Building a 1:8 Scale
1936 Citroen Traction Avant 11A

John Haddock
2020

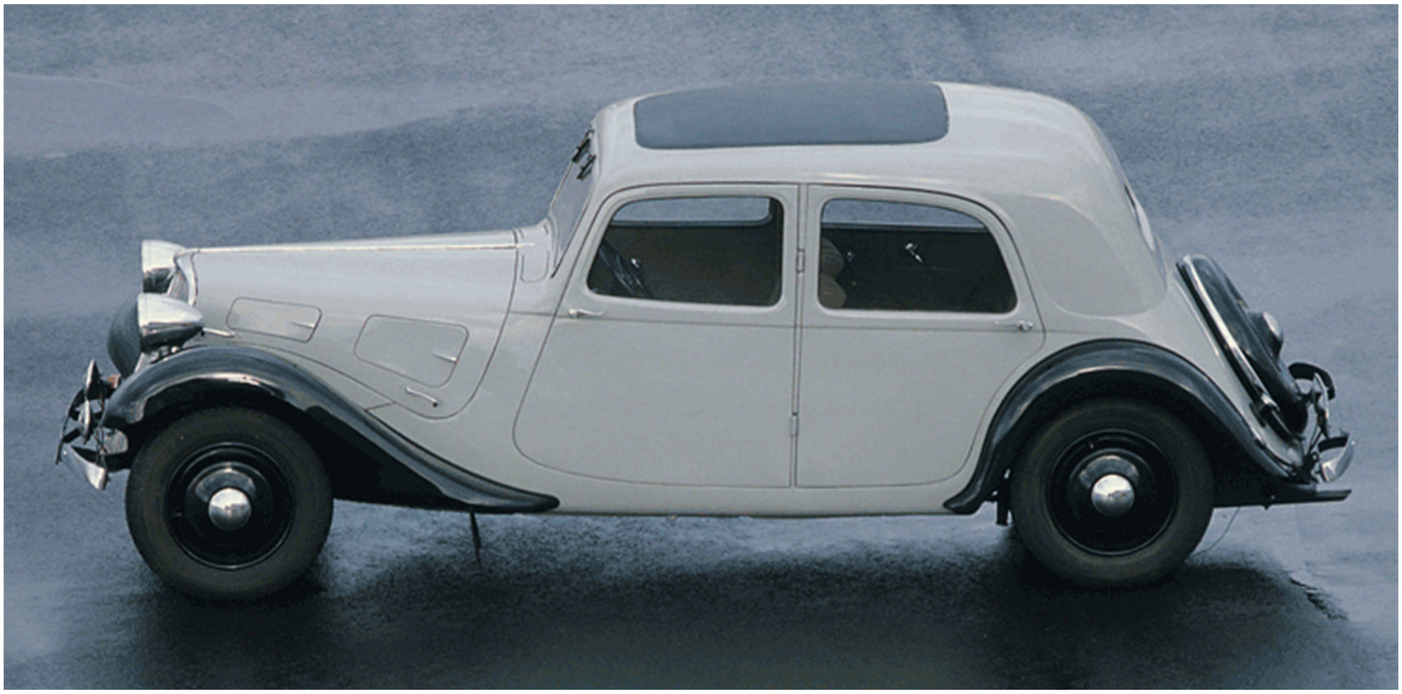
Building a 1:8 Scale
1936 Citroen Traction Avant 11A

Contents

Building a 1:8 Scale
1936 Citroen Traction Avant 11A

Introduction

In 1934 Citroen introduced a car that was radically different from almost all of the other cars on the road. It featured front wheel drive and unit body (monocoque) construction. Without a traditional chassis, it had a low center of gravity which, with torsion bar and independent front suspension, gave it significantly better road holding. Front and rear hydraulic brakes also gave it excellent stopping power. All this was at a time when a Rolls-Royce Phantom II still had a solid beam front axle, leaf springs, and mechanical brakes (albeit servo-assisted).
The Citroen was called the Traction Avant and was far ahead of its time. It was another significant step in the revolution in car designs that took place in the 1930s.



1934 7A

Although there was a production hiatus during World War II, the Traction Avant was in production from 1934 until 1957. In total, some 750,000 Tractions Avant were built. A significant number of those post WWII cars are still running.

Model

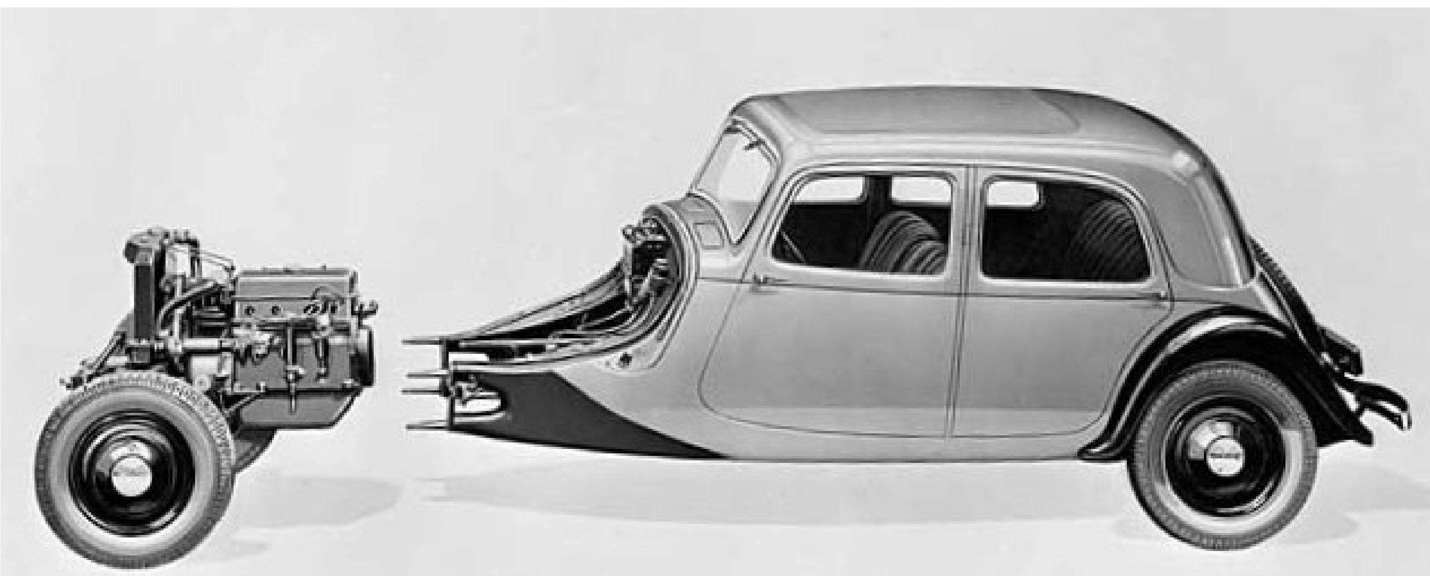
The transformation of car designs between 1929 and 1939 is nothing less than startling. So a model of a 1935 or 1936 version would fit well with my other 1:8 scale models; a 1933 Gurney Nutting Rolls-Royce Phantom II, a 1932 Figoni & Falaschi Rolls-Royce Phantom II and a 1935 Austin Seven Ruby all of which, in some way, represented that transformation. Those other models also marked the high and low ends of the car market. In contrast, at roughly twice the price of the Austin Seven, the Traction Avant was targeted at middle class families.

Heller had produced a 1:8 scale plastic kit of a 1952 Traction Avant 15-Six. The '15-Six' designation referred to its 15CV horsepower classification for French vehicle tax purposes, and the 'Six' referred to its six-cylinder engine. However, the original Traction Avant featured a four-cylinder engine, a very different gearbox, a smaller body and numerous other differences. Clearly, major modifications would be required to the kit if I was to create a 4-cyl mid-thirties version.

There was one other issue. The early 11CVs were fitted with conventional Michelin 'Stop' tires, designated 150x400. The designation meant a rim diameter of 400mm and a tire section width of 150mm. Then, in 1937, Michelin introduced the 'Pilote', a tire with a wider cross-section and better ride characteristics. The tires in the Heller kit tires are Pilotes and are labelled 185x400, which is correct for 1952 (although they measure less). It would be possible to use the kit tires, but they are really too big for a 1936 model so, ideally, new smaller 'Stop' tires with their narrower cross-section should be made.

Origins

Andre Citroen was familiar with both front wheel drive and unit body construction from work done by other companies in the early 30s and he understood the potential cost savings. Citroen, struggling financially, needed something new to reinvigorate sales. In 1933, Citroen hired Andre Lefebvre who had recently left Renault and who had been working privately on a small front wheel drive design. Lefebvre would lead the engineering design. The attractive body was the work of Flaminio Bertoni who had experience as a coachbuilder but was also an amateur artist and sculptor. He had joined Citroen in 1932 and was assigned work on the 1933 model year range. Together, Lefebvre and Bertoni created the Traction Avant.

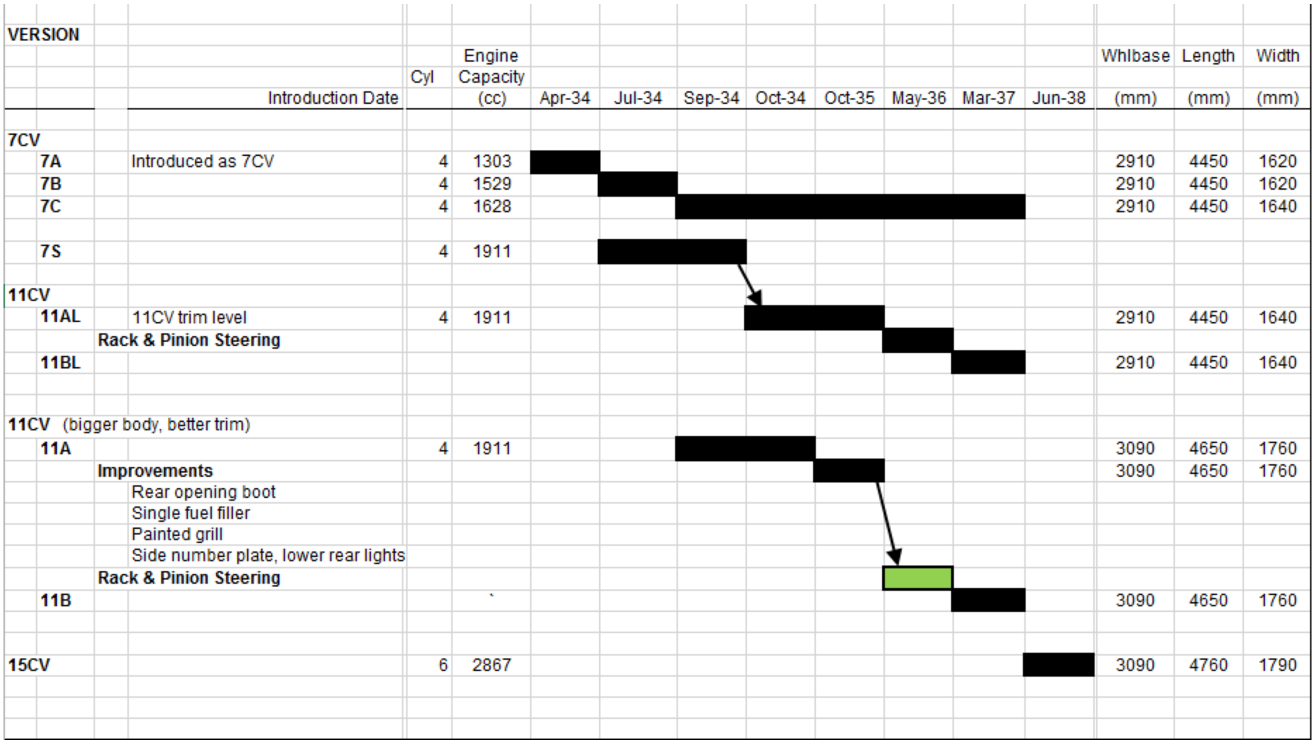


Specifications & Which Version to Model

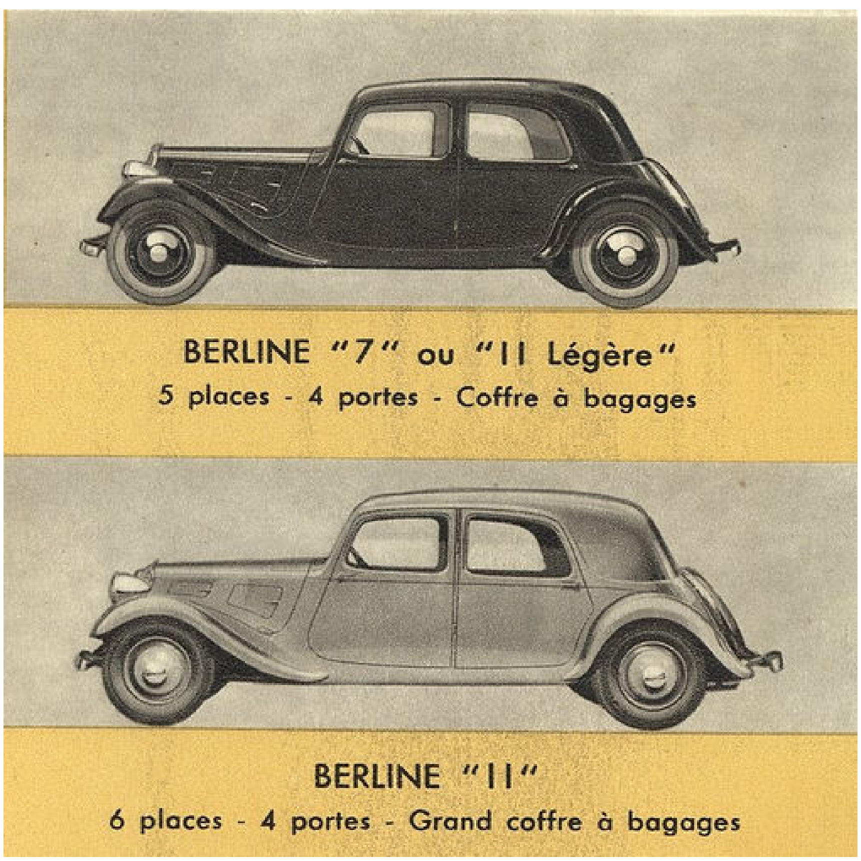
The first Traction Avant was designated 7CV, a reference to the French vehicle tax code into which the vehicle fit. Almost six months later a larger, more powerful version was launched called the 11CV 'Normale'. Its longer body and wider track was, subsequently, the platform for the 15CV which was introduced in 1938. So an 11CV Normale model would likely let me use quite a bit of the Heller 15CV body.

In May 1936, the original steering box and linkage of the 11CV was replaced with a new rack and pinion steering arrangement. It was a big improvement and made the notoriously heavy steering far more manageable. The rack and pinion steering was also carried over to the 15CV so, again, some of the Heller kit could be utilized.
Based on that I made the decision to build a model of an 11CV and, specifically, a June 1936 11A.

Here's a chart of the evolution of the Traction Avant from its inception to the introduction of the six cylinder 15CV in 1938. The proposed model is shown in green.



This leaflet shows the outlines of the early 7CV or 11AL (Legere) and, below it the 11 'Normale'. It highlights the longer body of the 11 'Normale':

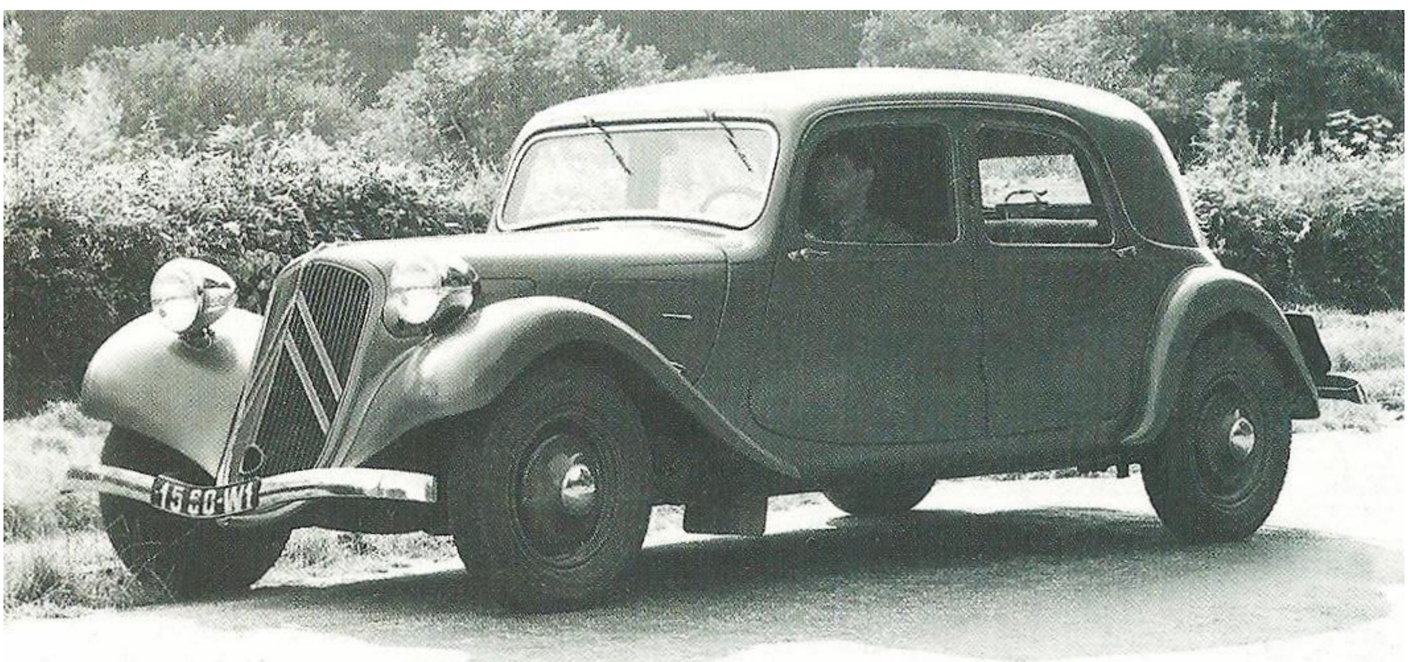


Where to Start, and Getting Information

I try to build historically accurate models. But, for 1930s cars, that poses somewhat of a problem. Very few, if any, dimensioned drawings are available. I also have the disadvantage of being in North America, so finding prototypes which can be measured is virtually impossible. Since the engine, gearbox and front suspension would need to be scratch built and I proposed to utilize 3D printed parts, I was going to have to produce CAD drawings. So reasonably accurate sketches and drawings were important.

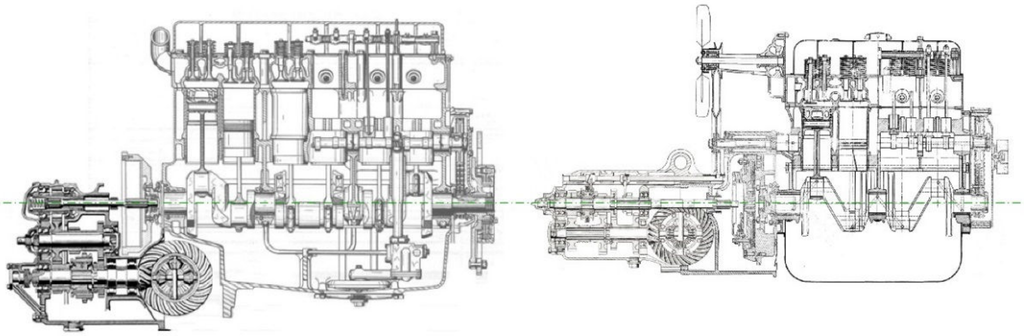
There were a handful of excellent books on the Tractions Avant, mostly in French. I bought them all. In addition, long, persistent Internet searches turned up copies of a 1934-37 parts list as well as body repair manuals, all of which had useful detailed sketches of assemblies. Similarly I found drawings of key body dimensions that let me confirm that the 11CV 'Normale' and 15CV bodies were very, very similar.
Some enthusiasts had their own sites which pointed to other sources and, in the UK, there is an excellent Traction Avant Owners Club that has an archive of technical articles about the Tractions Avant that goes back decades. But most useful were four or five engine and gearbox cross-sectional drawings. Although not dimensioned, and not entirely accurate, key dimensions could be inferred from the cylinder sizes.

In the end it comes down to what I call 'triangulation'; finding and verifying a few key dimensions and then backing into the other dimensions which can then be checked elsewhere. It's the same for the many version changes that took place, especially in the first few years. There never appears to be one single source that captures all the changes. But, when three or four sources agree on 'what' and 'when' you know it's probably correct! It's a form of industrial archeology and can be as much fun as building the actual model.
Here's a picture of an 11CV 'Normale' from the late-30s ….



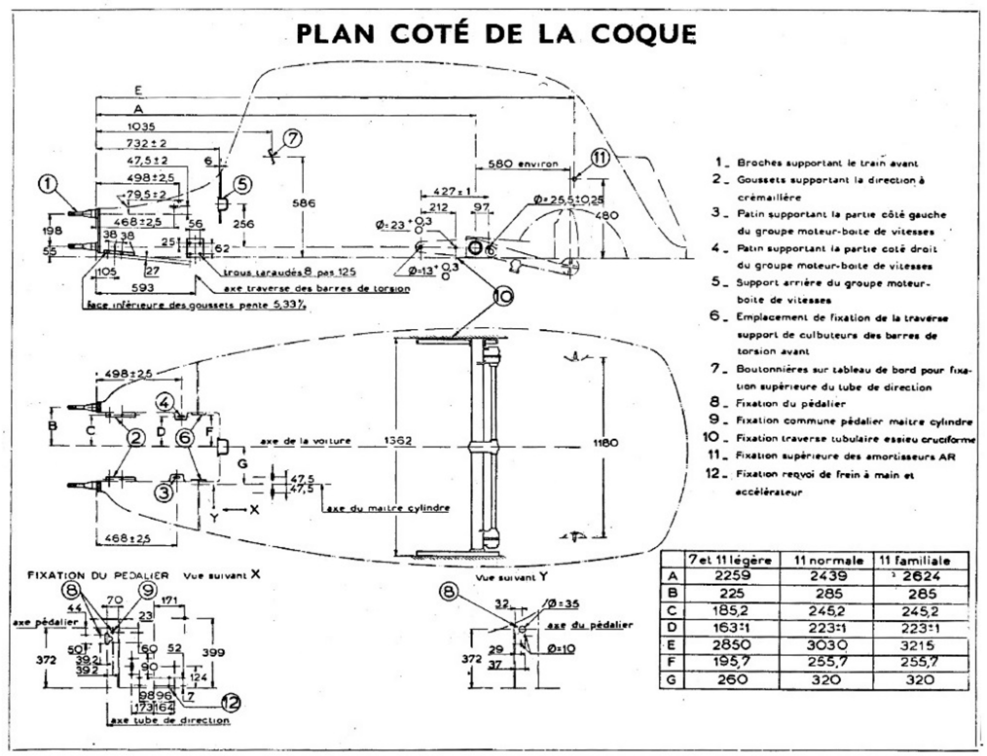
Drawings

The size differences between the six cylinder and four cylinder engines are illustrated in these drawings:



The bore and stroke of the 15CV engine and the 11CV engine are the same at 78mm x 100mm.

An outline body drawing gave the dimensions from the rear engine mount to the rear of the engine/gearbox cradle.



	7 et 11 légère	11 normale	11 familiale
A	2259	2439	2624
B	225	285	285
C	185,2	245,2	245,2
D	163±1	223±1	223±1
E	2850	3030	3215
F	195,7	255,7	255,7
G	260	320	320

The cradle was centered over the crown gear of the differential and from photos it was possible to infer the width of the cradle. Thus it was possible to get a very close approximation of the distance from the crown gear to the engine mount. This could then be checked against the same measurement based on the bore and stroke. Obviously any substantive differences would need to be explored and understood. But, otherwise, this is a good example of 'triangulating' the few measurements that exist.

A second useful source is the details of spare parts. There are a handful of companies that make spare parts for the Traction Avant and, helpfully some of them give key dimensions some of their parts such as the clutch housing or flywheel.

The scope of the changes needed to create a 4-cyl model are shown by the following photos. Apart from the obvious difference in the size of the engines/gearboxes, these photos highlight the much smaller engine cradle of the 4-cyl car and the smaller, and differently positioned, radiator.

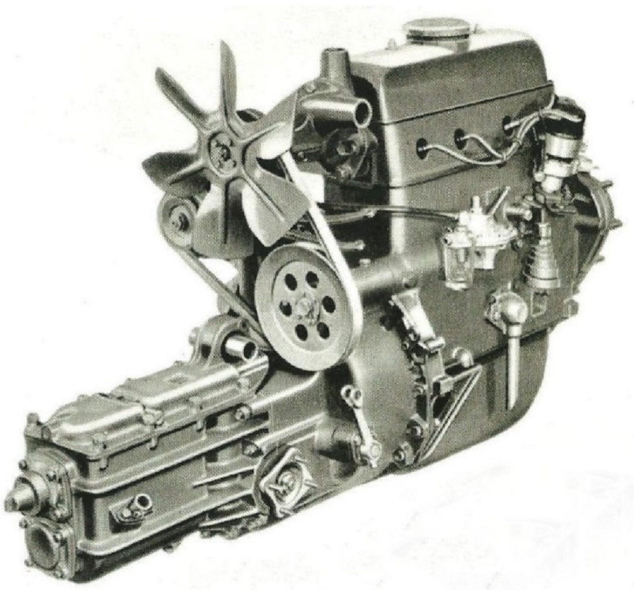
6-cyl	**4-cyl**

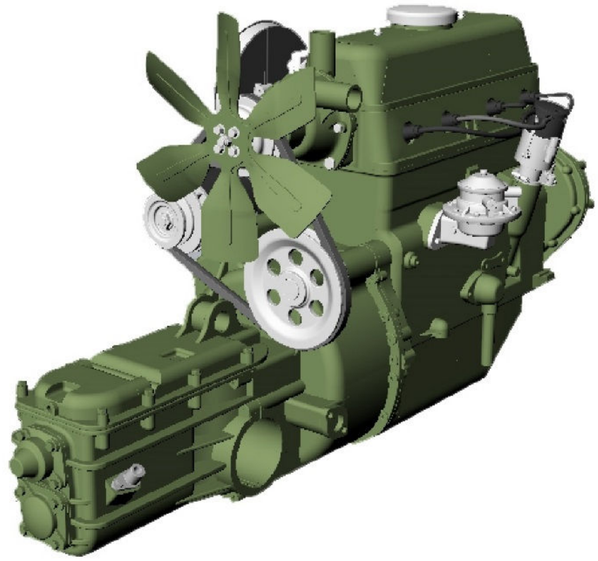
Clearly, the complete front end … engine, gearbox, radiator, cradle, and suspension … was going to have to be scratch built.

