



Fig. 3. A detail picture of the control arrangements that link the gear lever, clutch and brake pedals to the Chassis.

It is attached to a strong base so that its wheels are raised, and the E20R(S) driving motor is mounted in the base and is connected to the Chassis engine unit by Sprocket Wheels and Chain. The clutch, brake and gear-box levers are connected to special controls mounted in a panel bolted to the front of the base.

These controls of course are very large compared with the size of the Chassis, and they can be operated very easily, appropriate mechanisms in the Chassis then responding to the movements of the levers. The model is ideally suitable therefore to demonstrate the principles of the mechanisms of a

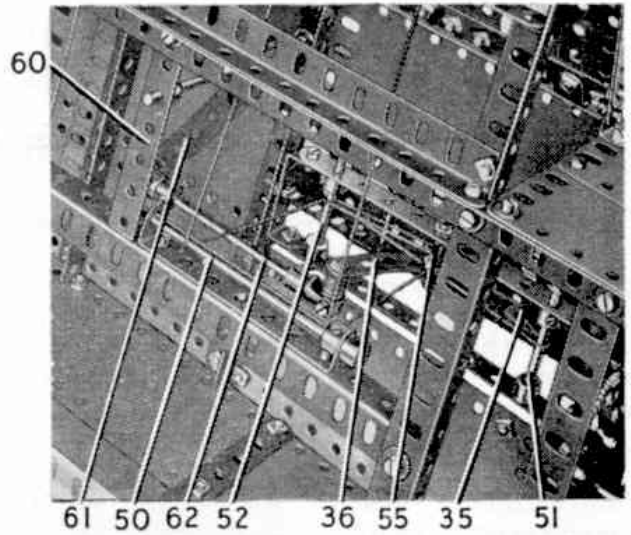
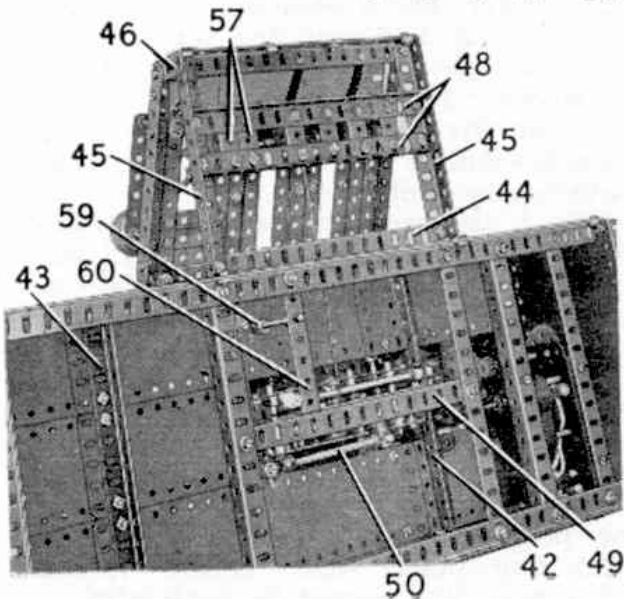
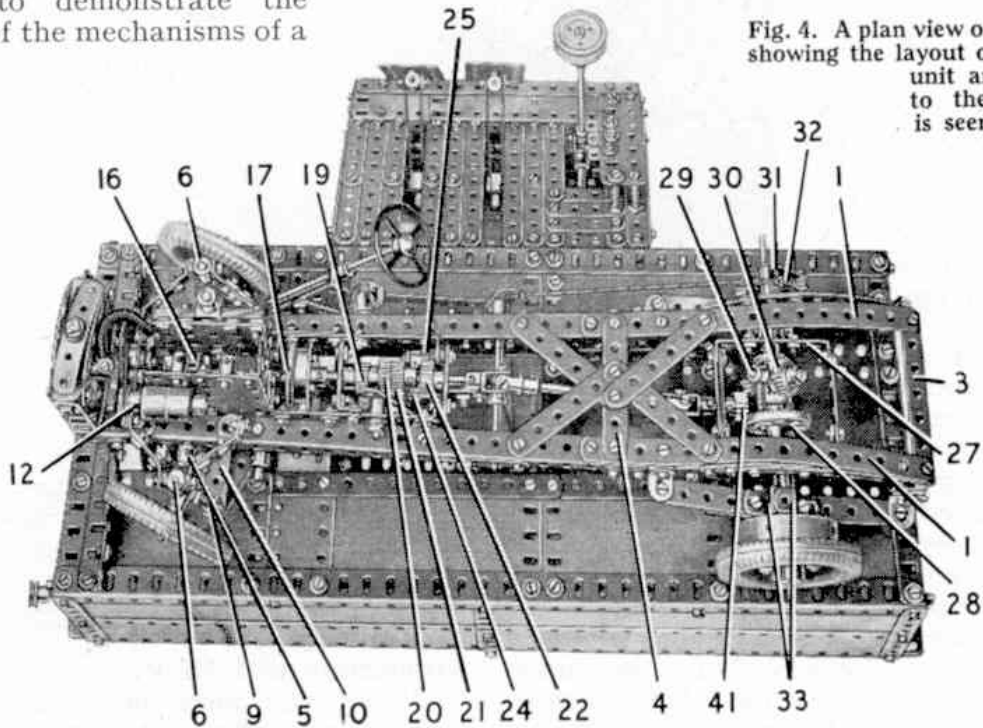


