping from the clutch pedal; no clutch slip (riding clutch); no left leg cramps in traffic; quick shift from fourth to third, are just a few of this transmission's good points. One of the transmission's great points is ease-of-shifting, even in hard cornering when extra power is needed. In a normal four-speed car you must remove one hand from the steering wheel, de-clutch with the left foot, move gear lever with right hand, release accelerator, etc. valuable time is lost in these motions! The control of the car may be lost by split-second timing in an emergency cornering situation. The Citromatic is instantaneous and, when adjusted properly, the shifting is precise. Most people are not patient enough to take time to understand the Citromatic. Most mechanics do not understand it, therefore, cannot adjust it properly. Most Citromatic clutches are so improperly adjusted that they have overheated and warped which causes clutch chatter and gives erratic operation. Once all of the components of the Citromatic are adjusted properly, the only slippage the driver will get is if the car is started off in a gear higher than it should be (second or third when it should be in first). Have you ever observed the shift pattern closely?



Typical Citroën Engineering!

The transmission must be in neutral to start for safety the shift block can only be in neutral or the starter will not turn. First and reverse are directly across from each other this is for ease of parking minimum movement of the lever. A properly adjusted DS will idle into a parallel spot just by touching the brake pedal and shifting from first to reverse to first again. By the way, the brake pedal on a DS is to be operated by the right foot only. No left foot on brake and right foot on accelerator, like an American auto this will defeat all adjustments.

The "champignon" or "mushroom" brake is designed for minimum travel it is lower than the accelerator pedal for a special reason: quick reaction time from the accelerator to the brake with the right foot your foot only has to pivot on the heel to depress the brake and pivot to the right for the accelerator. If this is not the case the accelerator linkage needs adjustment. This is all leading to proper driving of the Citromatic. When all of the adjustments have been carried out properly, to the driver's satisfaction, the only normal maintenance necessary should be clutch adjustment every 10,000 miles, (5,000 miles if the car is used primarily for stop-and-go driving). Exception: when any of the components in this circuit are replaced, adjustment of that component is necessary. The transmission, differential, clutch pressure plate, clutch disk, and release bearing are identical to the manual shift cars, except for the internal shift rods and forks and the operation of the clutch.

Instead of a mechanical clutch cable and rod there is a clutch slave cylinder and five servos or pistons, one for each gear, fitted to the top cover of the transmission. Lines leading from the hydraulic gear selector (shift block) to the transmission connect to these servos and are tied together in one bundle. The hydraulic clutch slave cylinder has one function to engage or release pressure on the clutch release fork to operate the clutch mechanism. This lengthy description is necessary because, in the manually-shifted car, clutch free travel is adjusted here by feel of distance or clearance, which can be checked quickly with finger and thumb. But not the Citromatic.

The Citromatic clutch is adjusted so that, at 750-800 r.p.m., the clutch components are just about ready to contact each other disk, pressure plate, and flywheel. Putting it more simply, the clutch release or throw-out bearing is depressing the fingers on the pressure plate to the point where the clutch is just about to engage slightly but is still disengaged. For comparison on a manual shift car, it is the point reached when you are in first gear and have eased out the clutch pedal to where another 1/8 inch would cause the car to start to creep away on the level.

Manual shift and Citromatic clutches are adjusted differently. The manual clutch is adjusted without the engine running and the clutch pedal out (clutch engaged position) by pressing with your right thumb against the adjusting bracket (clutch fork) toward the radiator. There should be approximately 6mm clearance or play. Turning the adjusting screw clockwise reduces the clearance, counter-clockwise increases it. That's it for the manual shift car owners, but for you people with Citromatic, let me continue as we are going to the meat and potatoes of it.

Citromatic Clutch Adjustment

Start the engine and bring it to normal operating temperature. Remove the rubber cap plugging the eyelet in the license plate section of the front bumper. Insert the crank extension far enough to engage the hexagon socket of the cranking dog on the gear box. This makes contact with the transmission main or clutch shaft which passes through the clutch disk and is supported by the pilot bearing in the flywheel.

If the front of your car has been wrecked and the crank extension will not fit through the air duct without binding you must either remove the duct or make a tool from 1/4 or 5/16" rod and weld about 2" of 14mm or 9/16" Allen key to the 3' long rod. We use an old army surplus rifle cleaning rod that has a "T" handle. This will take the place of the crank extension and is inserted in the front of the transmission and must be pushed in approximately 1".