3D Printing

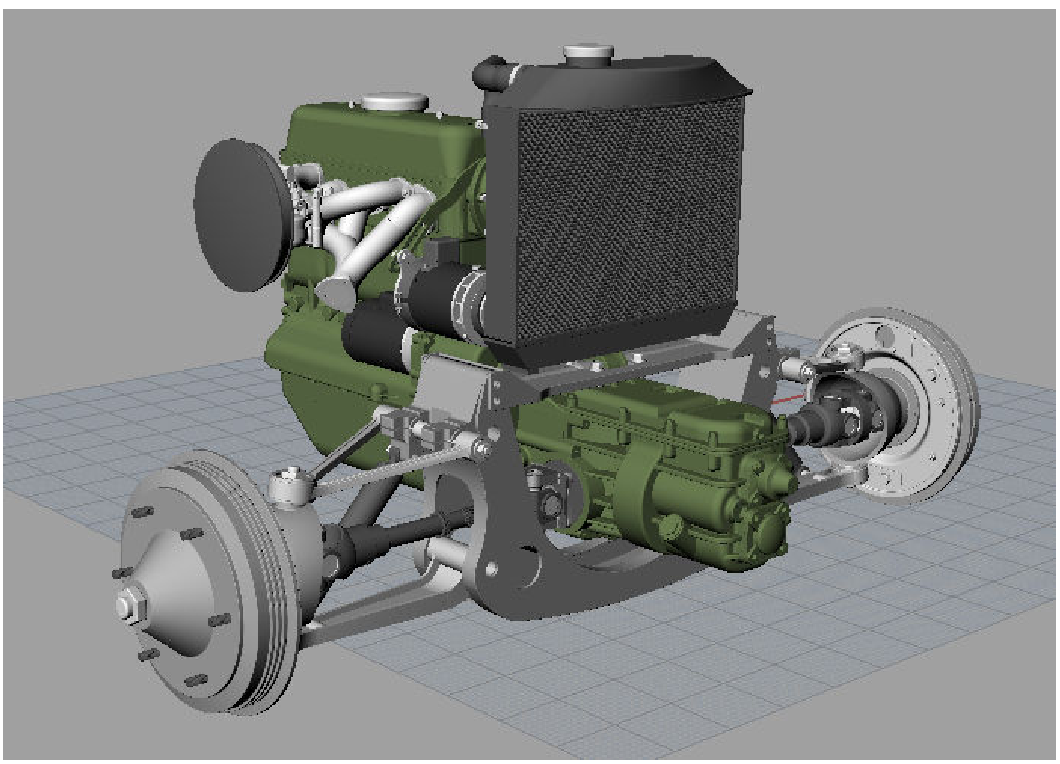
3D printing has revolutionized the production of prototype and short run parts. For the hobbyist, customized precision parts can be just a CAD drawing away. There are two challenges; learning CAD, and then producing drawings in a format ('solids') that are compatible with 3D printing. However, the other big advantage of drawings, especially for something as complex as the front end of a Traction Avant, is that they can ensure the dimensional compatibility of complete assemblies. In effect, you can design your own kit.

The engine was the starting point and everything progressed from there. Here's a comparison of the real engine with my CAD equivalent:

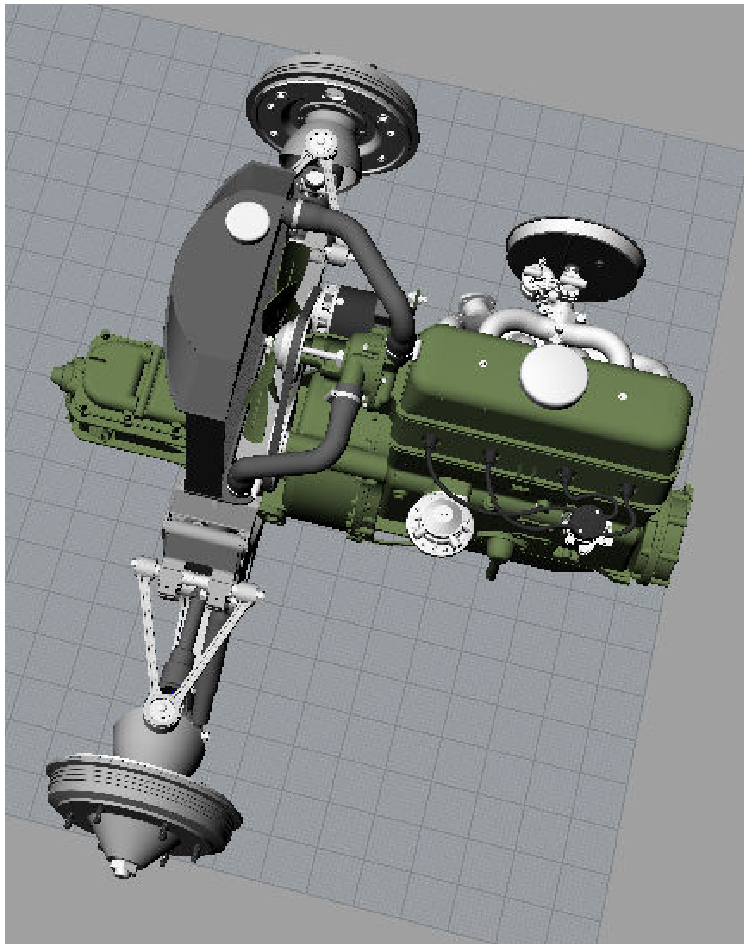
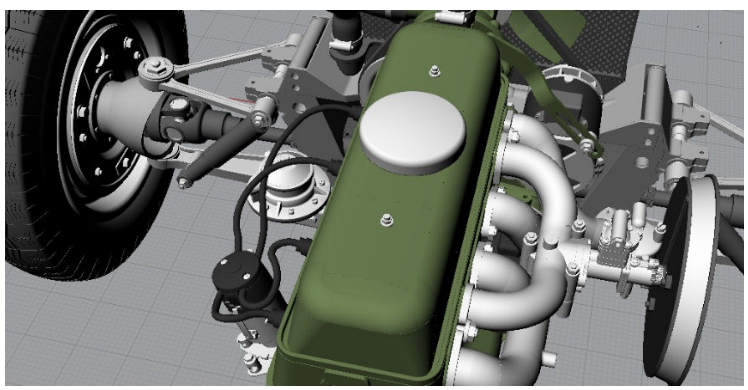
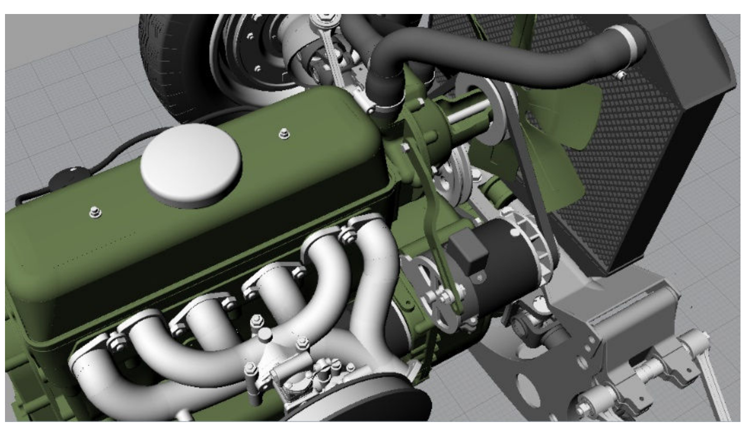




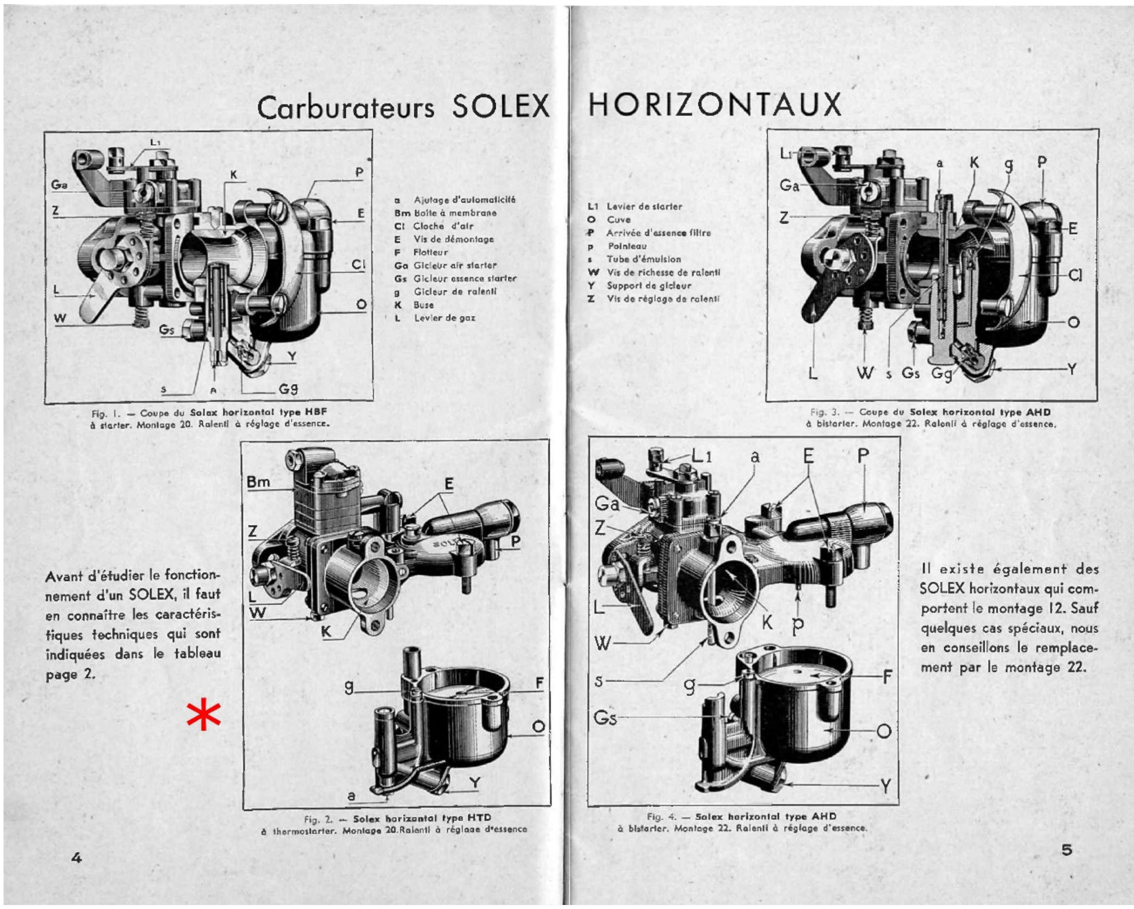
The end result was these renderings of the complete front end:



The front suspension is similar in concept to that of the 15 Six, but there are significant differences in the size of the suspension components and in the arrangement of the drive shafts.

Without the Internet, it would simply be impossible to create the level of detail in these renderings unless you have a 1936 Traction Avant in your garage. I don't. But, instead, I was able to find a variety of photographs, manuals and spare parts lists which, when pieced together, gave a pretty comprehensive picture of the car's feature and how they changed over time. So, for instance, in 1936, the car had a Solex 30HTD horizontal carburetor and a distinctive "Camembert" pancake air cleaner. After WWII, the cars were fitted with a vertical type carburetor and a very different air cleaner. Then I stumbled over a Solex carburetor manual and all was revealed (the asterisked version) …


Carburateurs SOLEX HORIZONTAUX

a Ajutage d'automaticité
Bm Boite à membrane
Cl Cloche d'air
E Vis de démontage
F Flotteur
Ga Gicleur air starter
Gs Gicleur essence starter
g Gicleur de ralenti
K Buse
L Levier de gaz

L1 Levier de starter
O Cuve
P Arrivée d'essence filtre
p Pointeau
s Tube d'émulsion
W Vis de richesse de ralenti
Y Support de gicleur
Z Vis de réglage de ralenti

Fig. 1. — Coupe du Solex horizontal type HBF à starter. Montage 20. Ralenti à réglage d'essence.

Fig. 3. — Coupe du Solex horizontal type AHD à bistarter. Montage 22. Ralenti à réglage d'essence.

Avant d'étudier le fonctionnement d'un SOLEX, il faut en connaître les caractéristiques techniques qui sont indiquées dans le tableau page 2.

Fig. 2. — Solex horizontal type HTD à thermostarter. Montage 20.Ralenti à réglaoe d'essence

Il existe également des SOLEX horizontaux qui comportent le montage 12. Sauf quelques cas spéciaux, nous en conseillons le remplacement par le montage 22.

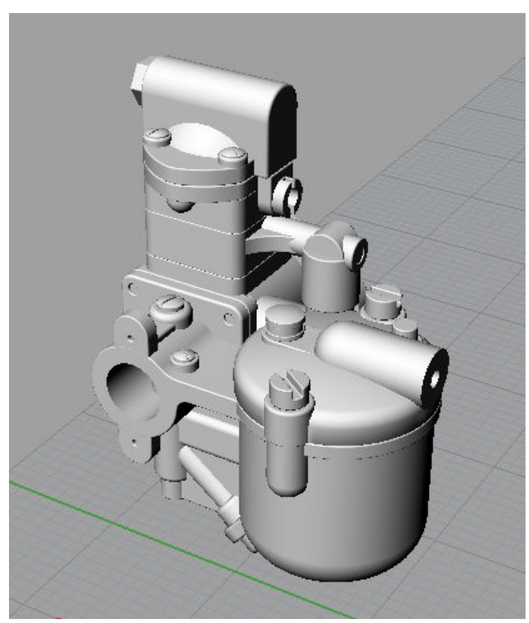
Fig. 4. — Solex horizontal type AHD à bistarter. Montage 22. Ralenti à réglage d'essence.

4

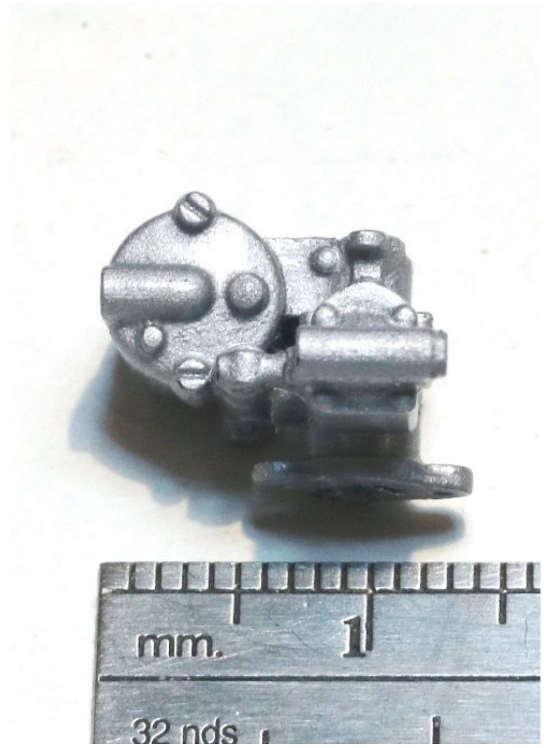
5

Although the carburetor is small, just 14mm x 14mm x 16mm, it is full of detail. Modeling that level of detail is part of what makes for a satisfying model.

Incidentally, the 1936 car had an automatic choke. In the rendering on the right, the inlet at the top of the carburetor is for a pipe from the manifold which forms part of that automatic choke. The fuel inlet is on the far right of the carburetor.



Here are pictures of the painted 3D printed version:



You can see the excellent level of detail reproduced in this tiny printed acrylic part.

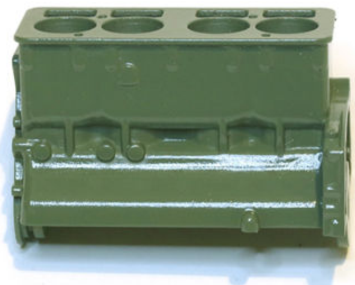
Engine & Gearbox

- **Paint**

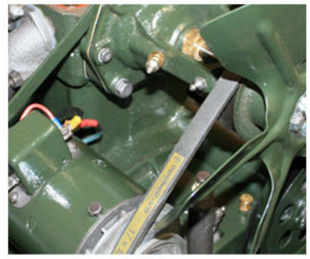
Once I had the 3D printed parts for the engine and gearbox assembly could begin. The first challenge was to find an appropriate green paint.
Somewhat surprisingly, there doesn't appear to be a universally accepted color code (with appropriate color specs) for the engine color even among Traction Avant enthusiasts. Photographs show a fairly wide range of green. The prototype engine colors shown below on the right seemed to be the most representative. Modern restorations don't help either since, frequently, the owners are looking for a high-temperature resistant paint and, for those paints, color choice is often limited. One 'code' mentioned frequently is RAL6020, but that seemed too dark (see below).

On the other hand, the Heller engine color seemed just too 'brassy'. So, in the end, I went with Tamiya TS-91, shown at the bottom. TS-91 dries with a flat finish so a final coat of TS-13 Clear provided the right level of gloss.

Heller



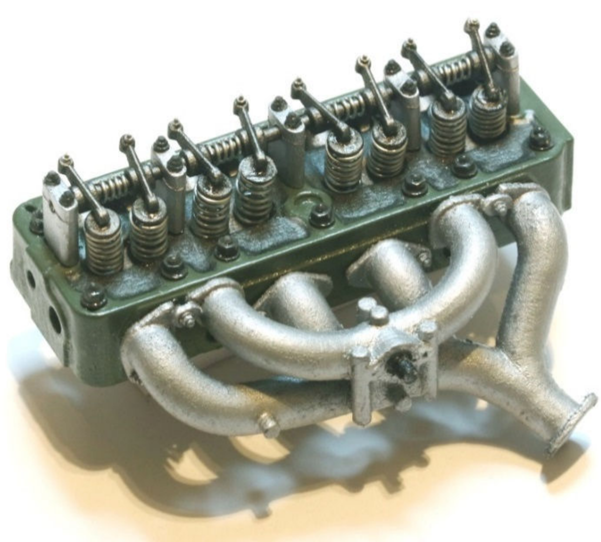
Tamiya
TS-91

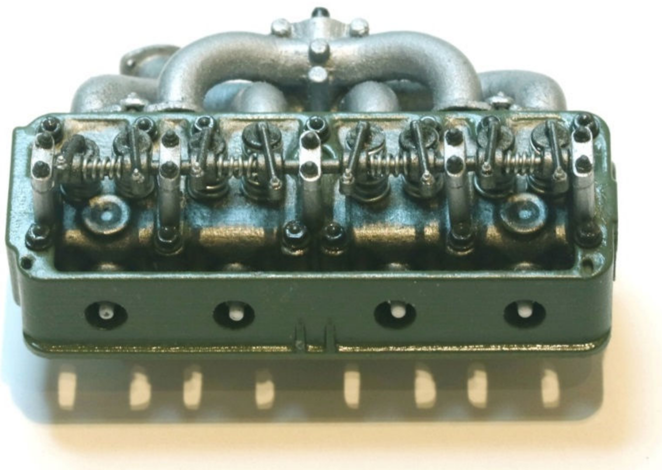


- **Cylinder Head**

With the paint color decided, I set about assembling the cylinder head. With valves, springs and rocker arms, it was going to be the most detailed part of the engine. Even though the rocker cover would normally cover up the detail, the rocker cover would be removable and so I thought the added detail would be worthwhile.

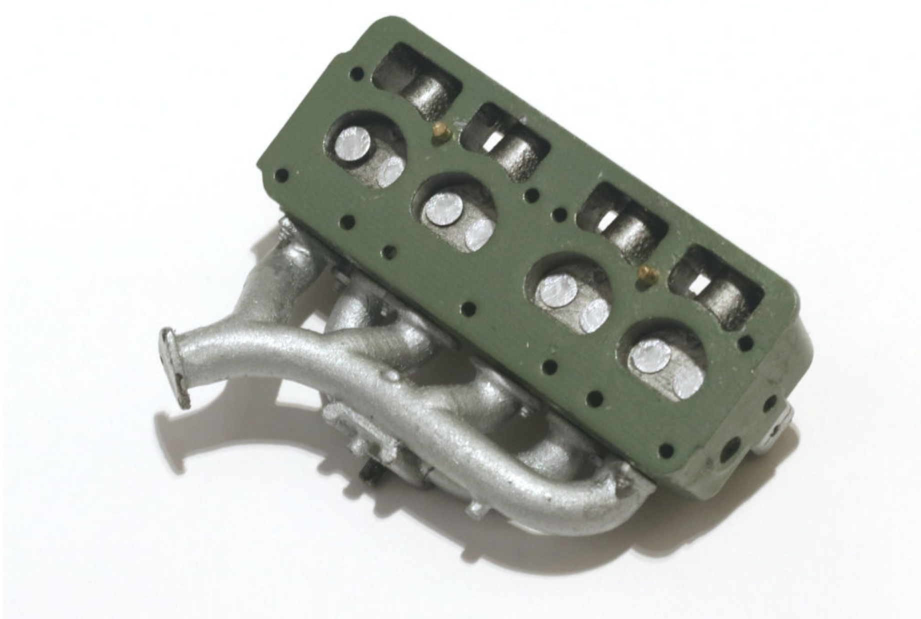
Here are pictures of the completed cylinder head with the inlet/exhaust manifolds:
(Note that the push rods aren't yet installed)



If you look carefully you'll note that, in the upper photo, the exhaust valve on the far right is 'open' and the inlet valve third from right is also 'open'. It's a small detail, but it reflects how the engine actually works!!
The rocker arms, valves, spring caps and spark plugs were all 3D printed in acrylic.
26Ga wire was used to make the valve springs and spacer springs between the rocker arms.
The cylinder head studs are 0-90 hardware (M10 studs on the prototypes) and the nuts and studs on the rocker arm support posts are 1mm.

Although the valve heads will never be seen, here's a photo showing how they fit in the cylinder head:



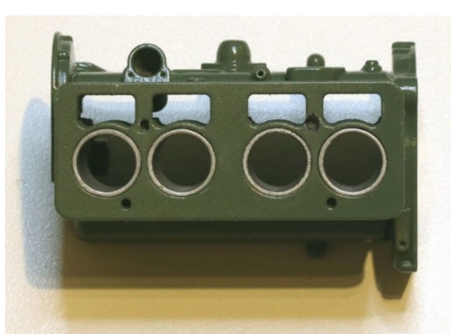
- **Timing Chain**

Another detail that will be hidden in the engine is the timing chain. It's a double chain and, conveniently in 1:8 scale, the chain pitch is 1.25mm which is the same as the chain that is available from Top Studio (www.topstudiohobby.com) for Tamiya's 1:12 scale Ducati 1199 Panigale S. With chain in hand, all that was necessary was to design gears for the double chain and have them 3D printed.
Assembling the chain wasn't easy, and it's not my best assembly job, but it still looked pretty good:

- **Crankcase**

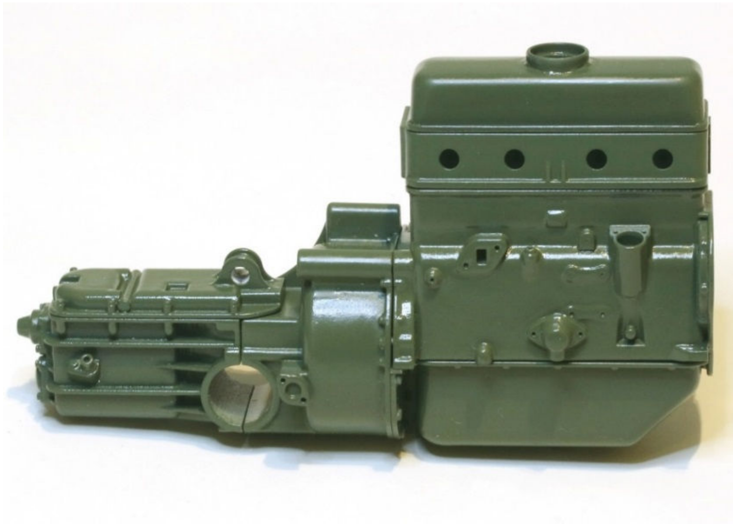
One of the great things about CAD is that you can replicate a lot of features of the prototypes.
The crankcase is a case in point. It's a complex casting into which were fitted cylinder liners.
With more time, it would have been possible to design and add a crankshaft, bearings, piston rods and pistons. But that was going to be a step too far!! So, here's my 1:8 version!

And, below, with cylinder liners installed.
The open areas are for the pushrods. There are, of course, similar openings in the cylinder head.

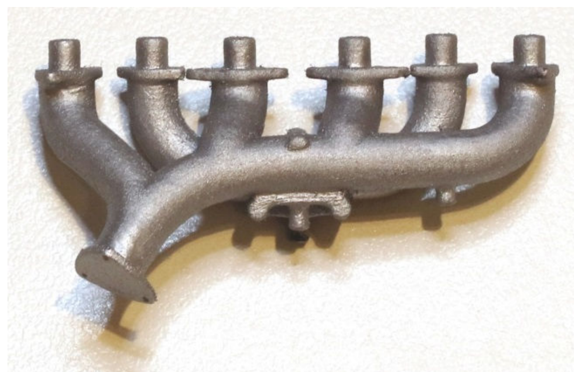


- **Engine - Test Assembly**

Once the engine and gearbox parts were painted, they could be test assembled. Pegs hold the parts together.



The next step was to add the manifolds. This single piece is 3D printed in nylon. It helps provide the typical, roughened, casting appearance. The black peg on the front of the manifold assembly is for the carburetor.

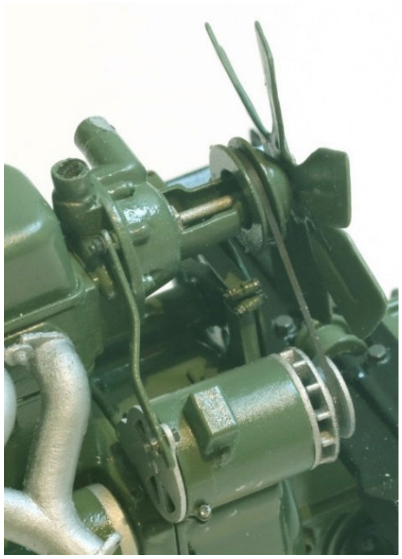


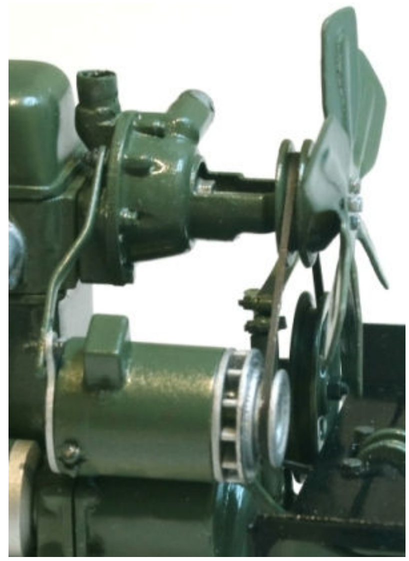
This following pictures show the carburetor, and the appropriately named “Camembert” air cleaner, mounted on the engine manifold. The “Camembert” cleaner was only used for a couple of years, but including it in the model was essential if the model is to be historically correct.

White paper wrapped around the edge of the filter housing, and covered by the finest mesh I could find, simulates the filter.

- **Water Pump, Fan & Dynamo**

On the front of the cylinder head is the water pump and fan drive assembly. Below it is the dynamo …





3D printing allowed the complex shape of the water pump housing to be made in one piece. A brass shaft supports the fan pulley.
The fan itself was too thin to be printed so, instead, was cut out from 0.016” brass sheet. The prototype fan, with its distinctive strengthening ribs, would have been stamped. For the model, the strengthening ribs were made by milling 1mm wide slots in each blade and then soldering a 1.5mm wide strip over each slot. The end result is very similar.

The dynamo was 3D printed in five pieces; pulley, impeller, body and two end plates. A brass rod through the middle holds everything together. The tiny boss on the rear of the dynamo (lower left in the right hand photo) simulates the clamp that, on prototypes, holds the cover plate and connection box in place. The dynamo is hinged off the top of the bell housing and the adjustment arm attaches to one of the bolts on the water pump housing. As much as possible, I tried to match prototype practice in my paint schemes but modern photos of 80 yr. old cars show a lot of variation!

Behind the dynamo and slightly below it is the starter motor. It’s a simple 3D printed part.

