THE MECCANO MOTOR CHASSIS PART 5 THE 1933 ALVIS FRONT WHEEL DRIVE

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Figure 1 The Meccano model as shown in MM 1933 p782

Following the successful Meccano supermodel chassis's SML1 and SML1A of 1928 and 1931 a further chassis design appeared in the MM in October 1933. This was described as "a motor car fitted with an Alvis type front wheel drive ... fitted with a very compact three speed and reverse gearbox, a neat single plate clutch and internal expanding brakes on all four wheels". The prototype for the model may well have been the 1928 Alvis front wheel drive sports car (long wheel base version shown below). As the forward to the Alvis brochure states this was a revolutionary car design for not only was propulsion through the front wheels but the design of the chassis with vertical independent springing to all four wheels, and the features of the engine are all quite unconventional.

Although the Meccano model represented most of the basic features of the prototype in comparison with SML1A it is less convincing in design and fails to capture the spirit of the actual car in the way that the SML1A did of the Bentley silent sports saloon. A comparison of the Meccano chassis shown in the MM and the prototype immediately shows the crude modeling of the chassis shape. *(see figures 3 to 4 below)*. The gearbox is both cumbersome and incorrect as the Alvis had a four speed and reverse gearbox. The FWD is reasonably well modeled but the universal couplings proposed by the MM design do not provide sufficient flexibility to give a smooth drive steering lock to steering lock. The front suspension is extremely sloppy in the MM model, however the rear suspension and modeling of the rear brakes make effective use of Meccano parts to demonstrate the principles of the design. In redesigning the model the information on the Alvis FWD internet site (www.hells-confetti.com) was found very helpful.



Figure 2: 1929 Alvis front wheel drive sports tourer

The successful use of front wheel drive for racing in USA, led Alvis to produce, in 1928, road cars using this system, the first manufacturer of any size to do so. This was an incredibly courageous move because the technology involved was radical and difficult. Technically, the Alvis FWD is extremely interesting, featuring a gear driven overhead camshaft, inboard front brakes and all-independent suspension in addition to the front wheel drive. The 1482 cc four cylinder engine was turned back-to-front to drive through a clutch and 4 speed gearbox, in front of the engine, to a differential and substantial nonconstant velocity joints. These latter resulted in some "fight" at the steering wheel when cornering. A conventional right hand gear change lever was used, in contrast to many other fwd cars where the gear lever migrated to the dashboard. Front suspension was by four transverse quarter elliptic springs on each side, whilst at the rear single longitudinal reversed quarter elliptics operated in conjunction with rear-hung radius arms. Many cars were fitted with superchargers; this instrument increased power from 50 bhp to 75. Two chassis lengths, 8'6" and 10', were available, for two or four seater open coachwork, although some saloons were also made. The short chassis types were denoted FA and FD, the long ones FB and FE. FC referred to a few special racing versions with fixed cylinder heads.

There are some 35 survivors out of a total production of about 150 front-wheel-drive cars produced from 1928 to 1931. Two cars ran at Le Mans in 1928 and came 6th and 9th overall, a very fine achievement. Maintenance is relatively complicated and the cars were rather noisy, complex and required owners to learn different driving techniques from those then regarded as normal.



Figure 3 The Alvis front wheel drive rolling chassis

In addition to FWD the Alvis also incorporated some unconventional design features. The petrol tank was carried between the dashboard and the engine bulkhead, and as can be seen in figure 3, the filler is perilously close to the engine. The overhead camshaft is gear driven rather than by chain. The magneto is carried in a horizontal position forward of the engine. Radiator cooling is not assisted by a fan and the silencer is an expansion chamber formed by bifurcation in the exhaust tube.



Figure 4: The Alvis FWD chassis from above

In building the model I have attempted to improve on the un-prototypical features of the MM model. The chassis has been remodeled to better represent the Alvis. The gearbox is the revised 4 speed and reverse used in my SML1A which is more compact and functional than the MM 3speed box. Although this is carried forward of the drive it has not been found possible to fully replicate the layout of the Alvis with clutch-gearbox forward of the engine. The front wheel drive arrangements and suspension have been remodeled to give a more prototypical representation. Only the principal revised features of the model are described.