Now, back to the adjustment procedure: engine at normal operating temperature; turn the large air screw (brass) located at the front bottom left of the carburettor clockwise until seated and slightly tight, this should slow the engine speed. Check and adjust the engine idle and mixture screws to obtain a smooth idle of 750-800 r.p.m. (check with tachometer) - this is the speed at which the engine will idle when you stop for any reason in driving so, at this speed, we want the clutch disengaged (primary idle). Since the clutch disk is connected to the transmission main shaft and the crank dog is pushed in with the crank or our home-made tool, by changing the adjustment, we can adjust the DS clutch properly.

This adjustment is made with the engine running so heed this WARNING: watch fingers in moving pieces belts, fans, etc.!

Turn the adjustment bolt counter-clockwise (14mm open-end wrench) with the engine running, until the crank extension just starts to rotate. This will mean that the clutch is starting to engage. Then turn the adjustment bolt clockwise until the extension just stops turning (clutch just disengaged) then continue to turn the bolt one full turn clockwise. You are now finished with the clutch adjustment. Note: if the shaft will not stop turning even after turning in the adjustment bolt all the way, then the pressure plate is broken and a new clutch is necessary. This is a fairly common occurrence even with manual shift cars with high mileage. If you try to adjust any other components of the system and you have a faulty pressure plate or clutch you will not be successful at all.

Engine Idle

The next step, providing the clutch adjustment was successful and the clutch/pressure plate mechanism is working properly, is to adjust the engine idle. I prefer 1000 r.p.m. secondary idle. To adjust, unscrew the large brass screw you previously screwed in, to obtain 1000 r.p.m.. Now step on the foot brake and the engine speed should drop to 750-800 r.p.m. (primary idle). When you let go of the brake the engine idle should rise to 1000 r.p.m. (secondary idle). You are finished adjusting the idle. Note: For future reference 1000 - 750 = 250 r.p.m..

Centrifugal Regulator

The next unit to adjust will be the centrifugal regulator, located above the high pressure pump and driven by a small belt from the pump. This belt must not be overtightened or the result will be

premature bearing failure in the regulator. The centrifugal regulator has one purpose only - to start discharging fluid, a very slight amount, from the clutch slave cylinder between 800 - 1000 r.p.m.. When the engine speed increases from primary to secondary idle speed, just enough fluid is released from the clutch slave cylinder to make the clutch start to engage. When the clutch starts to engage, just slightly, the car starts to "creep" or move slightly in first or reverse.

Therefore, the operation of the regulator is as follows: when in first or reverse gear and your foot is on the brake pedal, the engine is at primary idle and the regulator has the clutch disengaged and the car stays still. When you remove your foot from the brake pedal, the engine speeds up (approx 250 r.p.m.) to secondary idle which causes the weights in the regulator to signal the clutch to engage and the car begins to creep. It is only normal to have your foot on the brake when stopped at signals or stop signs, or for backing up. This is why it is important to use the right foot only for braking so that the accelerator is released and the primary and secondary idle work properly.

If the car will not creep, in first gear when the foot brake is released, it will need adjustment. Shut off the engine. The adjustment is an 8mm headed bolt which goes through the center of the regulator pulley and is locked in place with an 8mm nut. Unlock the nut and turn the bolt out, counter-clockwise, one turn. Lock nut, then start engine and check creep again. Continue this adjustment counter-clockwise to increase creep - clockwise to decrease creep - until the car is set to creep at a speed you are comfortable with.

If the car stalls on selection of first gear, screw in the adjustment screw until you achieve the desired creep. This is a fine adjustment and should be adjusted in increments of one turn or less at a time. If the car stalls every time on starting out or coming to a stop, usually the seals on the piston inside the regulator are swollen and hard causing the piston to stick in the bore. This is a simple unit and consists of a set of centrifugal weights and springs acting on a sliding piston controlled by the adjusting screw. Its only purpose is to activate between the difference in speed of primary and secondary idle and release a minute amount of fluid from the clutch slave cylinder.

Guarantee Control

Located on the right side of the transmission, its function is to guarantee that the first and second transmission gears are engaged before the clutch can engage by stopping fluid return from the clutch slave cylinder if the gears are not fully engaged. Generally, this unit never gives any trouble and almost never gets out of adjustment. Adjust only if it is removed for repairs.

Adjustment procedure: hydraulic pressure up, engine off, gear selector in neutral. Loosen two 11mm headed bolts which hold the control to the transmission, pull unit toward the front of the gearbox, stop and push backwards slowly until the unit snaps rearwards - this is the neutral position. Tighten the 11mm bolts.

Clutch Re-engagement Control

This control is attached to the intake manifold, in front of the carburettor, and is activated by the carburettor primary throttle shaft. Its function is to control how quickly fluid is discharged from the clutch slave cylinder between gear changes, (how fast the clutch re-engages during shifting from first to second, second to third, third to fourth).