Below the starter is a stabilizing brace that helps anchor the bell housing to the crankcase. There is a brace on each side of the engine.

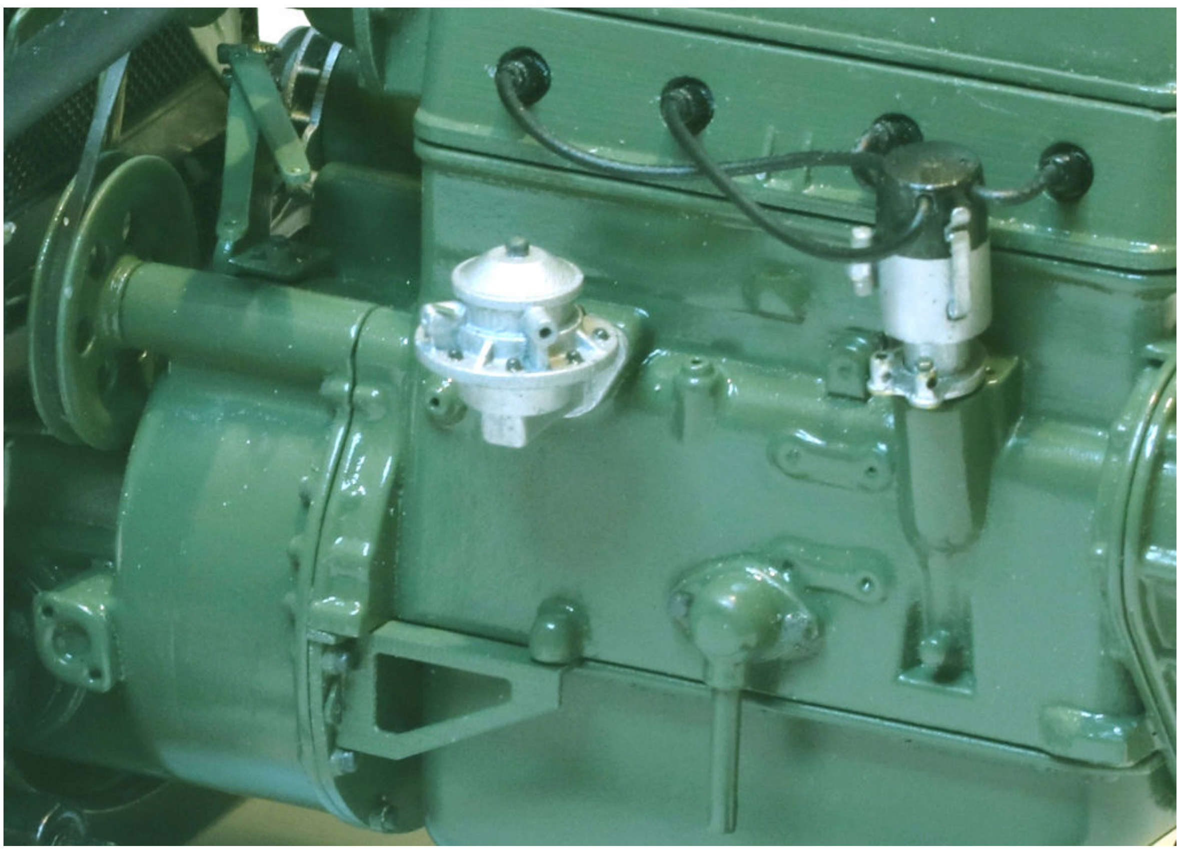
- **Fuel Filter & Distributor**

On the left hand side of the engine are the fuel filter and the distributor. Over time, Citroen used different fuel filters and distributors, but the designs you see here are consistent with a 1936 Traction Avant.

The fuel filter is just a single 3D printed part. A rectangular boss on the back of its flange anchors the filter to the crankcase.

The distributor body is also a 3D printed part. However, the capacitor, clamps and adjustment bracket were made out of brass.

Here is the distributor with the ignition wires connected. The caps fit over the spark plugs just like the prototype.

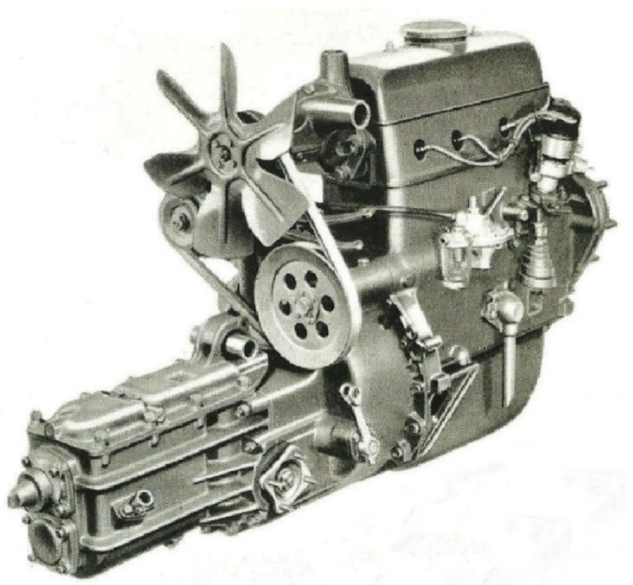


To the left of the fuel filter is the large pulley at the end of the camshaft. Above, and to the right of, the large pulley are the two gear change levers that will eventually connect to levers on the firewall,

To the left of the distributor, and slightly below it, is the crankcase breather pipe.

- **Assembled Engine & Gearbox**

This is how the assembled engine and gearbox (right) turned out vs. an original Citroen rendering …



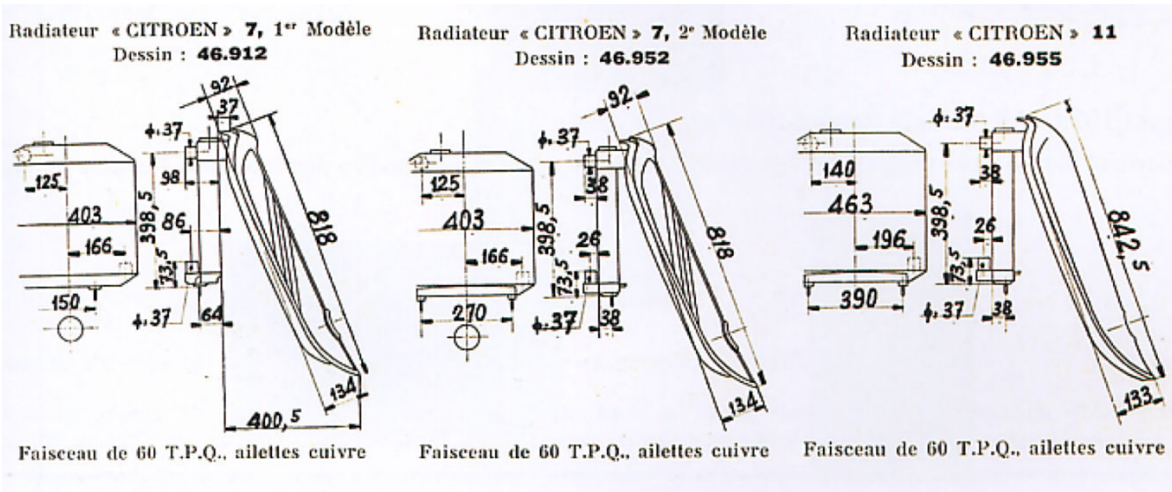
Now it was time to turn attention to the front cradle, radiator and drivetrain.

Front End Assembly

Below is a picture of the completed cradle and engine/gearbox assembly. It highlights the neat, compact, front wheel drive arrangement and also gives you some idea of the build challenges:

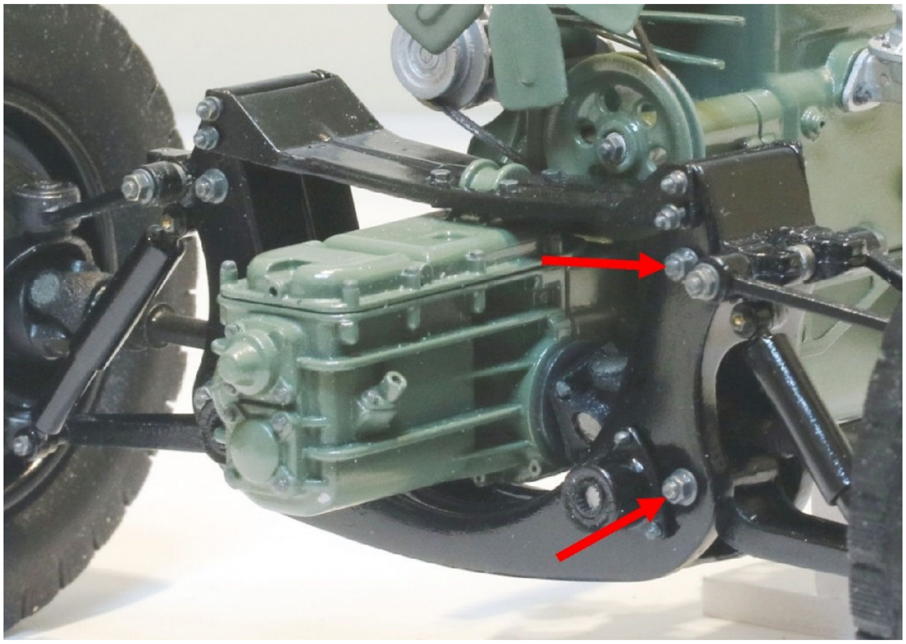
Radiator

The first step was to size the radiator. Based on that it would be possible to figure out the size of the cradle. Although the cradle and radiator for the 11A 'Normale' are both wider than the base model 7C, they are otherwise very similar. Fortunately, an Internet search turned up these key radiator dimensions:



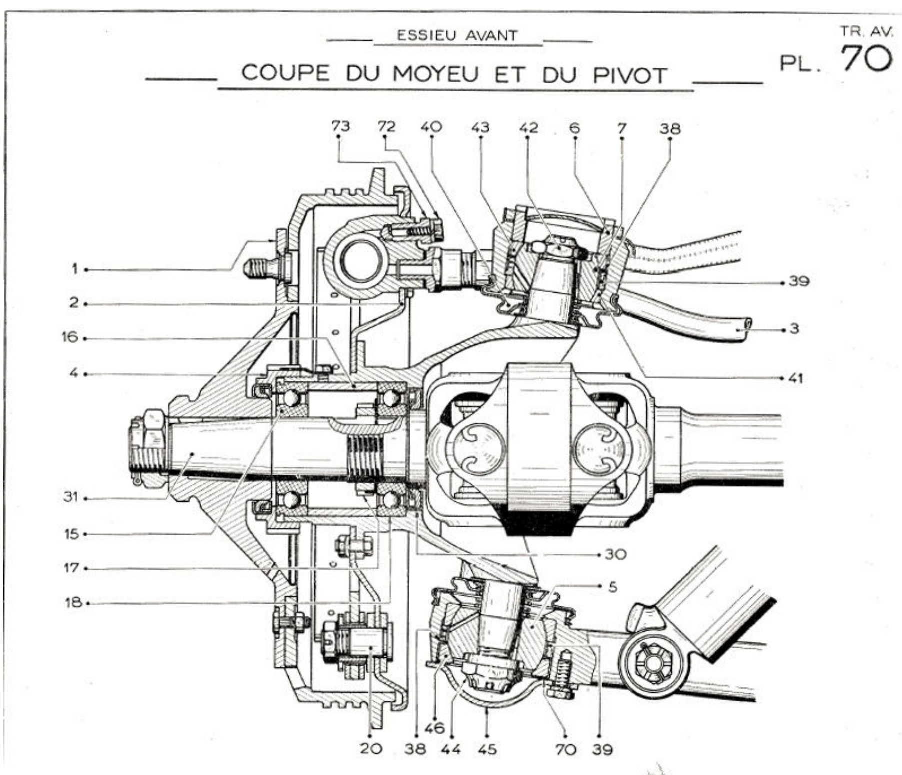
The radiator was 3D printed. The wall thickness of the grill was dictated by limitations of the printing process, but it looks good nevertheless. The hoses were also 3D printed, in nylon, and the ends reamed out to fit over the hose connections on the radiator. The hose clamps are made the way that is described in my Rolls-Royce Build Notes which can be found here:
http://www.jrhscalecars.com/RRSuperDetailing.html

Here is a closer look at the cradle …



The two arrows point to the ends of tubes that act as sleeves for the ends of the cantilever arms on the front of the body. The distance between the left and right sleeves is clearly identified on Traction Avant drawings so it was therefore possible to dimension the cradle with a high degree of confidence.

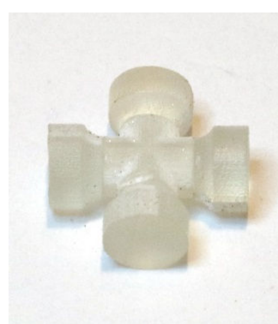
The cross-section drawing of the front hub, below, was enough to calculate the sizes of the suspension pivots and the universal joints for the drives. The front hub is 300mm in dia.



Here’s the completed radiator, cradle and drive trains:

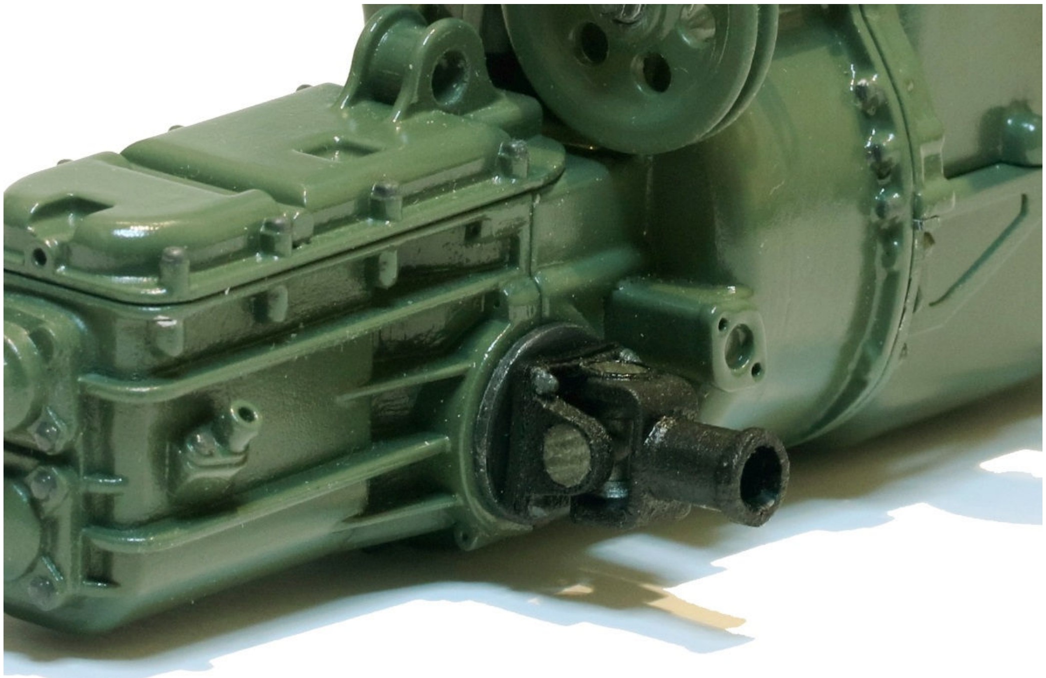
The shock absorbers work. 4mm dia. compression springs in the upper half of the shock absorbers keeps them extended but still allows for movement.

The universal joints, two on each side, work on the same principles as the prototype parts.
This is how the ‘cross’ of each ‘U’ joint is constructed …



This arrangement allows for straightforward assembly of each ‘U’ joint.
The ‘crosses’ are held in place within each ’U’ of the joint by thin discs cemented into the outer edges of each ‘U’. With care it is possible to cement the discs in place without affecting the working of the ‘cross’. I tried using retaining clips, just as on the prototype, but it was too hard to form a reliable clip that would stay in place!

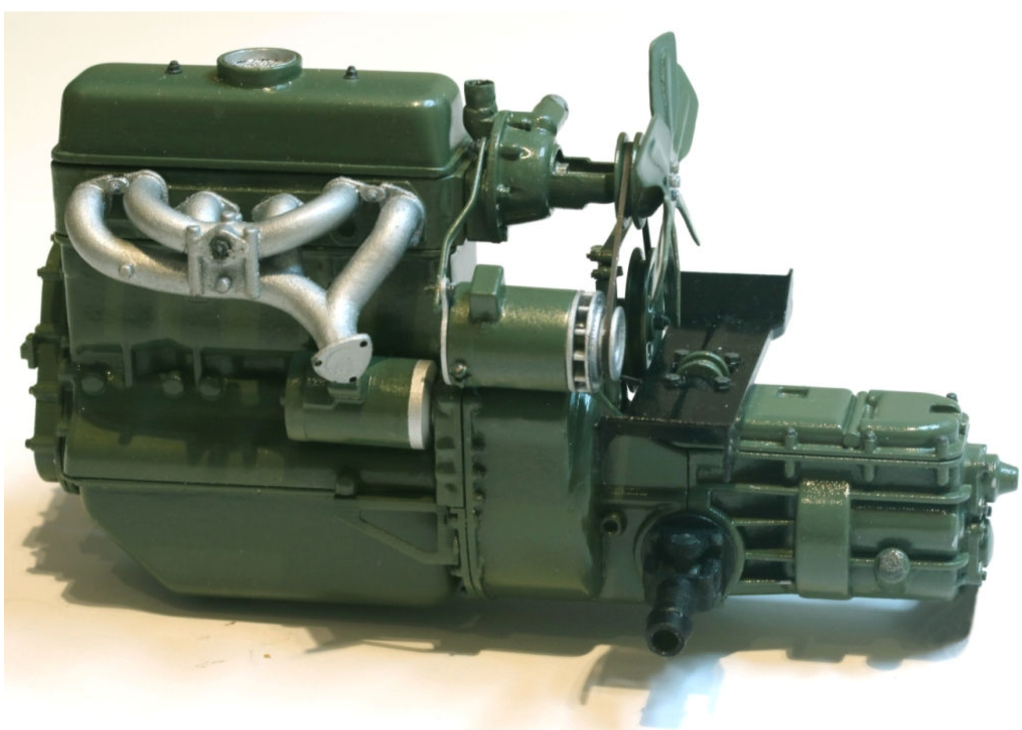
Here's more detail of the inboard 'U' joint:



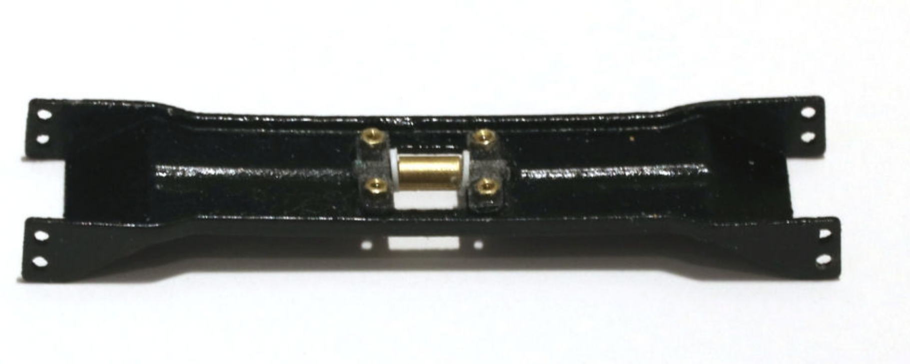
The hole in the end of the drive shaft accepts a splined shaft from the rest of the drive line. Although the spline arrangement worked, (and I used splined shafts for the torsion bars) it wasn't really needed so I drilled out the holes and left it as a simple sliding joint.

Engine/Gearbox Suspension

The engine and gearbox assembly is attached to, (or, more accurately, suspended from) the cradle by a bridge plate that extends across the cradle. In the following photo, the bridge has been installed on the gearbox:

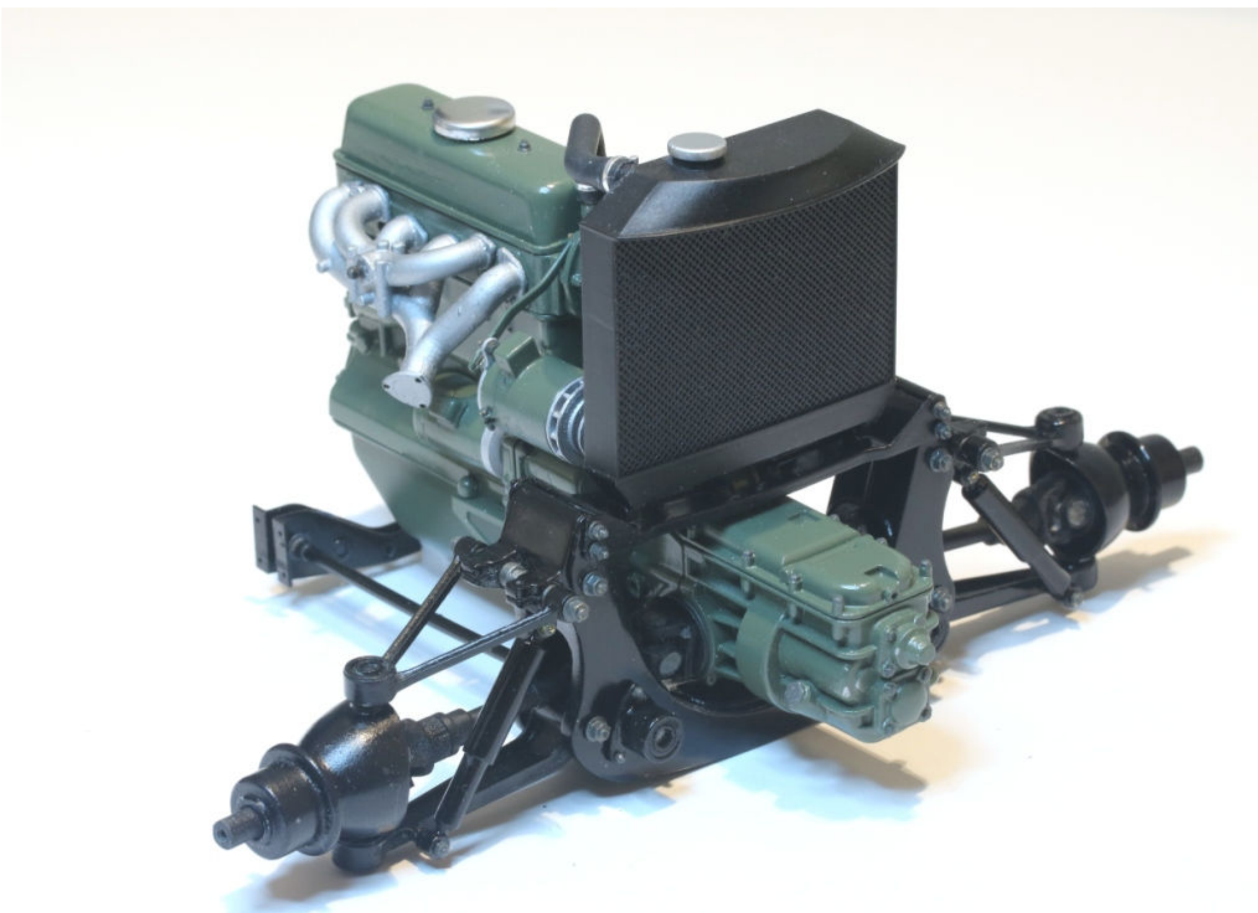


This is the underside of the bridge:



The brass tube in the center of the bridge fits inside gearbox boss and two brackets, one on either side of the tube, slot into the ends of the tube. Four bolts inserted from the top side of the bridge screw into the four nuts you see in the photo and bolt these brackets to the bridge.
The rear of the engine fits into a rubber bushing in the firewall so this bridge arrangement allows for some rocking of the suspension vis-à-vis the engine and gearbox.

Once the bridge plate was attached to the gearbox, the engine/gearbox assembly could be attached to the cradle.



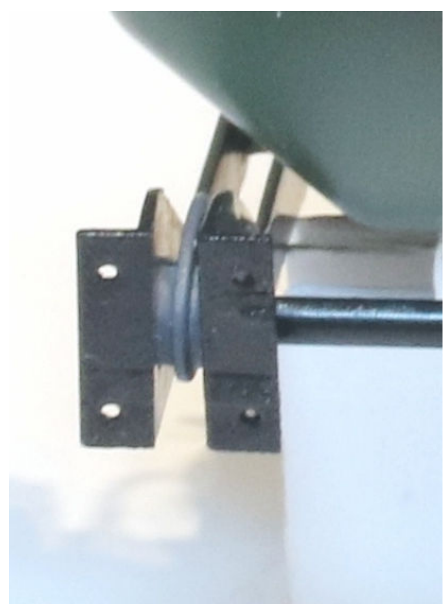
More views ….

The ends of the axles are designed to fit directly into the brake hubs.
In the photo on the right, the rear cross-member that anchors the torsion bars is clearly visible.

Torsion Bars

There are two torsion bars, one on either side of the engine. As these photos show, the front ends fits into large, splined bosses on the rear of the cradle. The rear ends fit into splined cams mounted in the cross-member. Although the splines are not easily visible, they are included in the model. The cams, seen in the second photo, could be rotated so that the amount of tension in the torsion bars could be increased or decreased.

Wheels

The last step in order to complete the front end was to add the wheels.

The wheel assembly of the model consists of a brake drum, brake cover plate, wheel rim, two hubcaps and, of course, a tire. In the photo on the left, the cover plate is not quite oriented correctly as this photo was taken when I was just checking fit;

The brass bolt, in the right-hand photo, screws into the end of the drive shaft and anchors the brake drum in place. The hub and wheel disc are bolted together with the five studs and nuts. However, I later realized this was incorrect. For a short period, including 1936, Citroen used a six-stud wheel mounting arrangement. So, I changed the rims and later photos show the six studs.
The inner hub cap will be clipped in place to a raised circular ridge on the inside of the wheel disc.

The tires that came with the Heller kit represented the revolutionary 'radial' tire which Michelin had introduced in 1937. It was wider and had a more rounded profile than the tire used in 1936. Specifically the Heller tire is 185x400 whereas in 1936 the tire size was 150x400. Although it was possible to use Heller tires, I decided to make tires that would match the 1936 design. The process is described here: http://www.jrhscalecars.com/ToolsTireMolding.html
For this tire, because of the tread design, the split line for the mold was placed in the center of the tire.

Here's a comparison of the two tires.
The Heller tire is on the right.