The Chassis



Figure 5: The remodeled Alvis FWD Meccano chassis(engine and petrol tank removed)



Figure 6 : Revised model of the Alvis FWD chassis underside (note steering, in this view the gear change is behind the engine and gearbox)

The construction of the chassis is straight-forward. A box girder is formed from angle girders and flat girders with cross bracing as shown above using $4\frac{1}{2}$ inch girders at the front and 6 inch compound girders at the rear. The steering rods are shown clearly above.



Front wheel drive and suspension:

Figure 7: front suspension

The front springs consist of a $2x2\frac{1}{2}$, 2, and $1\frac{1}{2}$, inch narrow strips. Double arm cranks forming the wheel bearings are bolted to $1\frac{1}{2}$ double angle strips and at the lower end carry a collar which forms a bearing for the king pin. The DAS is pivoted between two

early ³/₄ inch double brackets. The king pin, a short length of rod, is held secure in a crank and the collar. The double brackets are secured to the springs by collars and a 1 ¹/₂ inch strip links upper and lower springs. Two universal joints transmit the drive to the front wheels. The outer is the standard Meccano part 140, for the inner one small fork piece is replaced by two angle brackets fixed together by a threaded pin. The differential unit is the standard meccano differential without a cage



which is too bulky for the space available.

Figure 8 wheel bearing and steering

The Braking system

The rear brakes follow the design of the 1933 MM model; the Bowden cable brakes use spring cord as a sheath, the caliper is operated by the hand brake which pulls the 2 inch strips closer to the pulley thus forcing them apart causing collars in the end holes to bind on the rim of a wheel flange.(see figure 9 opposite)



The front brakes are carried inboard on the prototype, ie between the differential and the constant velocity joints. The redesigned suspension and use of two universal joints to ensure better drive through the steering range necessitates a rethink of the design of the front braking system used in the MM model; the MM brakes being too wide to fit the available space. A number of attempts were made to achieve a prototypical brake with



the flanged wheel but figure 10 shows a design which just about fits but uses the early large contrate as the brake drum instead.(*note: an earlier version is shown in figs* 6 & 12) A rubber collar is cut in half and placed over bolt heads for brake shoes. These bolts also secure the ends of a small piece of spring cord. The brake is operated by moving the block of six fish plates forcing the pawls apart. The redesign of the front axle and brakes requires a modification to the UJs replacing two of the small fork pieces (pn116a) by angle brackets as shown in figure 12.

Figure 10: redesigned front brake

The brake back plate is bolted to a second wheel disc using the $\frac{1}{2}$ inch long bolts which carry the pawls, these bolts also secure the wheel discs to the frame holding the front

wheel differential gear. Thin washers are used the ensure the differential does not move between the frames.

Figure 11: re-designed inboard front brake and differential unit



Gear box and clutch:

Although the gearbox and clutch cannot be carried forward of the engine the drive is arranged as in the prototype. In effect the normal drive through clutch and gearbox to differential is turned around ie drive is from left to right in figure 12. In the model a chain drive is used from a mains motor beneath a mounting board.



Figure 12 : clutch, gear box and fwd(note inboard brakes and gear change)

A right hand 4 speed and reverse gear change follows the standard H gate. The gear change replicates the unusual ALVIS dog and pin striking gear design shown below(figure 13). In the model a small fork piece engages gear change activators as the gear lever is moved through the H gate. A pivot mounted in a bent strip (pn102) carries a loose collar between the "strips" and a coupling beneath, fixed in its centre hole. The low gear change is controlled through movement of the upper collar which is extended to carry a screwed coupling and a collar. This latter is engaged by the small fork (shown in figure 12) linked to the gear change lever. The collar is connected by a ³/₄" bolt to another collar connected to a small fork piece (pn116a) which carries a collar fixed to the layshaft between its fork. As the gear lever is moved the pivot arm moves forward and back causing the layshaft to slide. For the high gear change the coupling(beneath the bent strip) is rigidly connected to a small fork fashioned from a 3 hole narrow strip. This traps a collar fixed to the layshaft. The coupling is extended by a large fork piece (pn116) to form the dog.



Figure 13: gear change mechanism





Two views of the completed model with gear change forward of the engine

This article appeared in the Runnymede Mecccano Guild magazine in February 2009. For more information on Meccano goto www.meccanoscene.co.uk. (The original diagrams and photos of the actual cars are from the "Hells-confetti" internet site thanks to Dr Tony Cox of the Alvis Register).