There are two adjustments:

1. On the left side of the unit facing towards the driver's side of the car, a straight slotted screw protrudes approximately 8mm, sometimes with a knob fixed by a small screw. The knob has a small raised post allowing it to be turned only 350 degrees, but, by unscrewing the small screw, it can be turned without stopping on the small peg. If the speed of the clutch re-engagement between gears is too slow, turn the screw in, clockwise, until you are satisfied with the clutch re-engagement speed. If the re-engagement is too fast, unscrew it (counter-clockwise) until it suits you. This screw will not unscrew and fall out and sometimes needs several turns depending on the condition of the clutch, such as when a new clutch is installed. After getting the adjustment set you can re-install the small knob with the set screw install the knob straight up, which will give you 175 degrees of fine adjustment in either direction.

2. Exception: someone may have removed the carburettor and did not fasten the unit on the idle position and the shaft adjustment in relation to the carburettor idle may have been moved. There is a small hole, usually plugged with a plastic plug, just above and to the rear of the shaft center line (towards front of car). This is an adjustment-alignment hole. Normally, with the throttle closed, a 2.5mm (.100") wire will pass through the hole in the housing and go into the line-up hole in the internal shaft locking the unit and the throttle shaft tight.

If it does, it is all right. If not, proceed as follows: grip the control unit shaft with thin vise grip pliers near the body of the control. and hold the shaft from turning. Loosen the 8mm bolt in the clamp between the control and the carburettor shaft. Push the 2.5mm (.100") wire into the hole in the housing and turn the shaft against the spring tension until the wire falls into the hole in the shaft and locks the unit from turning. Release the pliers, align the shaft coupling, and tighten the 8mm bolt. After re-alignment of the control, re-adjust the unit as described in step one. Then, on a road test, after adjusting the unit, drive the car at approximately 55 m.p.h. in fourth gear on a level road. Move the gear change control from fourth to third gear without releasing the accelerator pedal. The shift should be smooth and almost unnoticeable. If not, stop and fine adjust by the knob or screw if your control no longer has a knob on it. Continue the road test and re-adjust to suit your driving style. Total time involved is about 1/2 hour.

Shift Block

There is only one adjustment on the shift block itself and it seldom, if ever, needs readjustment unless the shift block has been removed from the car.

Adjustment procedure: With your left hand, reach under and to the rear of the shift block. There you will find a rubber plug with the largest part about 11mm in diameter. After removing this dust cover you will have access to a 3.94mm hole. When first gear is selected with the shift lever, a pin 3.94mm diameter x 50mm length will slide into the line-up hole approximately 30mm and lock first gear position in the shift box. If you can't see the hole, a mirror will help. The best method to line up the hole, if it is not already, is to have someone move the shift lever to the left/right and in/out slightly in order to line up the hole in the shift block so that the pin can be inserted. Once you have the pin inserted into the shift block properly, you must adjust the shift control lever to the corresponding first gear position. To do this you must first remove a dust cover from the metal cowl to the rear of the shift block (under the hood). This plug is about 1 3/4" in diameter and is made of rubber. It exposes two 8mm bolts which tighten a clamp between the control lever mechanism and the shift block. To adjust, loosen the lower 8mm bolt and align the shift control lever to the first speed detent (it pops into place).

Then, tighten the locking bolt. Remove the alignment pin and reinstall the dust cover plug. You are finished.

This unit is faithful and almost never gives trouble, but is often accused of being the cause of trouble. One exception is when it becomes gummed-up and stiff, especially in cold weather. It must then be flushed out or removed and cleaned. A hissing noise from the shift block can be caused by misadjustment or a sticking piston, which can be remedied by adjustment or removal and cleaning.

Seriously, this unit is like all Citroën hydraulic components and is well engineered and needs little attention. Should service be required, never take it apart in place, it is easily removed from the car and repaired on the work bench.

After all the adjustments are completed there are only a few items which wear and may need attention.

1. Clutch facings: adjust at recommended mileage intervals according to your type of driving.
2. Centrifugal regulator belt: it is recommended that you carry an extra belt in the car.
3. Centrifugal regulator bearings: do not overtighten the belt for best bearing life.
   In the event of a regulator belt or regulator bearing failure you may, in a pinch, use the small lever under the dash to operate the clutch engagement until you reach repair facilities or home.

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Vol. 13, #3 contains an article on how to drive a semi-automatic DS.

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Citroën Quarterly
Michael Cox, Editor
PO Box 30
Boston, MA 02113
(617) 742-6604