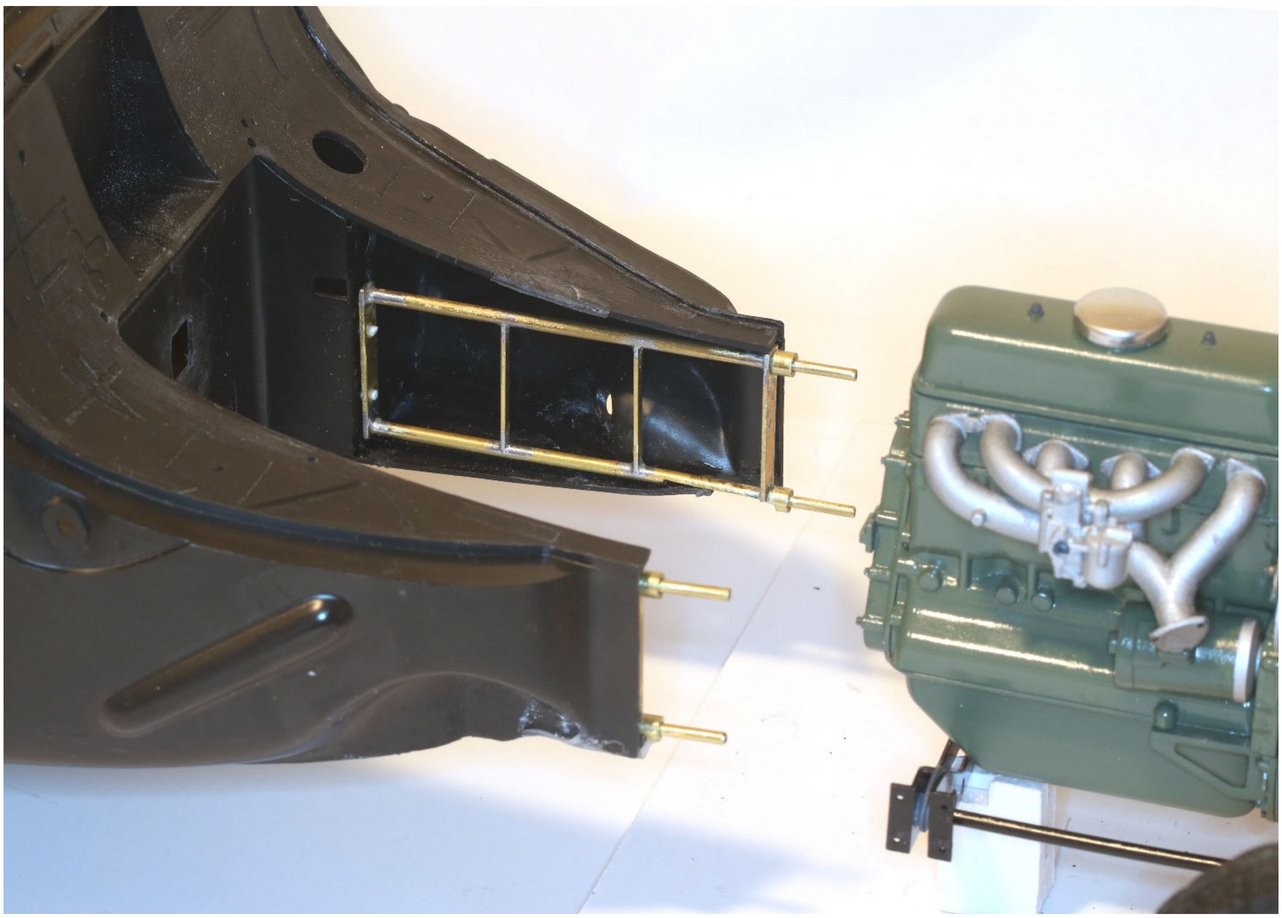
There are two hubcaps. The outer one was usually painted the same color as the body and the inner one was chrome.
Since I plan to paint the body black, the outer hub cap is also black.

At this point the front end is almost complete.

Body – Initial Steps

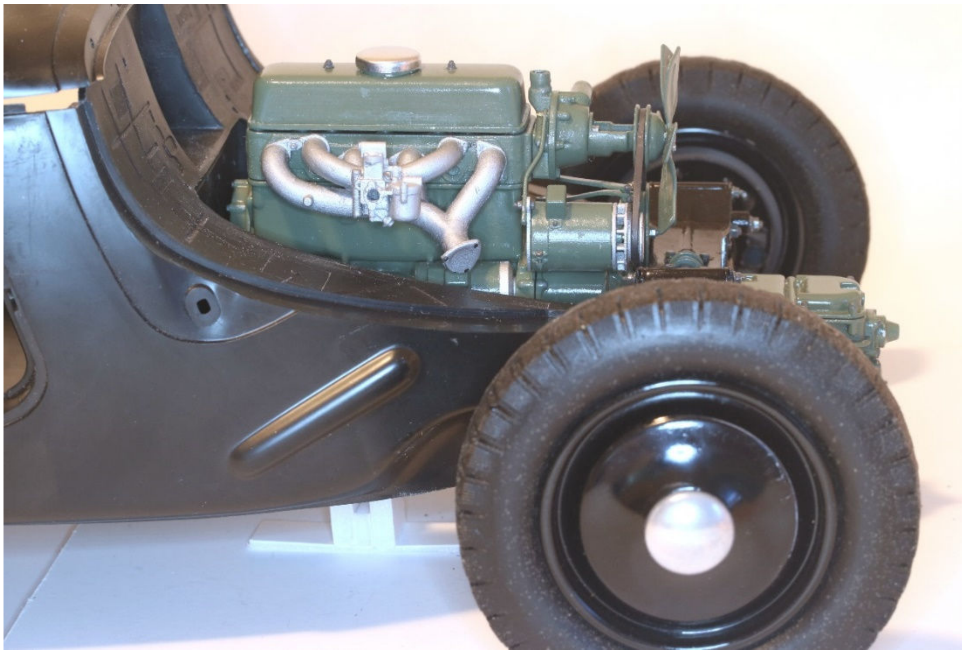
Now it was time to turn attention to the body.
Initially, the most important task was to make sure the front end mounted properly to the body and that, with the rear axle installed, the wheelbase and body profile looked correct. With that done, finishing the assembly of the body and detailing the engine bay could all be done with confidence. If there's one thing I've learned from all my models, it is that making major structural changes or adjustments after lots of detail has been added is a recipe for disaster.

The first step was to assemble the firewalls/bulkhead to the floor and also the door frames to the floor (to provide the required rigidity). Care needed to be taken gluing the front end 'box' together. It needed to be square and rigid since it sets the alignment for and supports the whole front end assembly.
Once the front 'box' was cemented together, I made new frames and cantilever arms to carry the front end assembly. The front end cradle is narrower than the one in the Heller kit (requiring shorter arms), plus the Heller frames are plastic and flexible (which I didn't like) so I made new frames made out of brass.



In the photo, you can see the top of two white styrene pegs holding the rear of the frame in place against the firewall. The frames won't be painted and glued in place until after the front end assembly is test mounted onto the cantilever arms.
To the left of the upper frame, and in the center of the firewall, is a square hole. This hole is for a cavity that will take a rubber block mounted on the timing gear cover at the rear of the engine. On prototypes, this provided a rear mount for the engine assembly.

Here the front end assembly is fully mounted onto the cantilever arms.



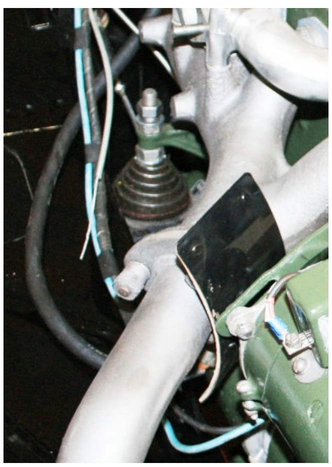
In the lower photo the bosses on the inside ends of the cantilever arms are just visible above and below the fan belt. Not visible are the torsion arms and the cross member that anchors them. But the cross member does fit and anchoring it in place should be straightforward.
So far so good.

This test assembly also confirmed that the rear mount on the timing gear cover would align with the hole I had cut in the firewall. Although not shown, the 'Camembert' air filter sits comfortably on the carburetor and won't interfere with the bulkhead.
But it looks like I'll need to pay careful attention to the routing of the exhaust pipe as it leaves the manifold.

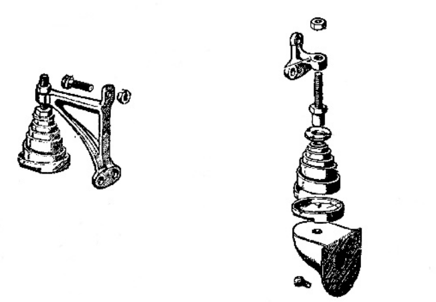
Here's a picture of the complete floor and front end assembly. At this point, the roof is not attached and is simply resting in place.

Engine Side Mounts

In addition to the supports at the firewall and at the cradle, the engine and gearbox assembly is supported on each side by coil (Volute) springs. These are cantilevered off the sides of the engine and rest on blocks attached to the sides of the engine bay. This is the right-hand side arrangement:



And the 1936 spare parts catalogue shows more detail:



These engine mounts were going to have to be scratch built for the model and this was a good time to do that.

The base of the springs are 8mm in diameter and the springs are made from 1/64" x 1/32" brass strip.
Here are the two cantilever and spring arrangements:

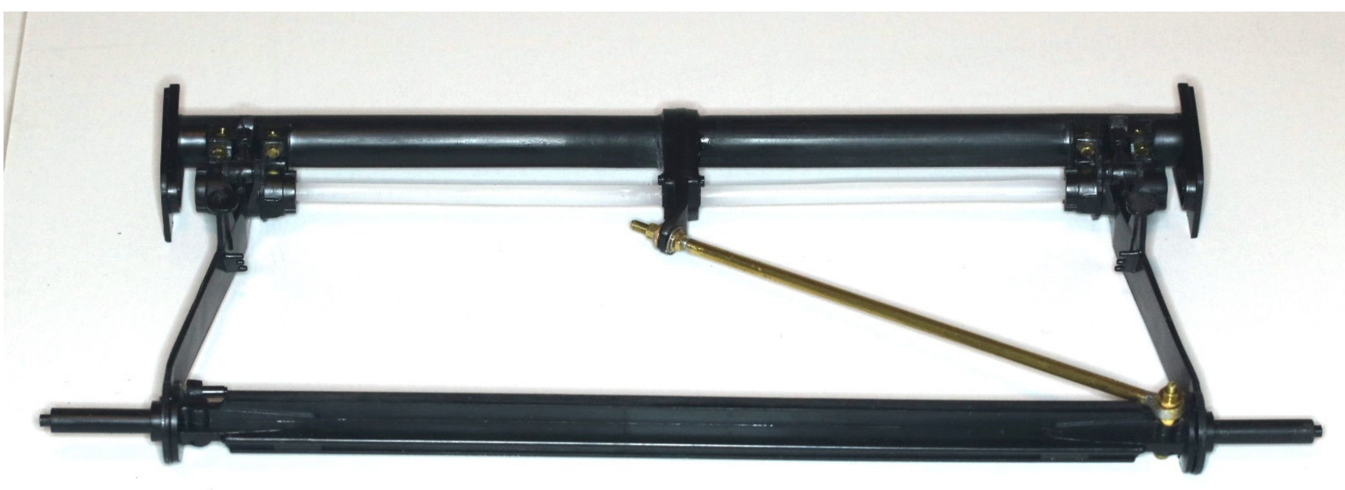
And here's one of the blocks, made from styrene, on which the springs sit

The arms were then temporarily mounted to the engine to make sure the springs would fit properly between the sides of the engine bay:

Rear Axle

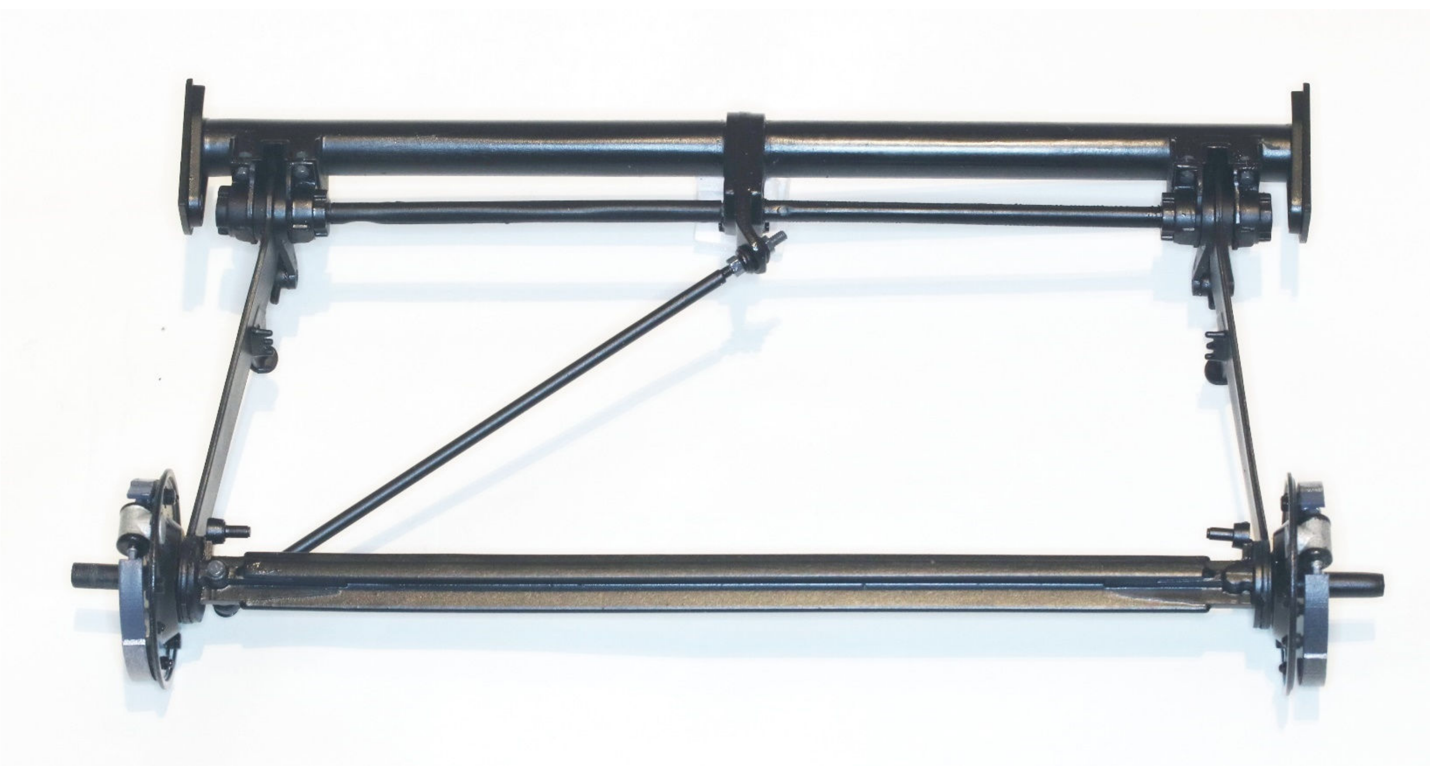
Now attention could shift to the rear of the car. The first step was to test assemble, and temporarily mount in place, the rear axle and rear shock absorber. With that done, the body could rest on its wheels and the profile checked again.

Here's the assembled rear axle although, at this point, nothing has been painted.
The anti-roll bar in the Heller kit has been replaced by a much stiffer (and more realistic) unit which was scratch-built in brass. At the same time, the faux bolts holding the torsion bar and axle arm brackets to the rear axle tube have been replaced by 00-90 hex head brass bolts. Not only are the bolts more realistic, they made it easier to assemble and disassemble the rear axle. The bolt heads are just visible in the top corners of the photo. (The axle is shown upside down.)



Mounting the axle assembly to the underside of the body was straightforward, as was installing the shock absorbers. 1-72 hex head bolts were used for mounting the upper part of the shock absorber to the body, replacing the pegs used in the kit.

The rear track of the 1936 'Normale' was 44mm narrower than the 1952 15-Six (the kit), or 5.5mm narrower in 1:8 scale. Fortunately, with the kit, it is possible to butt the brake covers right up against the axle support arms as shown below. This replicates the narrower track of the 1936 prototype:

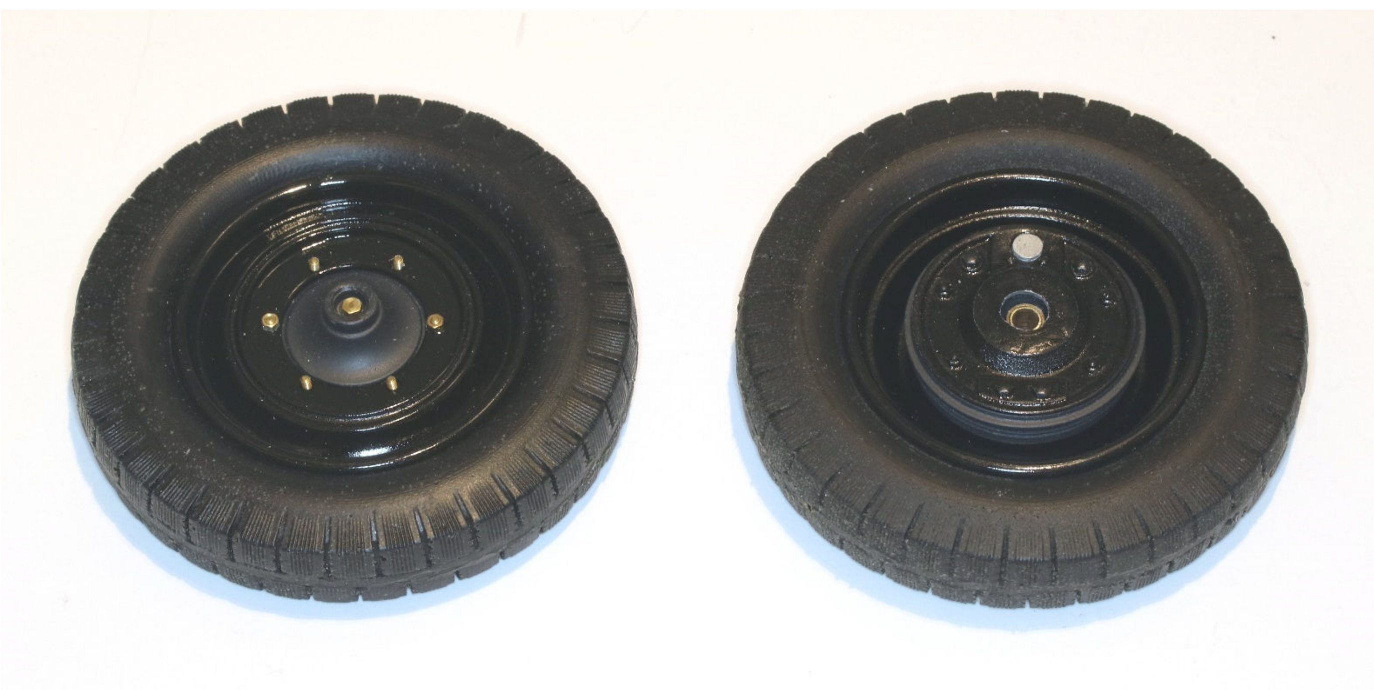


Details of the brake shoe assembly, 10” brake drum and cover are shown here:

The brake shoes, hydraulic actuator, brake drum and brake drum cover were all 3D printed.

The brass tube in the center of the hub fits over the end of the Heller axle.

And here:



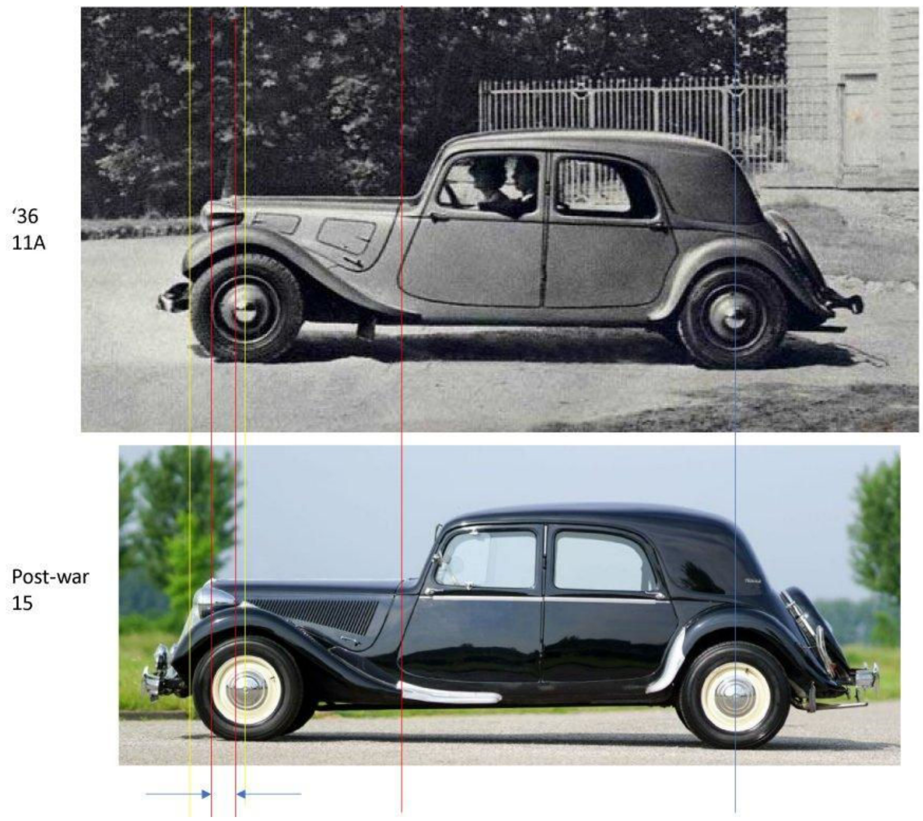
The wheel mounting now has the correct (for 1936) six stud mounting.
The center bolt you see screws into a tapped hole at the end of the axle and holds the wheel in place.

Front Wings, Grill & Bonnet

With the rear axle complete and the wheelbase, front and rear tracks and overall side profile all looking good, it was time to tackle one of the last major kit-bashing and scratch-building tasks; the front wings, grill and bonnet.

The issue is that the 6-cyl engine and gearbox is longer than the 4-cyl version. In 1:8 scale terms, that means the top of the radiator grill in the 4-cyl car is 20mm closer to the windshield than in the 6-cyl. Although the grill from the kit could be used (with some modifications), the grill is also at a steeper angle in the 4-cyl cars. So the grill side supports, wings and the bonnet would all have to be shortened by approximately 20mm and also re-profiled. Lastly, the bonnet sides had hinged doors for to ventilate the engine compartment, not the louvers that were used in the 15-Six.

This side profile comparison shows the overall differences:

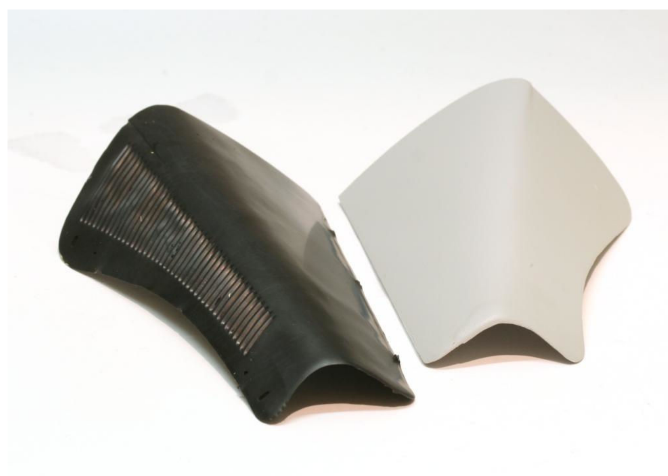


The first step was to shorten the grill side supports. They also anchor the sides of the wings. A 20mm segment was taken out of the middle of each support.

This photo shows the temporary setup with the shortened side supports taped to the grill and also to the engine bay. This let me check the forward slope of the bonnet, the clearance over the radiator (just a couple of millimeters over the radiator cap) and establish new side profiles for the wings (which, here, are roughly marked in pen).

With the new side supports in place, the bonnet could be shortened to match, and the louvers filled with body filler and filed down. Here the setup of the left-hand side support and shortened bonnet has almost been finalized. As you can see, the cutouts for the cooling doors have yet to be made.

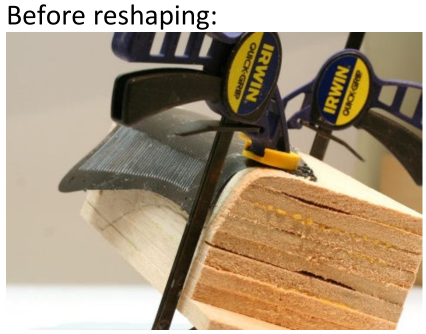
And here's a comparison of the original bonnet (left) with the modified version (right):



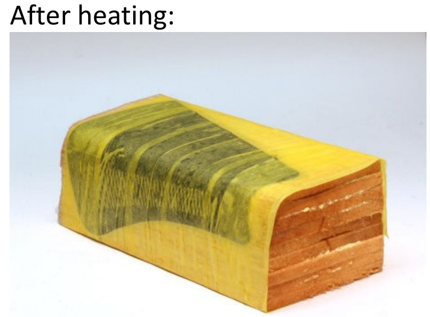
Although it's not obvious from the photo above, when the Heller kit was opened, the right-hand side bonnet was severely warped. It was reshaped using a balsa block and boiling water:

Warped bonnet:

Before reshaping:

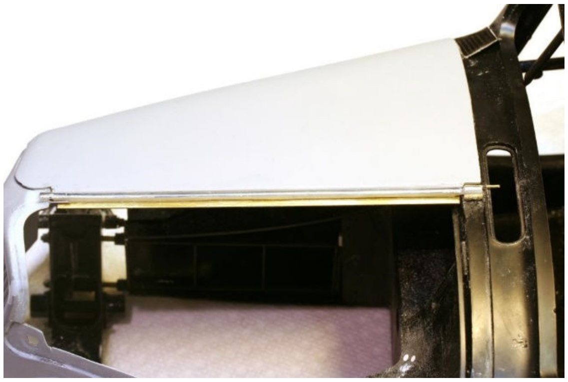


After heating:



Bonnet Hinges

Since major modifications were being made to the bonnet, it was an opportunity to replace the Heller rubber strip-based hinges with ones that were stronger, and more realistic. 3/64" thin wall tube was glued to the edges of each bonnet half. .020" piano wire anchors the tubes at each end and allows the bonnet to hinge freely:



Modified Wings

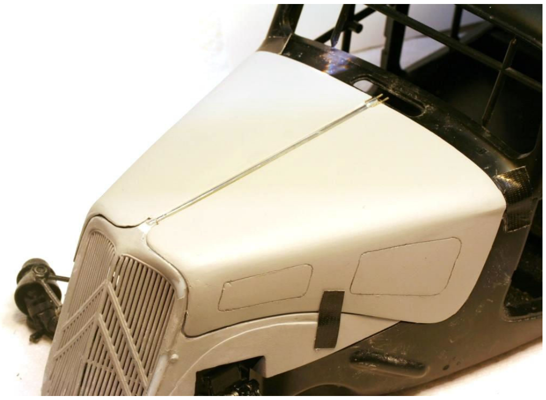
The next step was to shorten and reprofile the front wings.

This picture shows the extent of the reprofiling.
An original wing from the kit is on the left.
Automotive body filler was used to create the new profile. The scattering of holes visible on the modified wing act are anchors for the body filler on the underside of the wing.

The rear of the 11A wing ends just after the leading edge of the front door and so is shorter than the 15-Six wing. A piece of polystyrene sheet was therefore added to the rear of the Heller wing to round out the trailing edge. The added piece can be seen at the top of the picture.

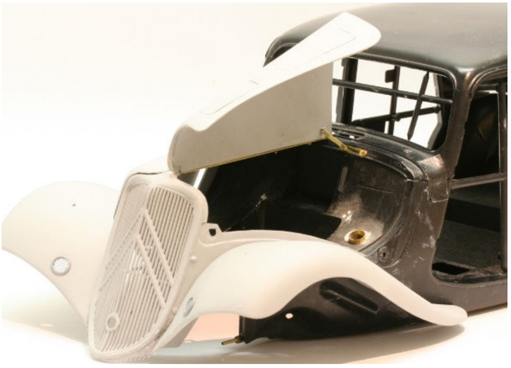
Ventilation Flaps & Bonnet Stays

Two of the last bonnet modifications were the addition of ventilation flaps and bonnet stays.
On the next page, the first photo shows the completed, primed, shortened bonnet with the outlines of the bonnet flaps scribed onto the surface. The second shows the bonnet with the completed flaps. The flaps are hinged in the middle so that the leading edge of the front hinge swings out. The rear flap does the opposite. At this point the bonnet handles, as well as echelons on the flaps, have not been installed.




Also noticeable in the second photo are the small circular grills which protect the horns. On the very early Traction Avant 11CVs, the horns were mounted on the bumper. They were moved behind the wings in October 1934. And the eagle eyed will note that the grill from the kit has been modified to remove the 15/6 emblem and provide a round hole for the starting handle.

Heller used a simplified, somewhat crude version of the bonnet stays in their kit. I decided to make working replicas in brass. They work just like the prototype and loook more realistic:

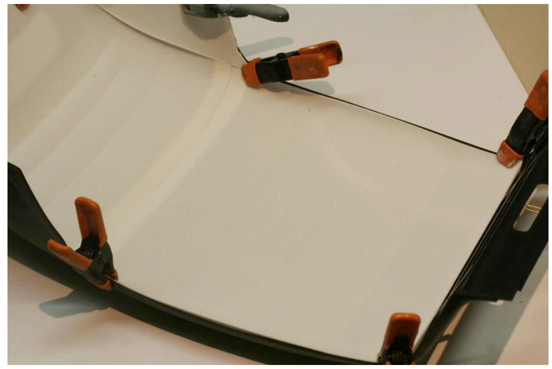



That pretty much completed all the modifications to the wings and bonnet:


Headliner

The kit includes a very flimsy, vacuum formed, plastic headliner. Unfortunately, mine was damaged.
So, I chose to 3D print a new one in nylon using templates made from the roof. The panel sections would match those on prototypes. The headliner is 0.8mm thick, the thinnest that could be printed in nylon. And because of printing limitations, the roof headliner had to be made in two pieces.

Here's the test fit of the unpainted parts:

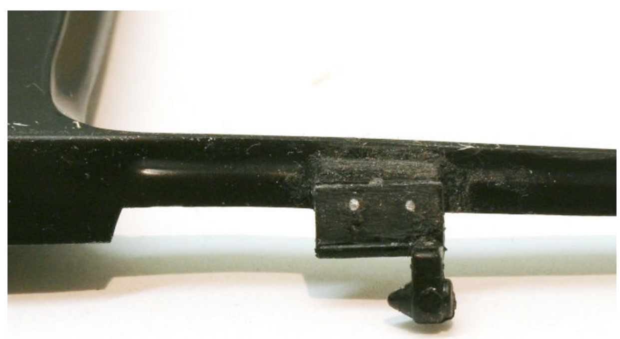


Although it's not entirely clear from these photos, the front section of the headliner has the same draping as the prototype.

Door Hinges

For obvious reasons, the assembly of the door hinges is crucial to the fit of the doors and the overall appearance of the model. Unfortunately, the door hinges in the kit are not very strong. The cross-section where the hinge arm attaches to its hinge plate is very thin and the plastic is very soft. As a result, there have been several blog comments about the tendency of the doors to sag over time.
Initially I thought that pinning the hinge plates to the doors would help strengthen the hinge (see below), but then I realized that it would do nothing to fix the weakness of the hinge arm.

Note the thin cross-sections.



Hinge plate pinned with piano wire.

A better solution would be to construct new hinges (arms, plates and pins) out of brass. The new brass hinges would be stronger and also, to some extent, by bending, adjustable.

The components of each hinge are a center post, a lower plate and an upper plate.



The post is a 3/32" tube (.014" wall) drilled to take a 00-90 stud and two spacing washers. The B pillar is drilled to take the stud. A nut and washer secure the post in place.
The top and bottom plates are formed from .032" brass sheet to which a short section of 3/32" tube is soldered and then fitted with a 1/16" peg.

The plates will be glued to sides of the door panels.

Assembled to the 'B' pillar, they look like this:

With the plates glued to the doors, the hinges could be tested:



Some minor adjustments to the fit of the doors was required to make sure the inner panels fit snugly and the outer panels fit flush with the body. But, otherwise, the hinges worked very well.

Window Winders

One critical missing feature of the Heller kit is a mechanism for opening and closing the side windows. Instead the kit is designed for the windows to be locked in one of three positions; closed, open or partially open. I thought it would be a neat feature to add a window winding mechanism even if the window winders would rarely be used.

So how to do it?
Here's a picture of the early Traction Avant window mechanism:

Based on these and other photos, and measurements of the Heller doors, it looked like a similar mechanism could be used. So, the first step was to create drawings starting with the rear doors.

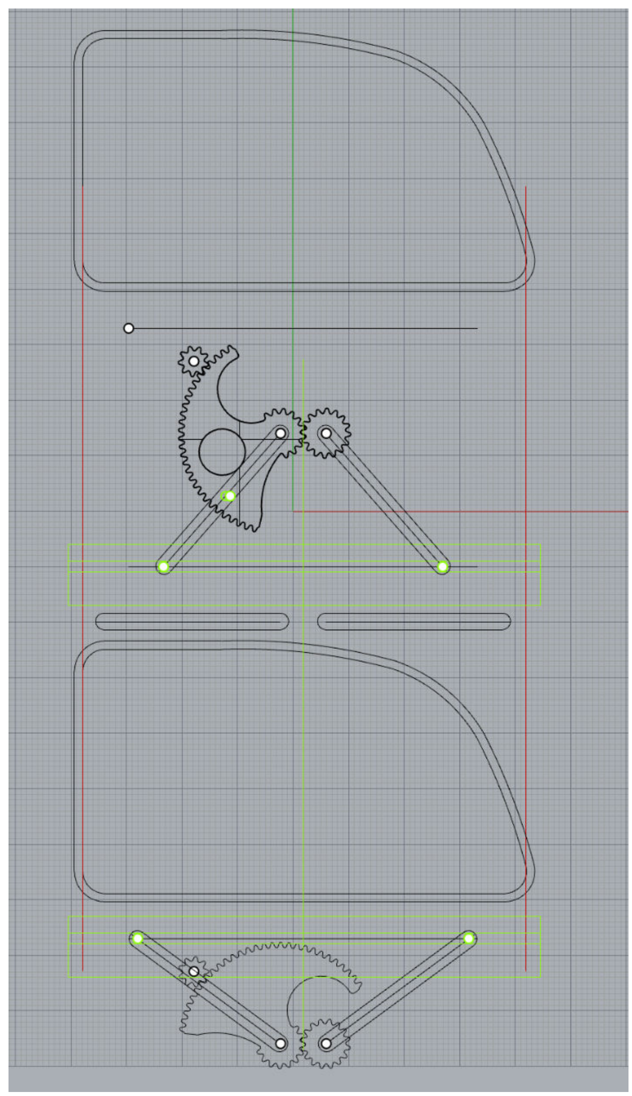
The drawing opposite is 1:8 scale on a millimeter grid.

The window winder handle operates the small spur gear shown at the top left of the layouts. This gear turns the large quadrant gear and thus the adjacent gear, both of which have attached arms. The two arms, operating like scissors, move horizontally in a slot which is attached to the window, moving the window up and down.

My plan is to have the window and slider plate move up and down within U channels, an approach I had used for a Rolls-Royce Phantom II and an Austin Seven. The gears would be 3D printed in nylon which is strong and wears well.

This drawing confirmed a number of elements:

- The two arms will rotate within the inner edges of the channels, so no problem there.
- The gear pitch of 1.5mm looks satisfactory. It is 50% larger than a 1:8 version of the prototype, in order to get greater gear tooth strength
- Similarly, for strength reasons, the small winder operated gear is larger than the prototype equivalent. But it changes the winder position only slightly.
- The quadrant gear remains well below the window opening throughout its full rotation.



The gears will be mounted on posts that have been soldered into a backing plate. That will maintain alignment of the gears. The backing plate will then be glued to the inside of the door.

OK, so much for the plan. The next step was to start prototyping the setup on the rear doors while I waited for the gears to be made. These photos show the window glass and slider in the fully closed, partially open and fully open positions:

The full range of the slider (up and down) is 43mm, so approximately 1mm of the glass protrudes above the bottom edge of the window frame in the fully open position. The window 'glass' is taken from the Heller kit. The ends of the location bosses have been cut off leaving two short tabs. These tabs are attached to the brass slider plate with a .015" thick styrene bridge piece. A duplicate bridge piece (not yet in place) will be glued on the side facing the camera.

The deep U channels are 3/32" in width and height. The slot is 1/16" wide and 1/16" deep. These channels used to be a standard item from K&S, but are no longer offered. I've not found an alternative source, but cutting a slot in 3/32" square brass tube would work. The channel easily accepts a .040" (1mm) thick clear acrylic window.

The arms will be attached to the slider plate from underneath. Brass pegs at the ends of the arms engage in the slot in the slider plate. The slider plates were made by soldering spacers between 1/8" wide and 1/4" wide 0.32" brass strips. The slot is just under 2mm wide which allows for easy movement of the pegs. There is approximately 3mm underneath the slider bar which allows for a 0.16" (0.4mm) thick backing plate, 1.5mm thick gears and .016" (0.4mm) thick arms.

An important step was to test fit the outer door panels and make sure the window side channels didn't interfere with the mating of the outer and inner door panels. Some small adjustments were required but, overall, the outer panels fit well.

Door Latches

Just visible in the previous photos is the new rear door latch. The photo adjacent shows it in more detail.

I have had poor experience with plastic door latches; they tend to bend or break. So, new latches, made from brass, made sense.

The hole for the door handle, in the outer door panel of the kit, dictated the position of the latch post. Fortunately, there was just enough room for the door latch to fit next to the new brass window channels.

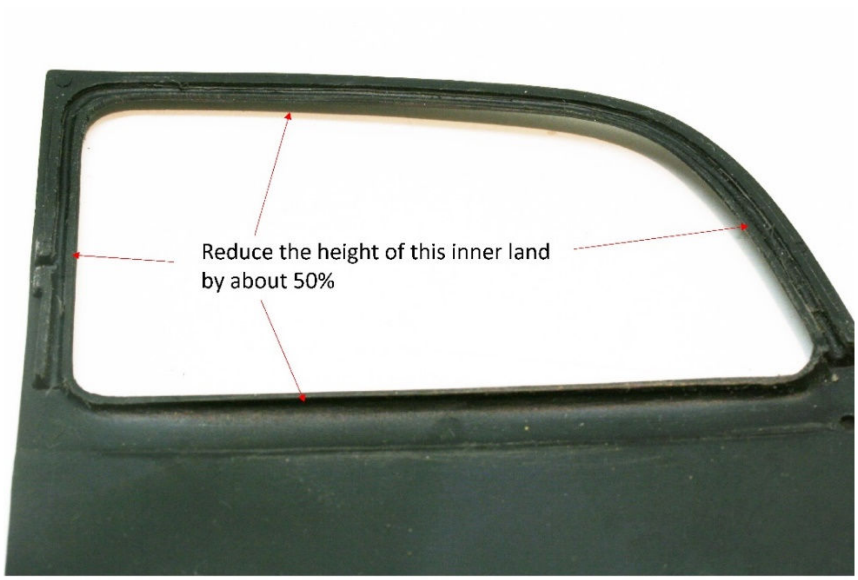
To make the latch assembly, a 0.032" triangular brass plate was drilled out for a 4mm long piece of 5/64" thin wall brass tube which was glued in place. The tube acts as a support sleeve for the 1/16" dia., 12mm long, latch post and positions the latch at the right height. The latch is made from 0.032", 1/8" wide strip.

On the door posts, Heller provided tiny little 'D'-shaped pieces of plastic that are glued in place to hold the end of the latches. The risk is that, pulling on the door handle when the latch is not fully open, will break off these small pieces. So, for added strength, I drilled through the edges of the pieces and used .020" piano wire pegs to hold them in place.

More On The Window Winders

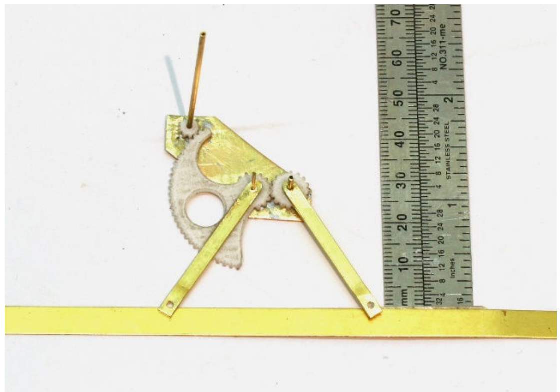
The winder arrangement prototyped on the rear doors was carried over to the front doors as shown here:

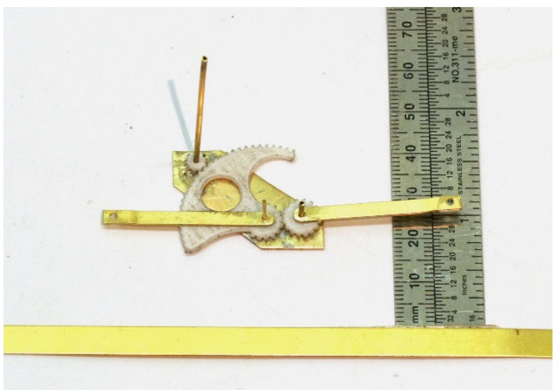
To accommodate the working windows, the outer door panels were modified to provide a greater gap between the inner and outer door panels. Otherwise, each time the window is raised or lowered, there would be a good risk of scratching the plastic window glass. The increased gap was created by lowering the height of the inner land on the outer door panel:

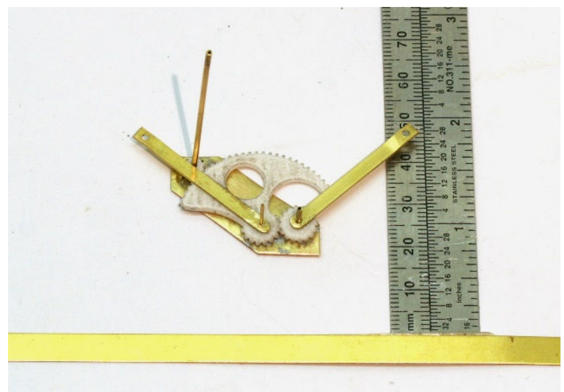


Window Gear Mechanism

Once the 3D printed gears arrived, the winding mechanism could be constructed and tested.
Initially I was going to use 1/32” posts for the gears, as shown in the photos below. But the joint between the posts and the base proved to be too weak, so I used 3/64” posts instead. Each gear was then drilled out to take a 1/16” (1.6mm) thin wall brass sleeve which fit over the 3/64” post.







The comfortable vertical range of movement is 46mm, more than enough to accommodate a full window opening.
Here are the completed left hand side assemblies with the windows about halfway down:

The two curved styrene crescents under the rear window slider are to maintain the right height for the slider arms. The bottom of the rear door is significantly deeper than the top so the slider arms kept falling out of the slot! The crescents are 1.5mm high at the bottom, 0.5 mm high at the top.

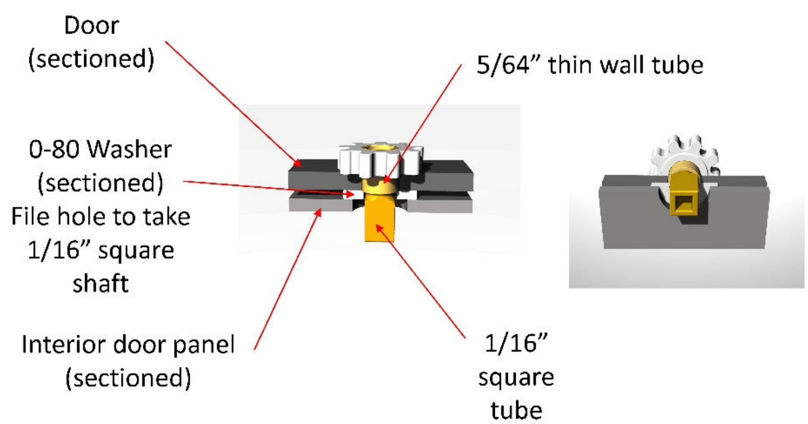
Here are those same mechanisms with the windows fully up, and fully down:

They work!!

The small spur gear, which drives the large quadrant gear, passes through the door as shown here:

The spur gear assembly consists of a 1/16" square tube, its end ground down, soldered into the end of a 1/16" thin wall round tube. The tube is then glued into a 5/64" thin wall tube that sleeves the center of the spur gear. A retention washer behind the door panel holds the shaft of the spur gear in place. The assembly is shown in these renderings:

Spur Gear Assembly



The square shaft provides a positive drive for the window winder handle and makes it easy to install the handle once all the door panels are complete.

The winder handle was carefully, and I mean carefully, drilled out and carved out to accept a 3/32” square shaft insert. The insert mates with the smaller 1/16” square shaft of the spur gear:

Door Panels

With working windows, new latches and new hinges, the doors were now complete except for the inner door panels and, of course, painting. The inner panels are built on .010” styrene sheet covered in the same cloth as the seats. Half round strakes reflect the simplified interior finish of 1936. Here the front pockets have still to be added.

Model

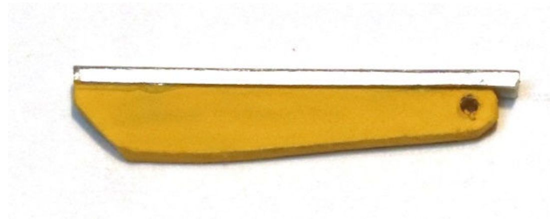
Prototype

Trafficators

Throughout the 1930s, cars used semaphore-like ‘trafficators’ to signal turns. They were also common on cars built right after WWII. Here are a couple of examples, the first is from Citroen, the second from Lucas. However all the pictures of pre-war Traction Avant trafficators showed a flatter profile than these two illustrations.

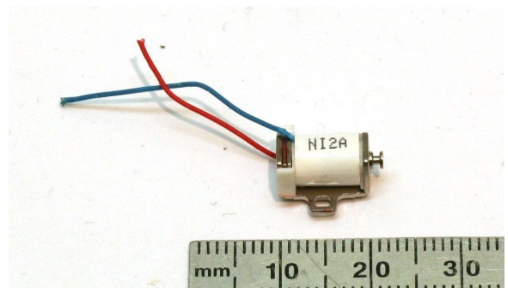
As you can see below, the Heller trafficators are only an approximation of the real thing and the profile is too flat. So new ones were built from .040” clear acrylic sheet and a brass channel cap.

Heller



Scratch- built

I also wanted to create working trafficators.
The idea was to use a simple, micro sized, low voltage, switch operated solenoid or actuator which could be installed in the B pillar. Surprisingly, finding small devices was difficult. Most actuators needed separate drivers and controllers which required significantly more space and significantly more money. I eventually found a tiny pull solenoid. It was just 12mm x 7mm x 6mm. The plunger was 2mm in dia.

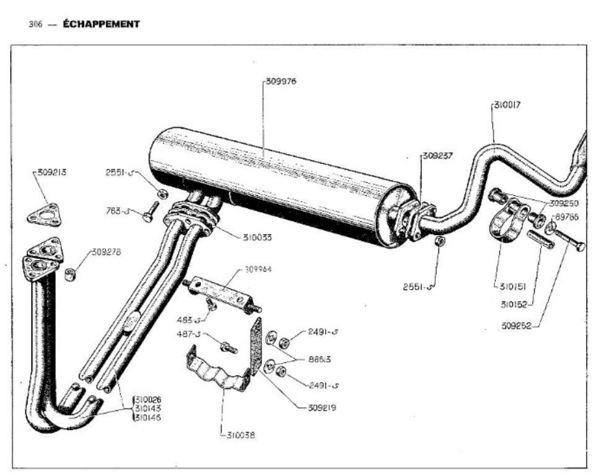


There were two challenges to getting the solenoid to work effectively. The first was finding, or making, a return spring. The spring needed to be strong enough to return the trafficator to the “off” position but weak enough for the solenoid to operate. The second was coming up with the electrical circuitry so that a simple on-off switch would consistently work the trafficator. Although I found a way to embed the solenoid in the B pillar and was able to successfully test a mechanical linkage, I was never able to solve the spring and circuitry challenge. So, in the end, I chose to just have the trafficators operate by hand! It was disappointing, but the effort to get them to work didn’t seem justified. Perhaps another time!

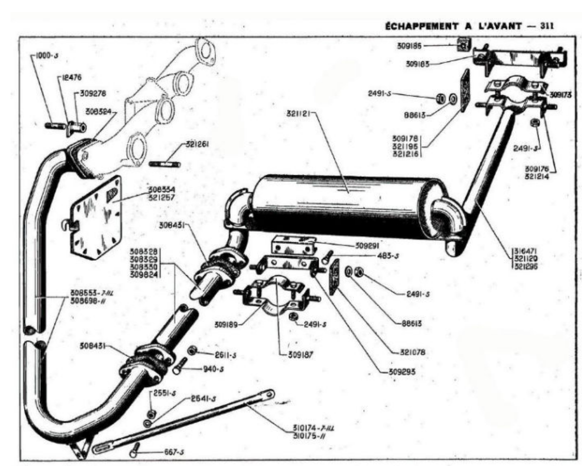
Exhaust System

As you can see from the drawings below, there are substantial differences between the 15-Six exhaust system (on the left) and 11CV exhaust system. So, a completely new, scratch-built, 11CV exhaust system was needed.

15-Six



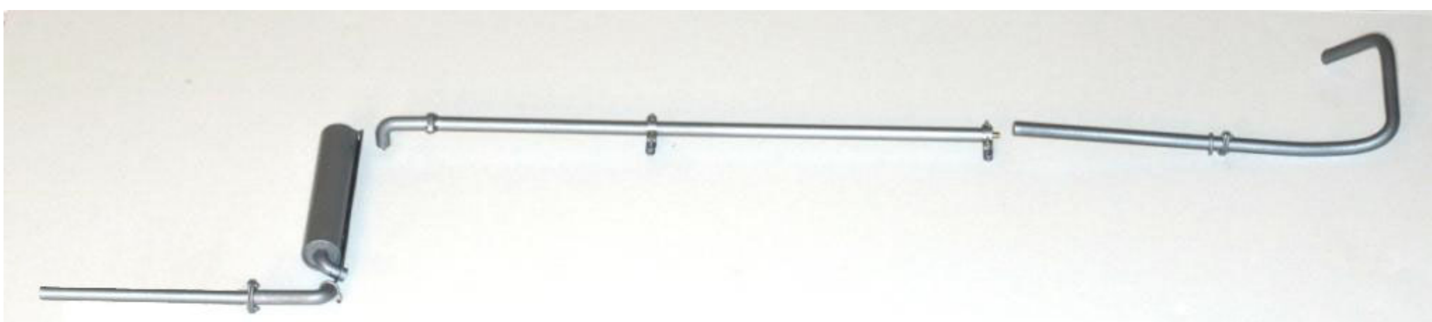
11CV



The front end of the exhaust pipe was made from 1/8” brass rod. Most of the remainder of the piping made from 1/8” styrene tube.

The most complex part was the silencer.
The 11CV silencer is of a similar diameter to the 15-Six, but much shorter. It was made from styrene tube, but the pipes at either end of the silencer were 3D-printed. Flanges were fabricated from styrene sheet. Of note, and just visible underneath the silencer, is a strengthening plate that locks the ends of the pipe to the silencer. The plate was made from 0.010” brass strip.

Here are all the various pieces:



You’ll note that, wherever possible, I use pegs to hold the pieces together in their proper position before they are glued together.

The manifold flange (below, left) and connecting flanges are made from 0.010” styrene sheet. The support brackets (below, right) are made from brass sheet and 0.5mm hardware.

Body – More Steps

At this point, attention shifted to beginning the assembly of the body and interior fittings. Early on I had made the decision to keep the roof separate from the lower body until the very final stages of assembly. This made it much easier to make the many modifications that were required … new headliner, new seats, new interior panels, a different pedal mounting, etc.

Here’s the lower body:

And the roof:

As is obvious from the photos, the body will be gloss black. Why black? Well, it just seemed the right color. Maybe I watched too many 1950s/1960s movies!! For the interior I chose a gray cloth for the seats and a different, but complimentary, gray color for the carpets. The headliner was painted GM Linen White which, in reality, is actually a very, very light gray and so compliments the rest of the color scheme.

Rear Seats

The first step was fit the new rear seats. The seats of the 1936 11A were much simpler than those on the more luxurious 1952 15-6. The standard seats were cloth covered bench seats, both front and back. The seat shells were 3D-printed and then covered with cloth. ‘Leather’ piping (made from 20 Ga wire) edged the seats. The wheel arches and interior panels were covered with the same material as the carpets.

Front Seats

A bench front seat was standard on the 11A in 1936, but split front seats were available as an option. Initially I decided on a bench seat for the model, so shells (for seat base and seat back) were 3-D printed and the supports made out of 1/8" brass rod (I didn't trust the plastic supports included in the kit).
Then I had a second thought and figured that split front seats would look better. So, shells for the split front seats were made and the chairs assembled (see below).

But I didn't like them. The cushioning just didn't look right … too clumsy. So, I decided to go back to a bench seat! Construction would be very similar.

Clips, on the tunnel under the seat, engage with the seat supports and let the seat slide back and forth. So all four chair supports needed to be in alignment. A couple of 1.0mm brass rods were used to ensure consistent spacing (see opposite).
The supports will be painted 'chrome' (metallic silver) before final assembly.

Here you can see the clips attached to the tunnel. The top of the clips are made from styrene tube.

This is the final seat arrangement complete with the long grab bar across the top of the seat. Again 20Ga wire serves as piping:

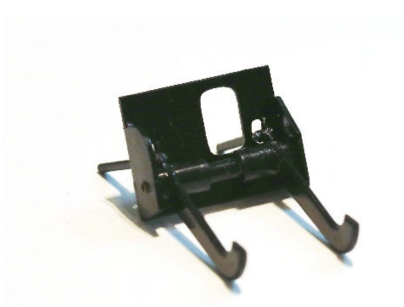
Here the front seat is clipped in position in the almost finished vehicle:

Pedals

The pedal arrangement obviously has to be similar to the 15-6, but the method of mounting the pedals was different. So, a new backplate had to be fabricated including holes for the operating rods. The left hand picture shows the pedal mounting and also the operating rods attached to the top of the pedal arms. The pedal arms are relatively weak so it's advisable to make new pedal arms from brass strip.

I also wanted to have operating pedals so I used a tiny compression spring that would return the pedals to the normal position. The middle photo, shows the spring arrangement. The end cap is soldered to the rod so that when the pedal is depressed, the spring is compressed and will return the pedal to the normal position once the pedal is released.

The photo on the far right shows the mounted spring assembly.

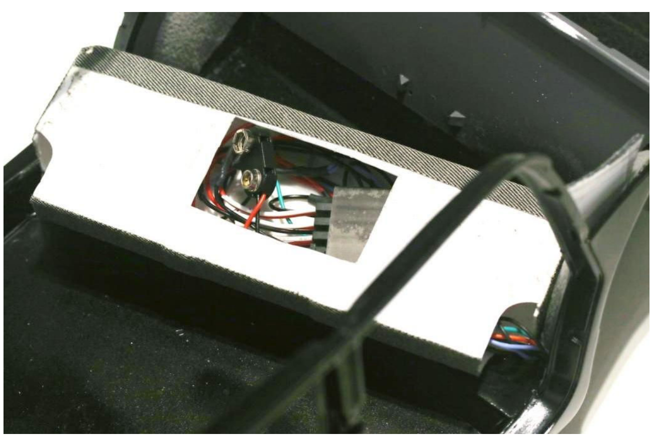


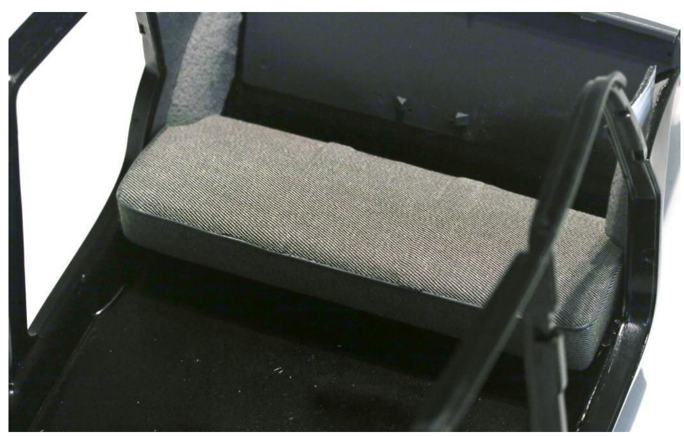
Working Lights

From the beginning I wanted the model to have working lights. This required mounting LEDs in the headlights, making new rear lights, stop light and interior light and, of course, adding backlighting to the dashboard instruments. Equal challenges were how to route the wiring and where to place the battery and switches.

I designed the rear seat cushion as a shell, so there was room under the seat for the 9V battery and also a miniature 4-channel remote unit. From the remote control unit, wiring could be run through the channel under the door sills to the front lights and dashboard. Initially I had hoped to use a common ground wire, but the remote unit didn't like that! Fortunately there was enough room in the channel for all the necessary wires. The following pictures show details of the wiring. The wires are 30Ga, rubber coated, with an outside dimension of 1.1mm. Using different colored wire made the hookups almost foolproof.

The more detailed picture on the left shows the remote control unit (on the right) and the connection for the 9V battery. The photo on the right shows the rear seat base installed with everything neatly hidden away.





Wiring was hidden in the body channel under the doors. The photo below shows the wiring emerging from the back of the channel and the passing through holes in the floor to the underside of the rear seat. The remote control unit needed a dedicated ground wire for each port. That made the wiring a little bit more complicated.

Here you can see the wires as they pass through the holes in the floor. The wires will be covered by the end plates of the rear axle assembly. Also in this picture is the fuel line from the fuel tank.

Headlights & Front Sidelights

I was able to use the headlights from the kit. However, within each headlight a large LED was added for the main beam and small chip LED added for the side light. Pillars, made from 5/64” OD thin wall brass tube, were used to support each headlight and provide a conduit for the LED wires.

In November 1936, a new French law was passed that mandated yellow headlights on all cars produced in 1937 and afterwards. However, since my model is a replica of a car built in June 1936, clear, ‘warm white’, LEDs would provide the appropriate lighting.

Below is the assembly sequence. The lens for the headlight has still to be installed.

And here’s the headlight installed on the front wing. Still without the lens!

Registration Plate and Rear Lights

In 1936 the Traction Avant rear registration plate was moved to the left rear fender. It incorporated a single rear stop light and the left rear sidelight. Another rear side light was mounted on the right-hand side fender.

But first it was necessary to come up with an appropriate vehicle registration number.
In France, a national registration system was first introduced in 1901. It was revised in 1928 and that revision remained in place until 1950. Registration plates issued after 1928 consisted of one to four numbers followed by a two-letter code. The two-letter code identified the département in which the car was registered. Small départements were issued just one two-letter designation, larger départements (such as Seine) received multiple designations.
My plan was to use TA (for Traction Avant) for the département code. TA had been issued to the Seine département, but never used, so it seemed reasonable to use it on the model. The registration number could then be 36-11-TA; which is an arrangement I had seen in photos of 1930s Traction Avants. It would nicely represent the model; a 1936, 11CV, Traction Avant!

Rear Registration Plate

Front Registration Plate

New rear lights with LEDs were then fabricated consistent with early Traction Avants:

Test setup with the stop light and both sidelights on.

Interior Light

The Heller kit included an oval interior light but, in 1936, the interior light was round. So, a new one was fabricated from brass tubes and a lens cut from clear acrylic sheet. A light sanding of the lens created the appropriate frosted appearance and a chip LED provided the lighting.

Dashboard

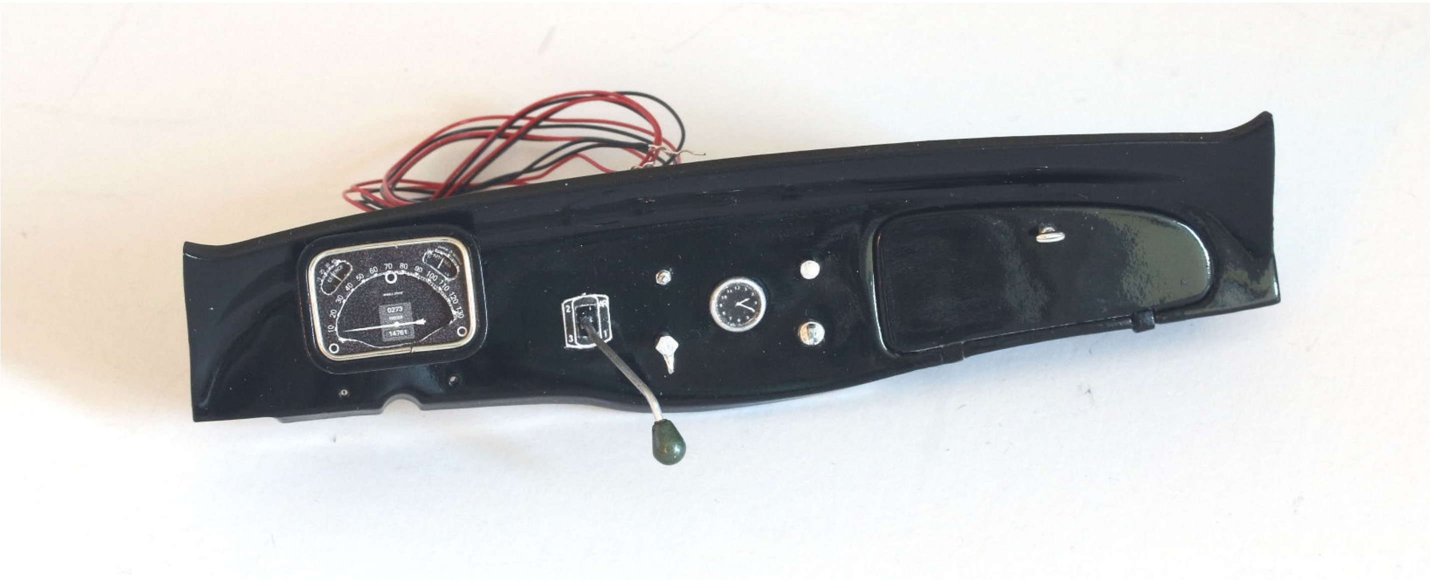
The 1936 11CV 'Normale' dashboard is the same overall size as the 15-Six, but the arrangement is significantly different. On the left is a typical pre-war 11A, on the right a 1950s 15CV.

Most notably, on the 1936 11A;

- The glove box is slightly more towards the center of the dashboard.
- The clock is in the middle of the dashboard instead of in the instrument binnacle.
- The plate showing the gear lever position is squarer.
- There are no plated strips and Citroen echelon as on the 15CV.
- The horn and light control ('comodo'), mounted on the steering column, is a very different design consisting of two separate levers.

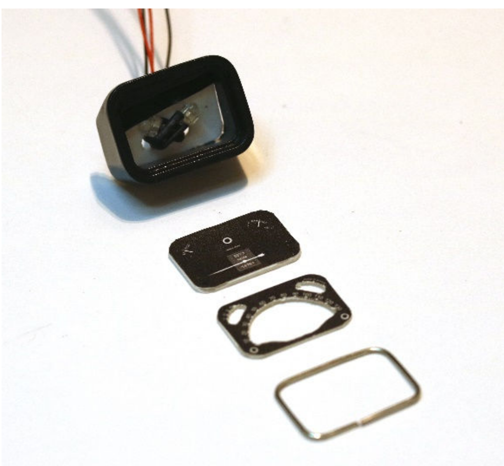
The glove box was moved approximately 3mm to the left and provision made for proper hinges. A new, more rounded, binnacle was also designed and 3D printed. The binnacle was made in such a way that the instruments could be backlit. New decals were printed to reflect the 1936 instrumentation.
Here's the new dashboard under construction:

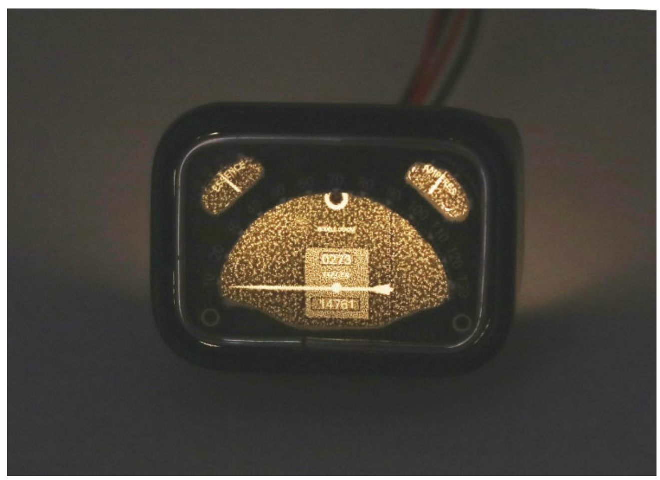
And here it is painted and assembled:



The gear lever knob on the prototypes was made from dark green Bakelite. On the model it is simulated with paint.

The binnacle is structured in layers so two small LEDs mounted in the rear of the binnacle backlight the instruments …



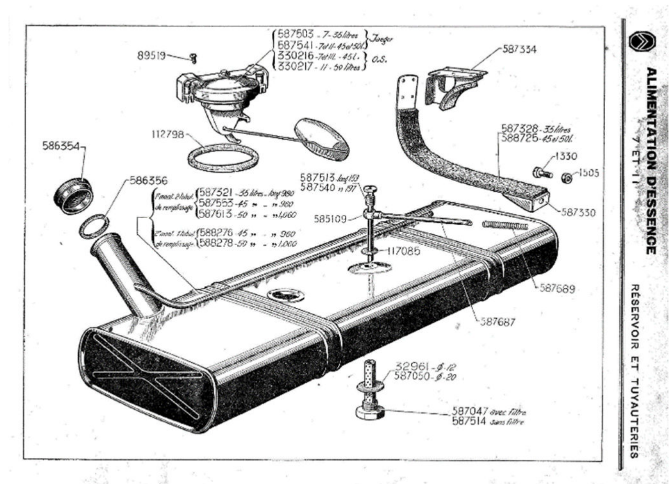


Finally, a new comodo was scratch-built based on actual prototypes. This photo shows it under construction:

Fuel Tank

The 11CV fuel tank was very different from that in the Heller kit so a new one was fabricated based on a 1935-1936 spare parts drawing:

Heller tank



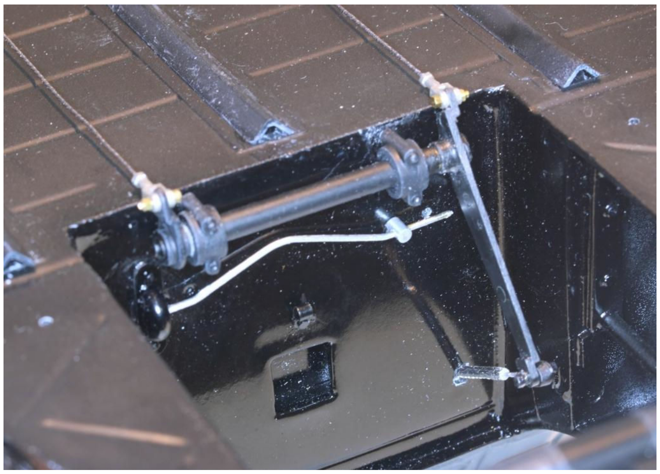
’35-‘36 11CV spare parts drawing

Heller simplified things on the 15-Six tank, molding the hangers into the tank body. That is somewhat surprising since there are many detailed parts in the kit and the hangers really ought to be separate items. So, in addition to 3D printing a more appropriately sized tank, separate tank hangers were fabricated from brass strip and rectangular brass tube. 1.0mm nuts and bolts clamp each hanger together. The bases of the hangers are glued to the underside of the floor, holding the tank in place. But before gluing the hangers in place, the fuel line running from the top of the tank was installed. Note that it travels down to the front of the body inside the left hand side ‘V’ channel.
These changes are all small details, but the end result is much more realistic, as you can see in the photo below. The tank is the same length and width of the 15-6 tank. The height was a calculation based on the litre capacity of the 11CV tank.

Rear Axle and Brakes

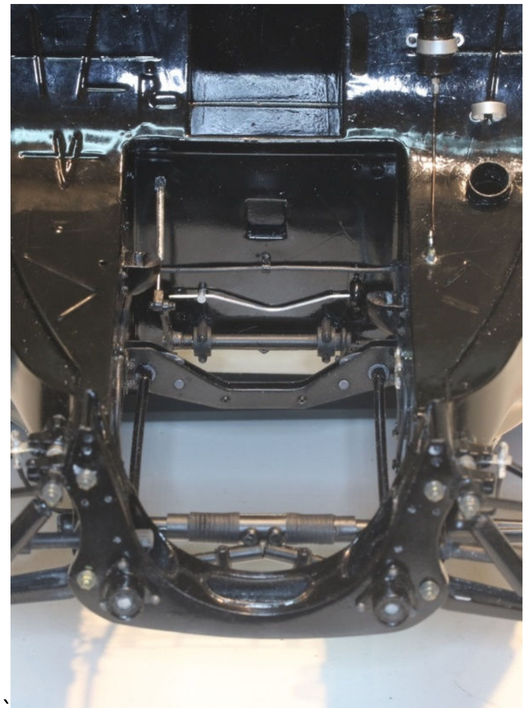
The picture above shows the installed rear axle. But before that was done, the handbrake linkage on the firewall needed to be added and cables run down the underside of the car.
The handbrake lever is mounted on the right-hand side of the engine bay. The supports for the handbrake cross tube are inboard of the levers, not outboard as on the Heller kit. The modifications was relatively straightforward.

From underneath



The silver ‘V’ rod next to the handbrake cross tube is part of the accelerator pedal linkage. A lever on the end of that tube, next to the handbrake lever, will connect to the carburetor.

Engine bay

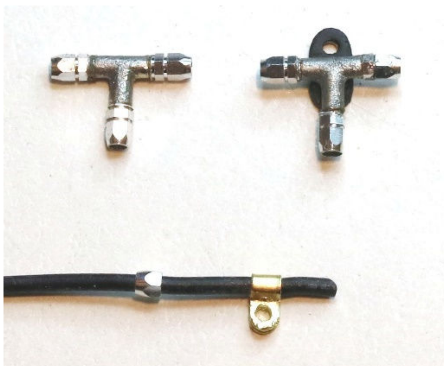


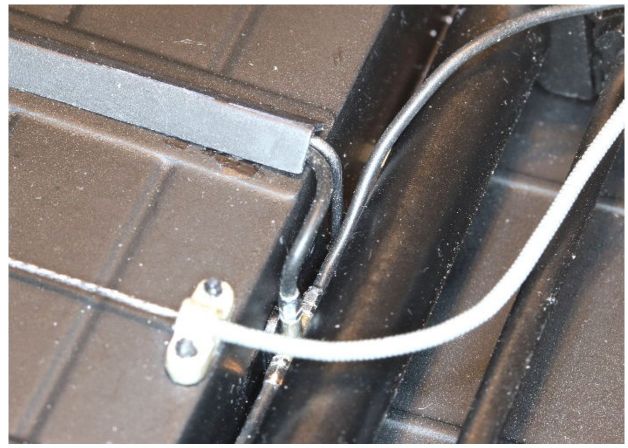
Handbrake Cables

The cables and cable sheaths in the Heller kit aren't very realistic. The typical prototype handbrake cable was 1/8" dia, or 0.4mm in 1:8 scale. So, I replaced the Heller rubber cables with 26Ga twisted wire (0.5mm) and made cable sheaths by tightly wrapping.26 Ga wire (0.43mm dis) around 0.025" piano wire. When the wire wrap was done, the piano wire was removed and replaced with 24 Ga wire. This kept the coils together and let the sheathed cable be bent easily into the shape required.
The sheaths terminate on the inside of the lower part of the rear brake hubs as shown below.
5/64" thin wall brass sleeves, glued into the back of the brake hubs, received the sheathed cables.

Hydraulic Hoses

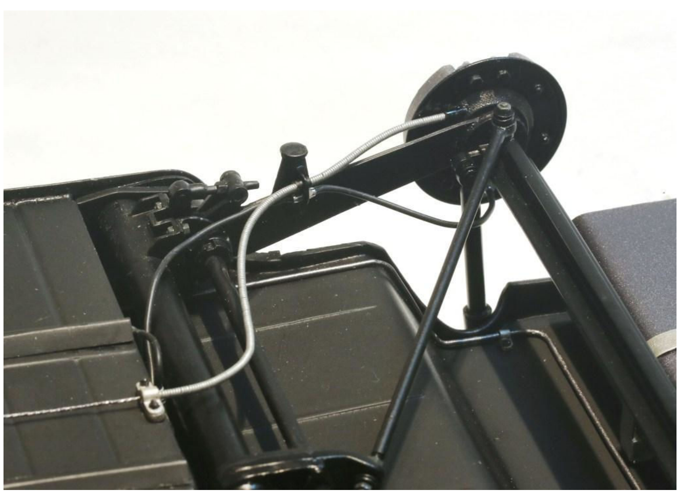
The last step before installing the rear axle was to install the 'T' piece for the hydraulic lines going to the rear brakes. Citroen spare parts catalogs show hydraulic lines of 4.5mm if solid tube, or 9mm if hose. The Heller rubber lines are much too thick at 1.7mm so I replaced them with 1.1mm OD electrical wire. This looked right and conveniently matches Detailmaster #4 pipe fittings. The clips holding the wire in place were made from 0.010" thick strip, 2mm wide, formed over a 1/16" dill bit and drilled out for 1mm hardware. 'T' pieces were made from1/16" thin wall tube sleeved with 3/64" thin wall tube. The Detailmaster #4 fittings fit over the 3/64" tubes.





Rear Axle Mounting

Mounting and gluing the rear axle assembly in place was then straightforward. But before mounting I had made small cutouts on the rear of the end plates so the plates would clear the wire for the LEDs. Also, the Heller cable support brackets on the trailing arms were cut off and replaced with new ones. The new ones were sleeved for the cable sheath and provided with pipe fittings for the hydraulic lines just as on the prototypes.

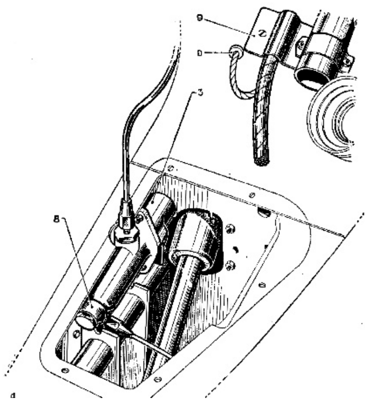


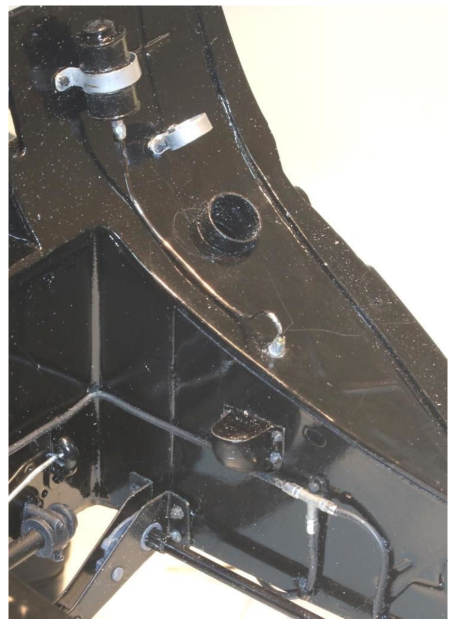
The last step was to add the rear shock absorbers. The pegs mounting the tops of the shock absorber to the body are weak and easily broken. They were replaced with 1-72 bolts.

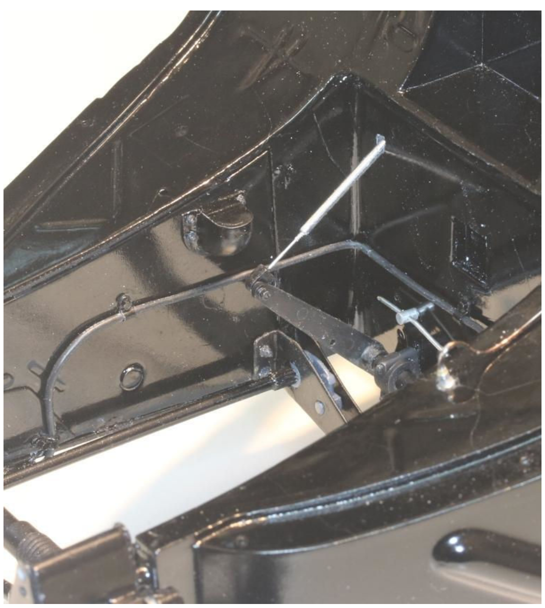
Front Brakes

Before mounting the front cradle, and the engine, any work on the inside of the engine bay needed to be completed. This included adding the hydraulic lines to and from the brake master cylinder.

In the 1936 11CV, the master cylinder was mounted on the left hand side of the engine bay under the scuttle. (Pic??) A feed line went from the hydraulic fuel reservoir, mounted on the firewall, to the master cylinder. The line from the master cylinder went through the engine bay wall into a 'T' piece. Two arms of the 'T' fed the two front brakes and the third fed the rear brakes. The lines to the front brakes ran around the walls of the engine bay to brackets mounted on the engine/gearbox cradle.





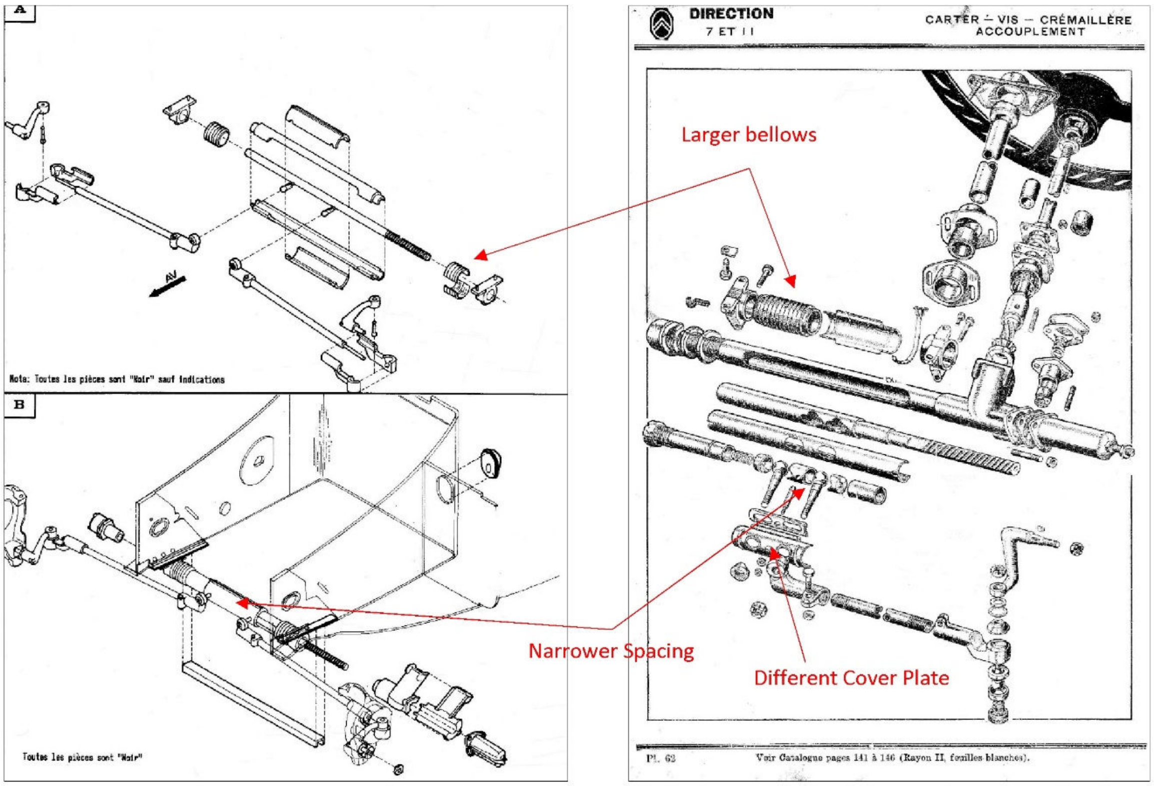


Steering Arrangement

As mentioned earlier, the 1936 11CV utilized rack and pinion steering. That was carried over, with some minor modifications, to the 15-Six. So, maybe I could use the Heller kit steering components on my model.

Following are the relevant drawings form the Heller kit shown against drawings from the Traction Avant 11CV Parts List (I've cleaned the drawings up for the sake of clarity) …

Heller 15-Six Kit | **Traction Avant 7CV & 11CV**



direction à crémaillère = rack & pinion

And here's the assembly after modifications to make it more consistent with the 11CV arrangement ….

The steering assembly has been glued in place but the cradle has yet to be bolted up to the body. The ends of the steering arms will be finished once the wheel are in place.
The silver bracket in the bottom right of the photo is the connector for the hydraulic line going to the front brake.

Roof Installation

With most of the underbody complete, the headliner installed and the fitting of the rear seats finalized, it was time to install the roof on the lower body. It was a pretty straightforward process and a matter of carefully aligning everything and carefully gluing the seams.

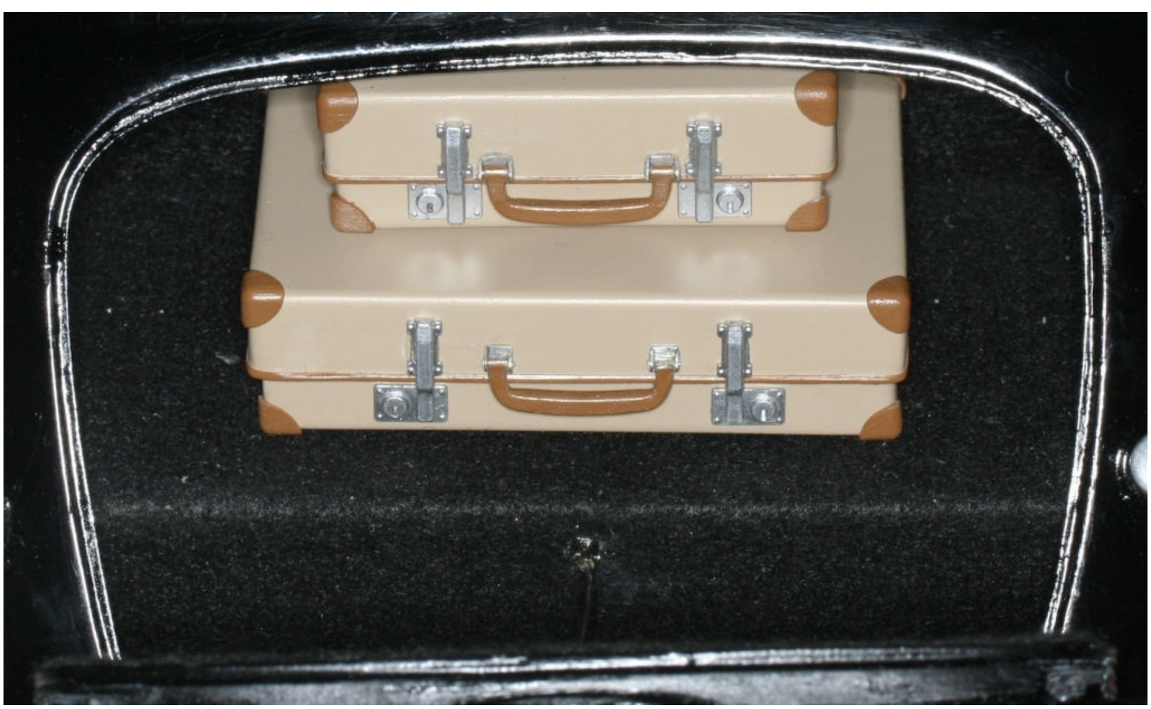
Once the roof was glued in place and the seams cleaned up, my plan was to completely mask off everything and spray on a couple of coats of Tamiya Black lacquer (TS-14) as a finishing coat. But I had painted the roof earlier and used a different 'lacquer' paint. That proved to be a big mistake because the Tamiya paint caused a slight, but noticeable crazing of the surface. Sanding and applying another coat of primer before repainting didn't work. The only solution was to literally sand off everything all the way down to the original primer. Ugh!
Finally, after several wasted hours, and days of delay, I was able to successfully repaint the roof and body with three coats of Tamiya TS-14.

My experience is just another reminder to test any paint combinations you use. That's especially true given all the reformulations that have taken place over the last ten or fifteen years as paint manufacturers have worked to comply with the tougher EPA regulations. Even the same paint isn't always the same paint!

Luggage

One side benefit was that during the time needed for the new coats of paint to dry on the body, I took the opportunity to make three pieces of 1930s luggage. Here they are:

They are based on 1930s expandable suitcases of the kind that might be owned by someone driving a Traction Avant. The shells were constructed from 0.030” styrene sheet. The corner protectors, hardware and handles were 3D printed. In 1:8 scale. The two smaller suitcases measure (mm); 76 x 53 x 21, and 60 x 35 x 20. They are designed to fit in the boot of the Traction Avant.



Now I could really focus on finishing the model.

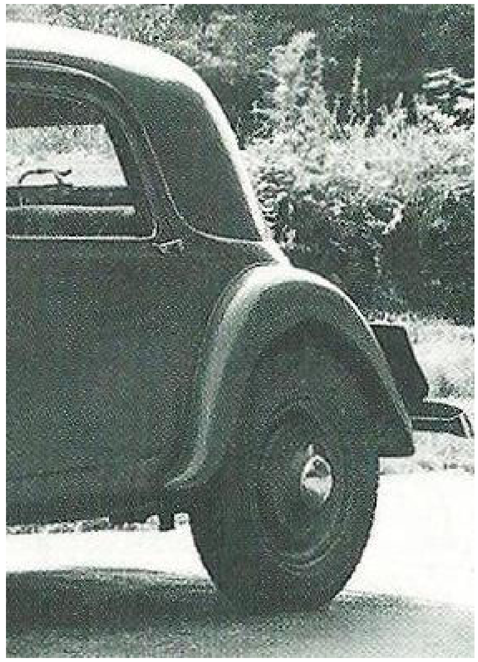
Rear Wings & Boot

The boot had already been lined with black felt.
To do that, I first made paper templates for the floor and sides of the boot. With those in hand it was then a simple process to cut out the felt and glue the pieces in place. Conveniently, the felt came with an adhesive backing. But double sided tape or adhesive sheet would have worked just as well.

The next step was to add the rear wings.
Unlike the 15-6, the rear wings of the 11A were a solid color. So, I pegged and glued the Heller chromed pieces to the leading edge of the wings and then milled and sanded them smooth before finishing with primer and paint.

The wings mate with the rear edge of the boot as well as the complex curvature of the body. That makes gluing the wings to the body fairly tricky. To help, I placed 0.5mm pegs into the sides of the rear boot edge as shown below. With the rear end of the wings accurately located by the pegs, it was much easier to ensure the rest of the wing mated properly with the body.

The last step of installing the wings was to add the bead on the interface between the wing and the body. You can see the bead in the prototype photo below and on the model photo on the prior page.
On the model, 30Ga insulated wire with an outside diameter of 0.7mm provide an effective bead.



Now the boot lid could be mounted and the working locks installed.
The boot hinges aren't easy to mount, especially if you want the lid to mate properly with the body. It takes care!
And the locks proved to be troublesome. Any kind of friction in the assembly and the soft plastic of the handle pins would twist and, eventually, break. So, in the end, I chose to make new pins from 1/16" brass tube soldered over 1/32" brass rod. The boot lid and lock arms were drilled out for the 1/16" tube. Then, when assembling the lock, the 1/16" tubes were glued into the lock arms. The lock handles were then drilled out for the 1/32" rod and the 1/32" rods glued into the handles. This proved to be a much more robust arrangement.

Rear Lights

With the wings in place the rear lights could be installed and the wiring hookups completed. Here's the rear of the car. On the left, the boot is open. On the right, the boot is closed and the brake light and two rear lights are on:

Front Window

The front window in the kit consists of four pieces; an outer chromed frame, acrylic ‘glass’, an intermediate chromed frame and a black inner frame. The outer and intermediate frames sandwich the glass and assembling and gluing them together was straightforward. However, aligning this assembly with the inner frame looked like it would be tricky as the sandwich would be on the outside of the window opening and the inner frame on the inside. So, I chose to use pegs to help with the alignment. Six 0.020” piano wire pegs were glued into the backside of intermediate chromed frame and these mated with holes in the inner black frame. The pegs protruded out about 2mm. Both a test assembly and the subsequent assembly on the model worked out very well.
Also visible in the photo is the front air vent for the interior of the car. The cover plate, which was adjustable from inside the car, has yet to be installed.

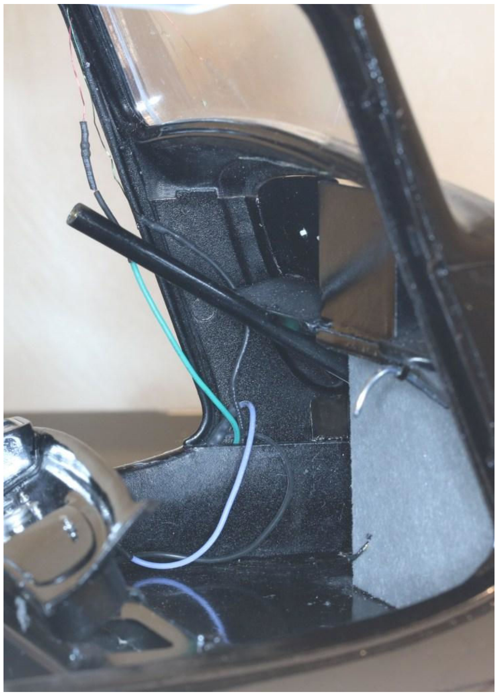
Front Headliner Panel

Above the window and in front of the headliner is a solid panel that carries the windscreen wiper motor and two sunshades. Installing it was straightforward. However, in the kit, the sunshades are held in place by plastic brackets. These brackets looked very clunky compared to the brackets on prototype vehicles so, before installing the panel, I replaced them with thinner brackets made from brass strip. It’s not a huge deal but it’s one more item that makes for a more realistic model.

The wire hanging down the inside of the left ‘A’ column is for the center reading light. Eventually it will be hidden inside the column.

Dashboard Installation

Before installing the dashboard, the side panels of footwell needed to be installed. The left side panel would hide the wires for the dashboard lights and also the interior light, as these two photos show:



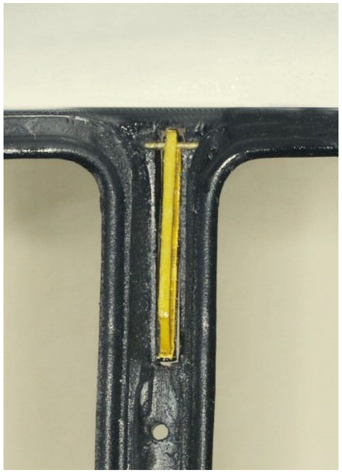
The floor and sides of the footwell will eventually be carpeted.
Installing the completed dashboard was then straightforward:

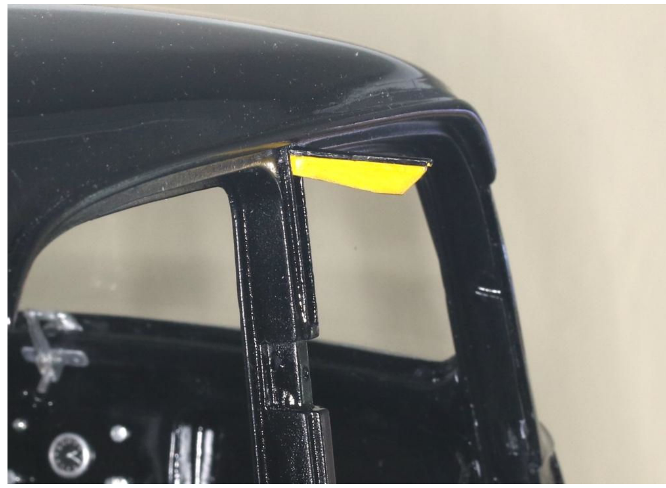
The last step was to add the front windscreen opener.
The opener in the kit is a poor approximation of the real thing, so a new one was fabricated in brass:

It looks very similar to the prototype:

Trafficators

As was noted previously, I had given up on the idea of using solenoid operated trafficators. But I still wanted to mount them in such a way that they could be pulled out manually. The simplest way to do this was to mill out slots inside the body (one on each side of the opening for each trafficator) that would take a horizontal peg going through the top of the trafficator. The left hand picture below shows the peg and the location of the slots.





It would have been cool if the trafficators not only worked (by solenoid) but also incorporated a miniature LED that turned on when the trafficator was deployed. Maybe next time!

Carpets

With most of the interior fittings in place, it now made sense to add the carpets. A light gray soft material from the local fabric store matched well with the seats and provided a plush, carpet-like appearance. I used tracing paper to make templates for the front, rear sections and side pieces. Double sided adhesive paper holds the carpet pieces in place.

With the rear and interior of the car now almost complete, attention could shift to the front.

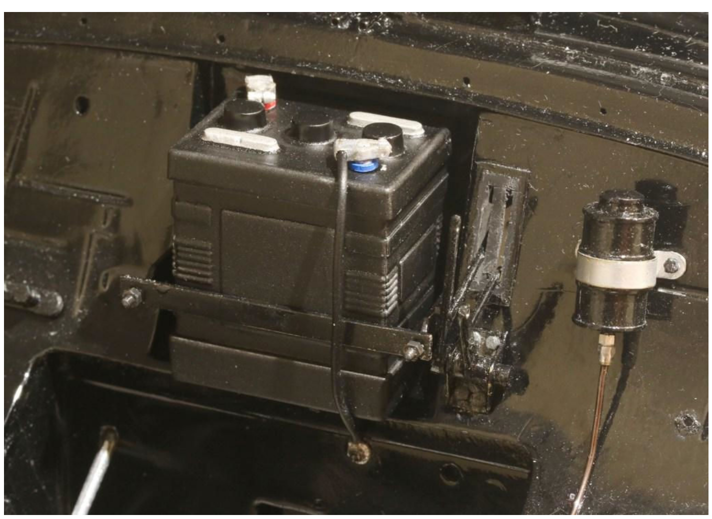
Electrical Connections - First Steps

The first step was to add the wiring to the starter motor and dynamo since these would be harder to access once the engine/gearbox was re-installed. A 1935/36 electrical diagram showed that the starter motor has one wire from the battery and another that goes through the firewall to the instrument cluster. The dynamo has connections to the instrument cluster and to the Commodo. For the battery connections, I used 1.1mm dia wire (consistent with 4AWG wire which is frequently used for cars) and for the ordinary electrical connections 0.5mm wire.

For the ordinary electrical wiring I made very small connectors as shown below. The connector comprises a piece of 1mm thin wall tube (0.5mm ID), flattened at one end and that end drilled out with a #66 drill (0.84mm). The tube takes the 0.5mm wire I used for the electrical wiring. The nut and stud are 0.8mm. The ones you see here were 3D printed in acrylic which, for me, was a less expensive way than buying brass hardware.

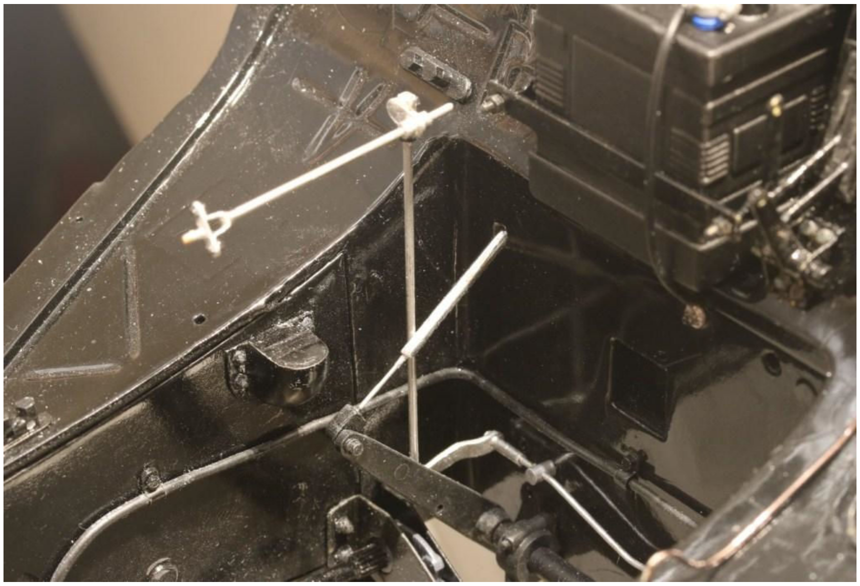
Here you can see these connectors on the dynamo:

At this point it also made sense to install the battery and ground cable since the ground cable is fastened to the firewall below the battery.



Accelerator Linkage

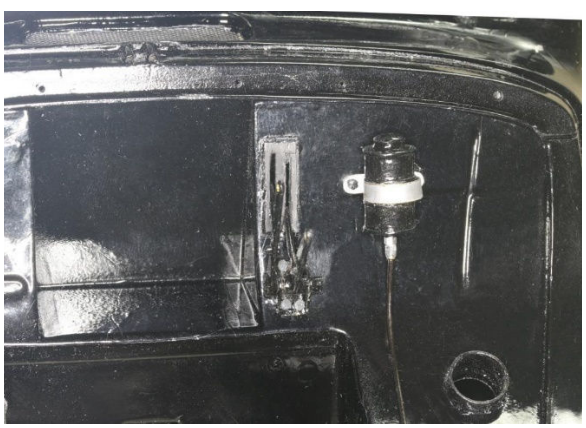
Most of the accelerator linkage lies behind the engine or in the corner of the engine bay. Finishing that was a necessary step before installing the engine.

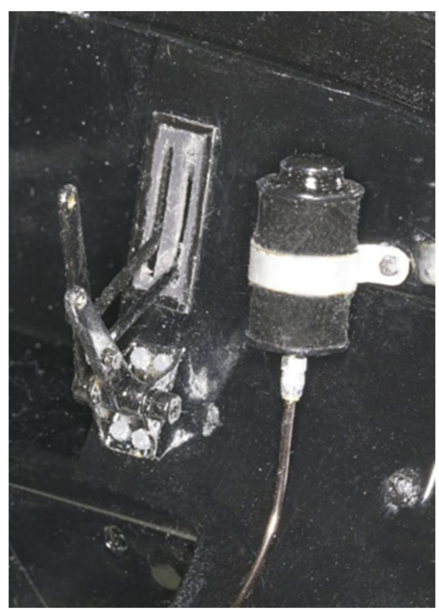


Now the engine/gearbox could be re-installed.

Gearshift Linkages

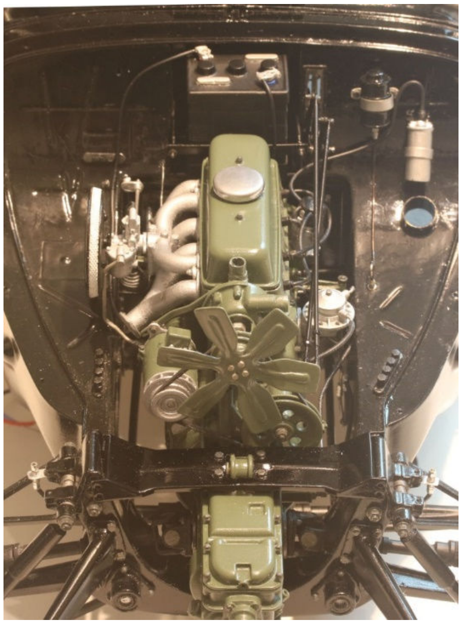
With the engine/gearbox in place, the gearshift linkages could be completed.
The gearshift lever arrangement on the firewall is somewhat different from the 15-6, so a new arrangement was scratch built starting with the levers on the firewall:

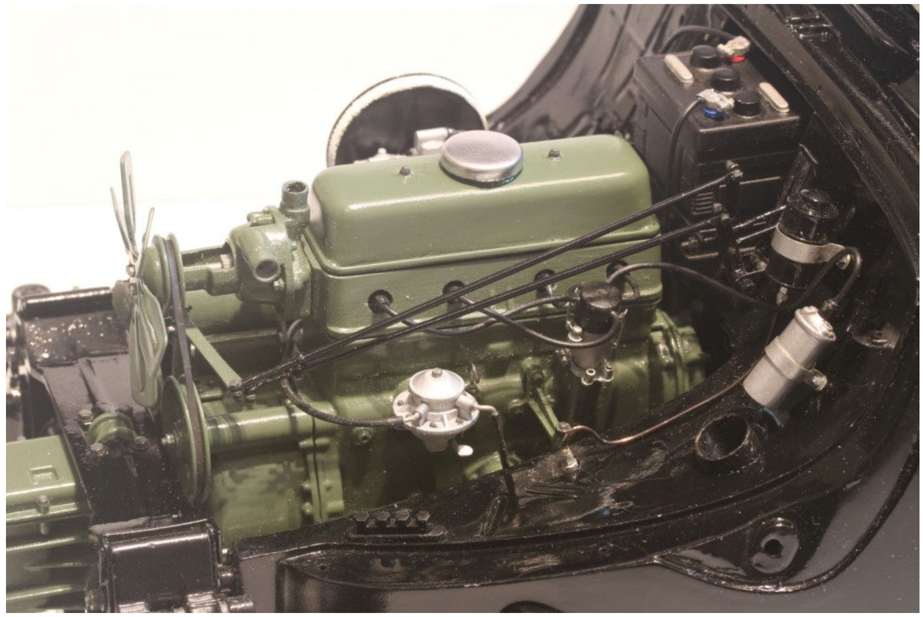




The rubber gasket is cut from shrink tubing. A thin styrene frame, painted black is overlaid on top.

The gearshift rods are made from 3/64” thin wall brass tube sleeved over a short piece of 1/32” thin wall tube. This allowed the length of the rod assembly to be adjusted during installation. The ends of the rods are flattened out and drilled out with a #66 drill to take 0.8mm bolts.

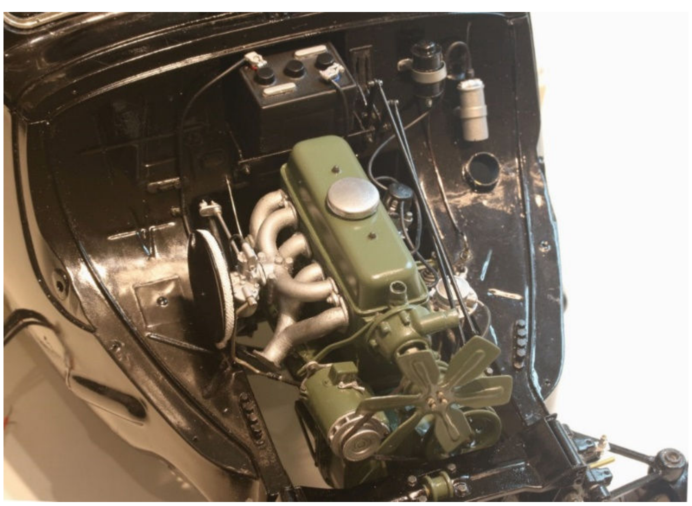


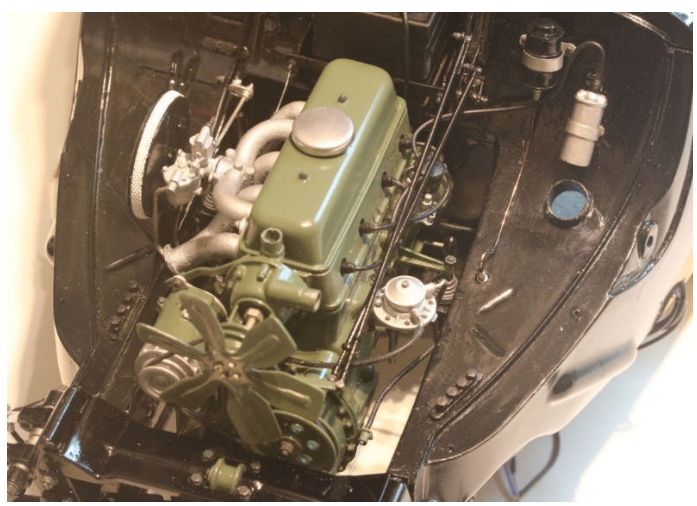


Clutch Cable

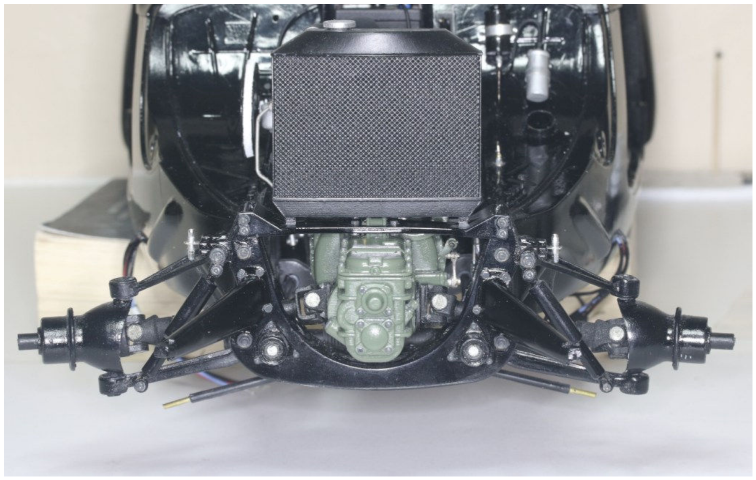
Note the pancake “Camembert” air cleaner and, just to its right, the fuel line from the fuel filter. Note also the wiring connectors on the dynamo. The wiring has yet to be installed.
In the photo above right, and just to the right of the fuel filter is the oil dipstick. The distributor is typical for a 1936 Traction Avant. In all four photos the coil is visible and the completed ignition wiring.

In the right hand photo below, and just below the fuel filter, you can see the clutch cable. It’s another detail that lends authenticity to the model.



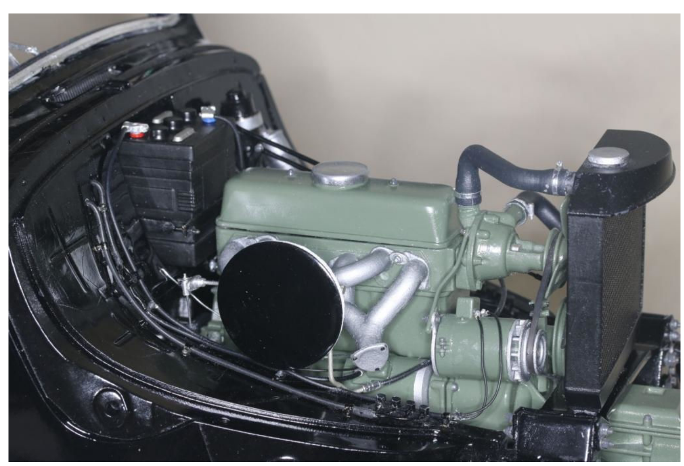


Here are details of the front suspension and drive train:



More Wiring

And, below, photos with wiring installed for the coil, dynamo, starter motor, and to the terminal blocks for the front lights and horns. For individual wires I used 0.45mm OD soft black wire. For wiring harnesses, (i.e. containing multiple wires), I used 1.2mm OD electrical wire from which I stripped the wire core. With care I could glue up to four individual wires into the ends of the harness and have it all look very realistic.

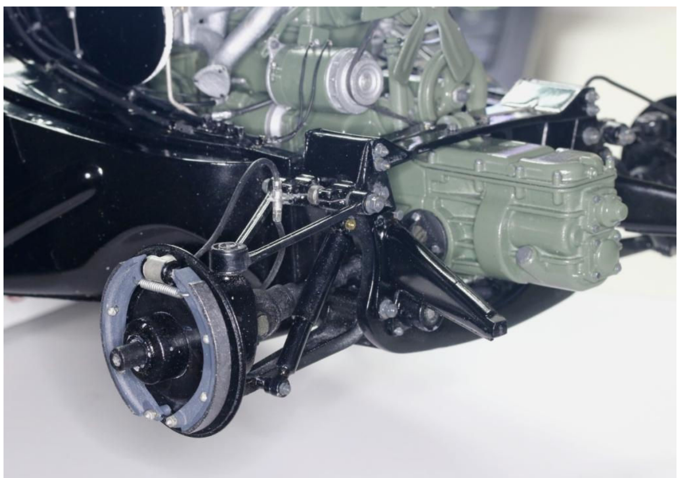


Exhaust System Installation Check

Before adding the front wings and grill, I decided to check out the exhaust system and its installation. There were a couple of reasons for doing that. First, to install the exhaust system, the car was going to have to be turned on its side, or upside down, and the risk of damage to the wings and grill was very real. Second, the car, without its wheels, had been resting on a book that supported the car underneath the B pillars. Once the exhaust system was in place, I would need another way to support the car. Rather than struggle with that, I chose to test fit all the pieces now but hold off installing them unto the car was almost finished.

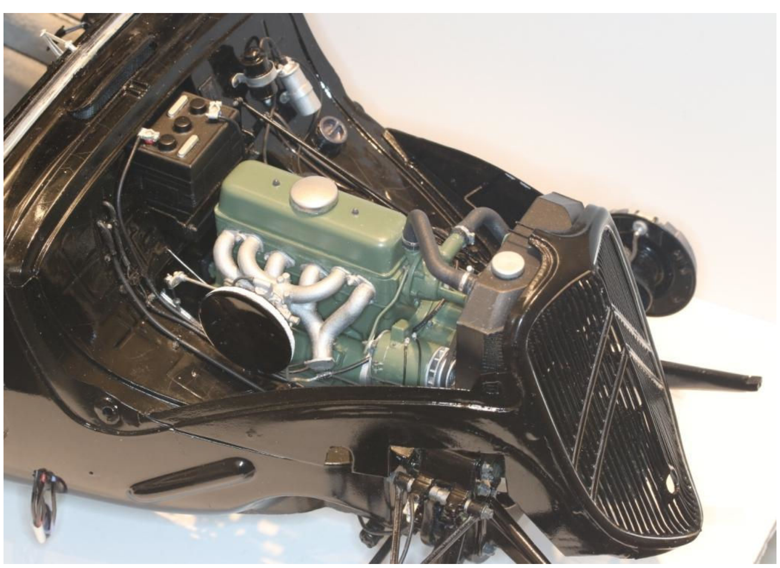
Front Brake Hydraulic Lines

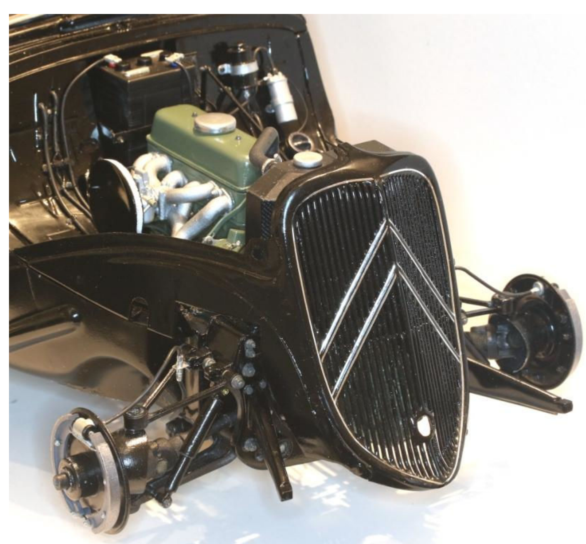
There was one last step before I turned my attention to adding the grill and wings. That was to install the front brake assemblies and hook up the hydraulic lines.
The backing plates are a push fit over the hubs and were then simply glued in place. The hydraulic lines are 1.1mm OD electrical wire and are a push fit into the Detailmaster #4 pipe fittings. A dab of gap-filling superglue holds them in place.



Grille

The front grill assembly was made to be simply bolted in place. I used 00-90 bolts because, although they are oversize, the grill takes all the load for the front of the bonnet and I wanted it to stay firmly in place.





Horns

One of the subtle differences between the 1936 11A and the 1952 15-Six is the location of the horns. In the 15-Six Heller kit, the horns are mounted on the front bumper and, given their prominence, are chrome plated. However, on very early Traction Avants, the horns were mounted behind the front grille. By 1936 the horns had been moved behind small grilles cut into the front wings and the horns were mounted on the bumper support brackets as shown below. Since the horns were effectively hidden, they were painted black. There was no need of expensive chrome plating.

Bonnet & Wings

With the grille in place the two halves of the bonnet were test installed and minor fitting adjustments made.

Then, with the horns mounted and with the bonnet sorted, the front wings could be bolted into place.

There is a hole in each wing just in front of each horn. Each hole is covered by a small circular grille.

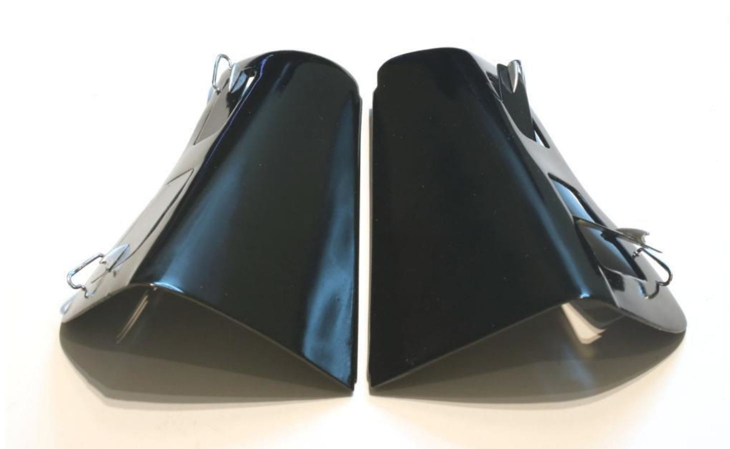
The grilles were simply pressed into place.

Following that, the headlight assemblies were installed and aligned. Wiring up the headlights, with their incorporated sidelights, was straightforward.

Note: In the photo above, the windscreen has still to be installed.

Just visible, in the top left-hand corner of the rear window, is the edge of the instrument panel lights.

This photo shows some of the bonnet detail with the operable vent doors and handles installed:

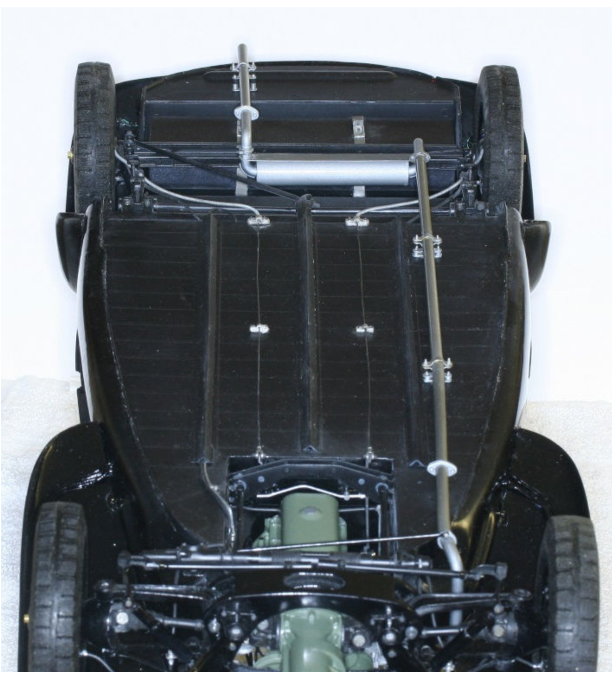


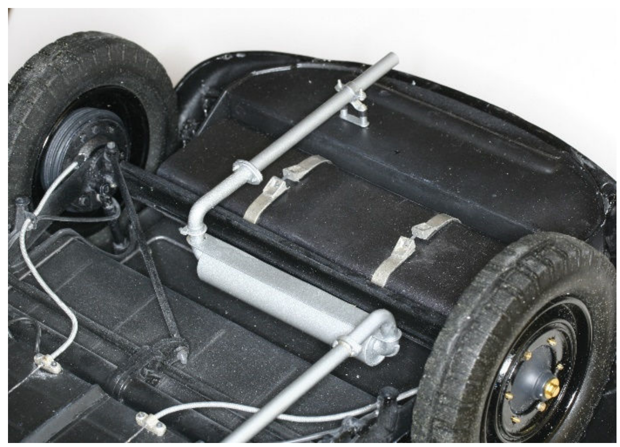
Before the bonnet was finally installed, the car was turned upside down to install the exhaust system.

Exhaust System Installation

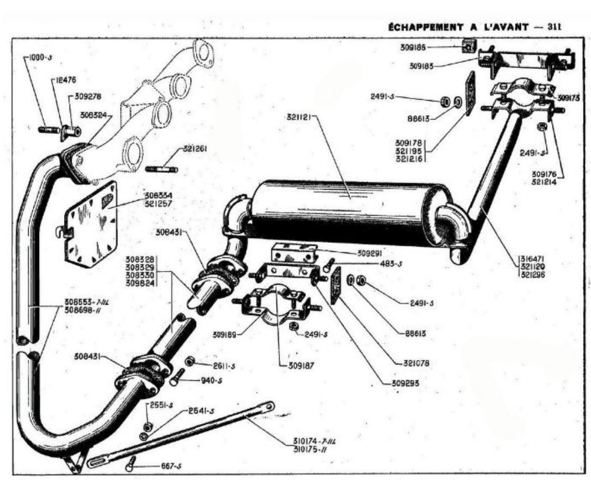
Most of the pieces had already been made so it was a straightforward assembly process, although the rear exhaust support was increased in height to level the rear pipe.

These are views of the complete arrangement;





As you can see in the photos above, a cross brace steadies the front of the exhaust pipe. This is consistent with prototypes as shown in this following picture and schematic;



Bonnet Installation

Like the exhaust system, all the bonnet pieces had already been completed, so final installation of the bonnet was relatively straightforward:

The windscreen and the emblem on top of the grill have yet to be installed.

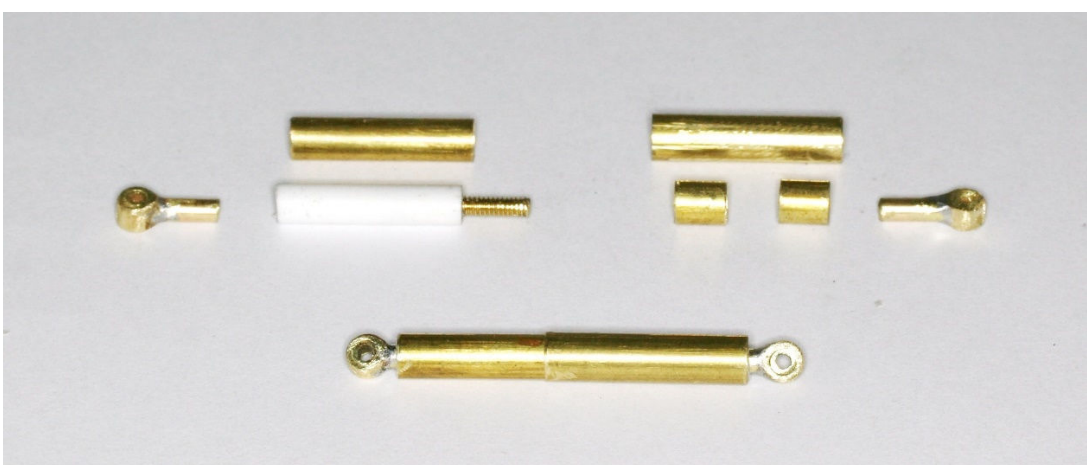
Open vents!

The Heller bonnet stays have been replaced by new, more realistic ones fabricated from brass.

Suspension Failure!

So far, all had been going well. Then one of the perils of large scale model making appeared. The front suspension collapsed. Or, more precisely, the bottom shock absorber mountings failed when I applied a modest load.
The front suspension of the model was designed to work like the independent suspension of the prototype. Unfortunately, the way I had built the model meant that the torsion bars weren't terribly effective and so much of the weight of the model was carried through the front shock absorbers. Although the suspension worked, it clearly wasn't robust enough and, even if fixed, the prospect was for another failure in the future. I needed a fix which would not only better distribute the load but also let me make a final adjustment to the ride height. New parts were ordered.

Even with the new parts in hand, it was pretty obvious that I wouldn't be able to get the torsion bars to take the load on the front suspension. But I would be able to 'lockup' the suspension at an appropriate ride height. On my model, a splined rod fits through the inner end of the lower suspension arm and is anchored by splined bosses that attach to the engine/gearbox cradle. By gluing the splined rod through the suspension arm, I could rotate the arm to the desired position, fit the outer splined boss over the rod and, then, by gluing the boss to the cradle, 'set' that position.
Also, to provide more help with the load, I decided not to use the old shock absorber design but instead make new ones that would be much more robust and also adjustable. The top and bottom halves of the shock absorbers would be connected by a long screw so that the length of the shock absorber could be adjusted by up to 5mm.
The overall construction of the shocks is shown below. The design is suitable for any large scale model.

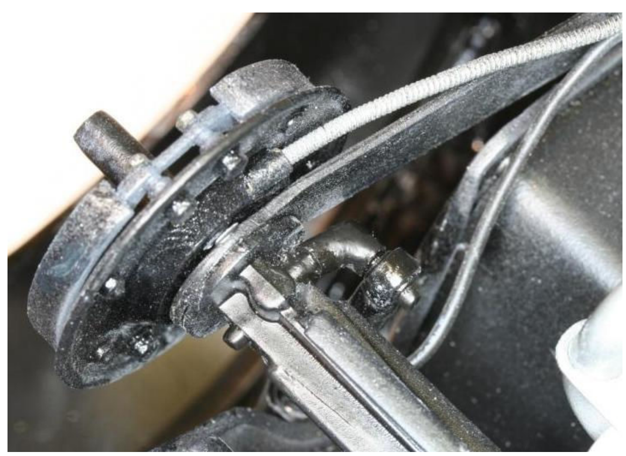


The top and bottom halves consist of a 3/16” OD and 11/64” OD thin wall brass tubes respectively. The bottom half was sleeved with 5/32” OD and 3/32” OD styrene tubes. The top end of the 3/32” tube is tapped for a 2-56 stud and the bottom end takes the 3/64” rod that is part of the anchor. Likewise, the anchor for the upper half fits into a 5mm long section of 3/32” OD styrene tube. That tube is over-sleeved with a 5/32” OD styrene tube and a 11/64” OD thin wall brass tube. The 2-56 stud screws into a 2-56 nut soldered inside a 5mm long section of 5/32” OD brass tube plus an 11/64” OD thin wall over-sleeve. This short section with the nut was glued 6mm into the upper half. This way, there would be a 1mm overlap of the top and bottom halves and the lower half could be screwed in by 5mm.

For the anchors, a 5/64” hole was drilled in the side of a 5/32” OD brass tube and also a 1/8” OD brass tube. The holes were lined up and a 6mm long 5/64” brass rod soldered into the hole. The assembly was then cut down to 2.5mm wide, the center hole cleaned out and a 2.5mm long 3/32” OD sleeve inserted and glued in place. This sleeve takes the 00-90 bolt that fastens the shock absorber in place. During final assembly, by simply undoing the bolt that holds the lower anchor in place, the lower half of the shock absorber could be turned and its length adjusted.

The picture opposite shows the test installation of new suspension arms and shock absorbers. It’s not obvious from this picture, but the ride height looks like it will be fine. So far, so good.

Given the issue with the front mountings, I decided to test the rear shock absorber mountings too. Uh, oh!
With only modest downward pressure one of the rear mountings failed, shearing off next to the rear axle. Because of the softness of the rear suspension, I was using the shock absorbers to set the rear ride height and had turned them into struts! So the shock absorbers were taking all the weight. Simply gluing the broken part back in place wouldn’t work because the joint would be weaker than it was before. So, I decided to fabricate new mountings using 2.0mm (5/64”) brass rod. The 2mm rod would fit into the 2.0mm diameter mounting hole in the bottom of the shock absorber.
As you can see in the photos below, the brass rod was bent into an ‘L’ shape and then sleeved with small pieces of styrene tube to simulate the boss. It was then inserted into a 5/64” hole which had been drilled through the middle of the rear axle and glued in place with gap-filling superglue. The end of the shock absorber then fit over the end of the rod, as shown. Because it’s a brass rod and goes through the core of the axle, the mounting is much stronger than the cantilevered plastic boss it replaced. Problem solved!



Note On Large Scale Plastic Models

Based on this experience, earlier struggles with Rolls-Royce Pocher kits, and my own scratch-built Austin 7, it's pretty clear that suspensions (and steering assembles for that matter) are a weak point in large scale plastic car models. So, if you're going to build a working suspension (and steering), and not simply lock everything together, it's worth figuring out how to strengthen attachment points, springs, and other weight and stress bearing components.
My suggestions:

- Critically examine all suspension points and components.
  In particular, note any that have thin cross-sections and/or could be easily bent.
- Wherever possible, replace critical plastic parts with brass parts or reinforce them with brass inserts.
  Where you can, use the strength of brass to keep parts to accurate scale dimensions.
- As early as possible, test the suspension arrangement, especially in dynamic mode. Simulate the weight of the completed car. Look for any parts that seem to be flexing.
- Make sure the suspension returns easily to its nominal position and that nothing is binding.
  Take into account the fact that parts will be painted!
- Be mindful of ride height. Think about how it can be set correctly and/or adjusted.

Door Installation

Next up were the door installations.
The first step was to fine tune the fit of the inner doors and verify that the door latches worked properly.
These two pictures show the doors in place, the hinges bolted to the B pillar and the latches in place.

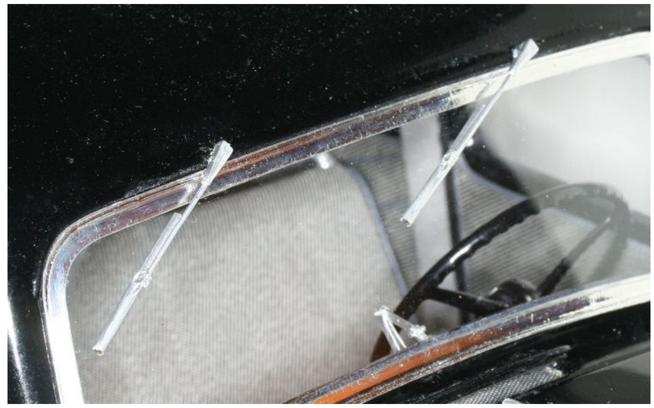
With the fit of the doors confirmed, the windows and then the outer door panels could be installed. When the outer door panels are in place, the washer you see on the latch post will be positioned on, and then glued to, the post to make sure the latch can't be pulled out of its socket.
However, before installing the outer panels, the inner door panels were installed. The first step was to check for fit, in particular making sure the panels wouldn't interfere with the closing and latching of the doors. The easiest way to do that was to make a pencil line on the back of the door using the edge of the door opening to mark the limit for each panel. Then, small pieces of double-sided tape were used to position the panels. As it turned out, two of the panels had to be reworked. When all fit correctly, the panels were glued to the doors.

Once the windows were in and working correctly, the outer door panels were lightly glued in place, making sure they fit flush against the body. Here, the solid latches really helped to get a smooth fit between the doors and the body. Afterwards gap-filling super glue was applied along the seams to make a solid door assembly.

Now the overall appearance is coming into focus, even though there are still a few key steps to complete such as adding door hardware and installing the windscreen, wipers, steering wheel, bumpers and hubcaps.

Windscreen & Wipers

The Heller wipers were very fragile so the wiper blades and arms were rebuilt. New blades were made by cutting the wall of a thin wall tube and inserting a slice of rubber into the slot. Short, wide slots were then cut into the middle of the blades for the ends of the arms. The thin plastic arms were replaced by 1/32” rod. Installation of the wipers and outer windscreen was straightforward.



Steering Wheel

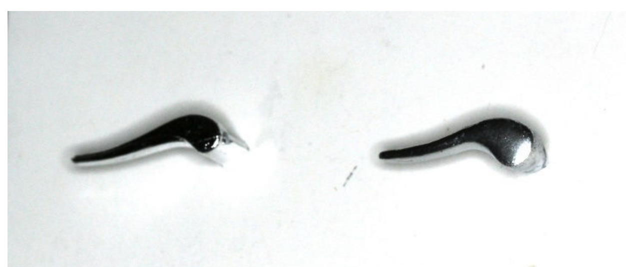
In 1936, the steering wheel had three spokes, not two as in the kit. The center boss was also different. So, a new three-spoke wheel was 3D printed. The new one is on the left.

The steering wheel was a simple push fit over the end of the steering column.

Exterior Door Handles

The door latches had 1/16” brass posts. That meant the door handles from the kit needed to be drilled out slightly to take the posts. This weakened the already weak plastic handles. Since the doors were a tight fit, the plastic door handles were likely to break, so I chose to replace them with scratch built brass handles. The handles were constructed from 2.5mm wide .065” thick brass strips formed into an ‘S’ shape, then soldered to a 2.5mm long piece of 1/8” brass tube. A 5mm long section of 3/32” brass tube sleeved into the 1/8” tube. Once the handles had been shaped, the 3/32” tube was slid over the posts and glued in place.

The new handle is on the right:



Bumpers

The last major step was to add the bumpers. The 1936 bumpers were similar to those in the kit, but without the over-riders. I also wanted the curved pieces at the end to be part of the outer section of the bumper as they are on prototypes, and not part of inner section as they are in the kit. So, some rebuilding and repainting was required.

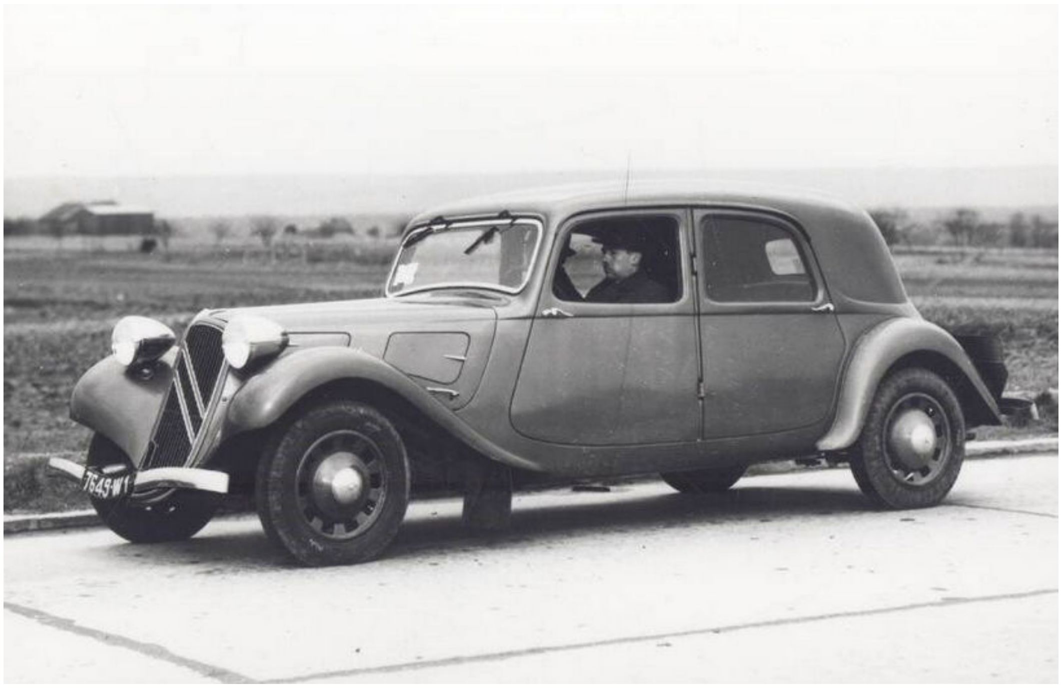
But once that was taken care of, the model was finished.

Finished Model

The project took a lot more work than I originally anticipated. But I think the results were worth it.

’36 11A Model

’38 11B … with Pilote wheels and tires

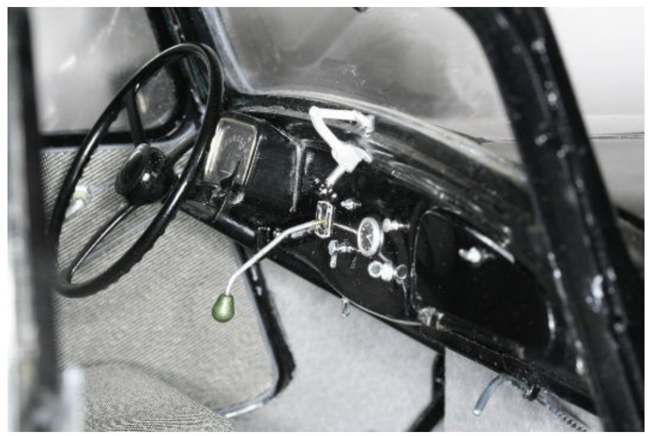



36-11-TA


36-11-TA


36-11-TA



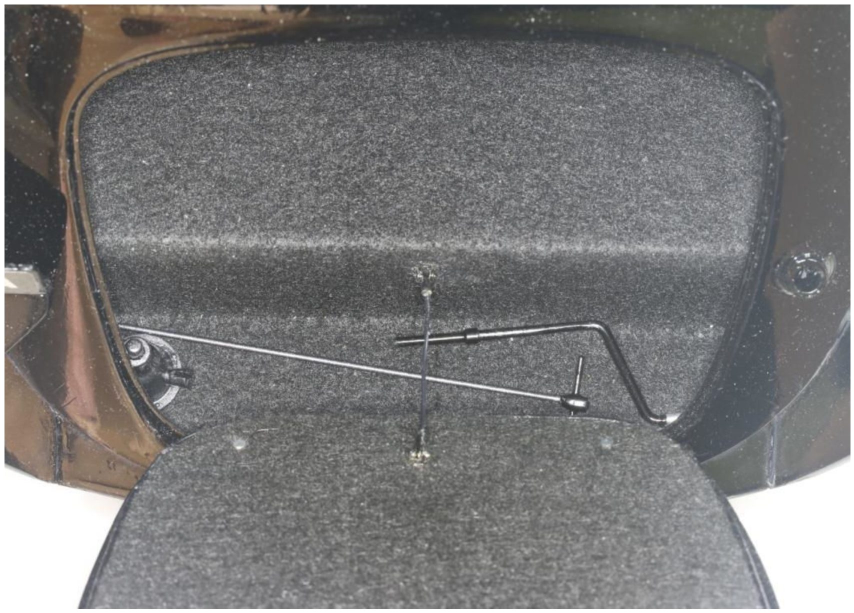



36-11-TA

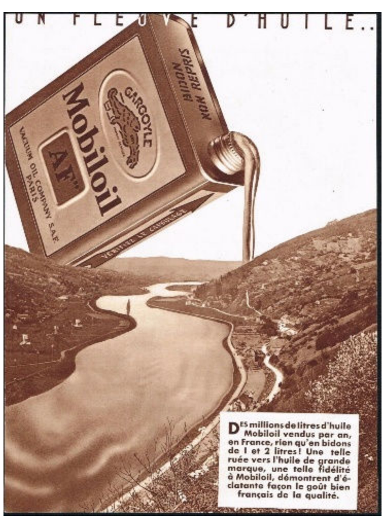

Little Details

One of the things that can help make a model interesting are little details.
Below are some that are relevant to this particular model.

The kit included a jack and a starting handle. A neat touch.
Most photos of prototypes show them simply lying in the boot of the car, like this;

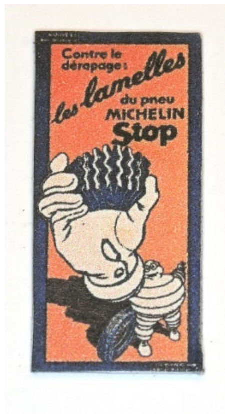


Another little detail … the oil can that sits in the engine compartment!
The oil can was included in the Heller kit, but the appropriate 1930s decals were not. So, here's my version:

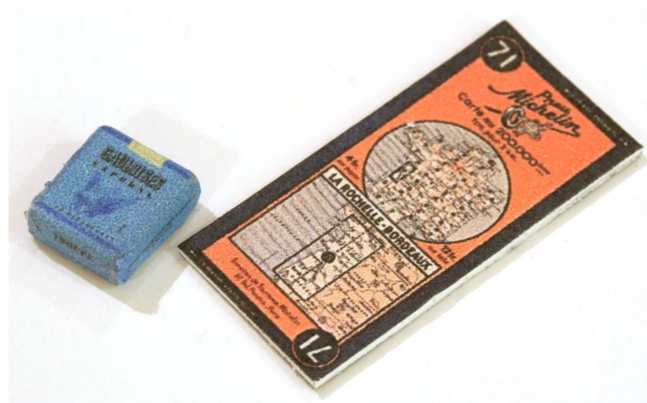


Mobiloil's "AF" oil was equivalent to SAE 40W.
Also available were a heavier "BB" oil and an "ARC" oil (SAE 20W) for winter conditions.

With no GPS, a Michelin road map would show the way to go. This mid-1930s road map is the kind that would be lying on the front seat! The maps were approximately 4 – 5mm thick, so the decals were glued onto 0.020” styrene sheet.



And you noticed the cigarette package?
In 1936, smoking was normal. More than two-thirds of French men smoked. So, what better than to have a pack of the distinctively strong Gauloises cigarettes in the car! In 1:8 scale the pack is just 8.5 x 9 x 3 mm.



Final Thoughts

Constructing the model was very enjoyable, even if it took significantly longer than anticipated.
These models seem to have a timing all of their own and I’ve learned that forcing the pace invariably brings errors and omissions. So, the time becomes what it wants to be!

I’m still amazed how far ahead of other manufacturers Citroen was when it launched the Traction Avant. Even more so as I’ve become intimately familiar with the elements of the design. That the Traction Avant had a war-interrupted run of over 20 years is a testament to how good a design it was.

The transformation of automobile design in the 1930s was remarkable. The Traction Avant was a major contributor.

I hope you enjoyed reading about the journey.

John Haddock

Spring 2020