Fig. 4. A plan view of the Chassis, showing the layout of the engine unit and the drive to the rear axle, is seen on the left.



real chassis. The brake pedal operates a simple brake on one rear wheel only, and when the brake is operated the differential mechanism is brought into action and increases the speed of the opposite wheel.

Apart from the mechanisms already mentioned the Motor Chassis is fitted with a neat independent front suspension arrangement controlled by torsion bars, and the steering mechanism is of the rack and pinion type. The model is exceptionally interesting to build and operate, and readers requiring full constructional details can obtain them by writing to the Editor, enclosing a 2d. stamp for return postage.

Fig. 5. This underneath view of the base shows the arrangement of the E20R(S) Electric Motor that operates the model.

MODEL OF THE MONTHMOTOR CHASSISConstruction of the Chassis

Each side-member of the chassis consists of a  $12\frac{1}{2}$ " Angle Girder extended at the rear by two  $2\frac{1}{2}$ " Curved Strips and a 4" Curved Strip. A  $7\frac{1}{2}$ " Strip 1 is bolted to the Angle Girder and is connected to the rear end of the 4" Curved Strip by an Angle Bracket. The side-members are connected by a  $2\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip 2, a  $5\frac{1}{2}$ " Angle Girder 3 and a 3" Strip 4. Further 3" Strips are bolted between the Strip 4 and the side-members as shown.

Each of the rear springs consist of a  $5\frac{1}{2}$ ", a  $4\frac{1}{2}$ " a  $3\frac{1}{2}$ " and a  $2\frac{1}{2}$ " Strip. The front end of the  $5\frac{1}{2}$ " Strip is bolted to an Angle Bracket lock-nutted to the chassis and the rear end is fitted with an Angle Bracket lock-nutted to a Fishplate that also is lock-nutted to the chassis.

The independent front suspension is controlled by torsion bars, each of which consists of two  $5\frac{1}{2}$ " Strips placed face to face. The rear end of each torsion bar is bolted to a  $1\frac{1}{2}$ " Angle Girder fixed to the chassis, and a Coupling is screwed tightly to a bolt passed through the front end of the Strips. A 1" Rod fixed in the Coupling is passed through a slotted hole in the chassis side-member and is fitted with a Swivel Bearing 5. A  $1\frac{1}{2}$ " Rod is held in the "Spider" of the Swivel Bearing and on this Rod a Short Coupling is mounted freely and is held in place by a Collar on the lower end of the Rod. The upper end of the  $1\frac{1}{2}$ " Rod carries a Collar 6 and the Short Coupling supports another 1" Rod that forms the stub axle for the front wheel. The wheel is held on the axle by a Collar.

Each of the arms 7 is formed by two Obtuse Angle Brackets bolted to a Fishplate. One of the Obtuse Angle Brackets pivots on a bolt screwed into the Collar 6 and the other Obtuse Angle Bracket is lock-nutted to an Angle Bracket bolted to the chassis.

Arrangement of the Steering Mechanism.

The steering column is a 5" Rod supported in a  $2\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip bolted to a  $1\frac{1}{2}$ " Corner Bracket that is fixed to the chassis. The Rod carries at its lower end a  $7/16$ " Pinion that engages a Worm 8. This Worm is fixed on a  $3\frac{1}{2}$ " Rod mounted in two 1" x  $\frac{1}{2}$ " Angle Brackets bolted underneath the chassis side-members. A Fishplate is fixed to each Angle Bracket so that its round hole covers the slotted hole in the Angle Bracket to support the  $3\frac{1}{2}$ " Rod. A Collar is fixed on the Rod between the two 1" x  $\frac{1}{2}$ " Angle Brackets and a  $2\frac{1}{2}$ " Strip is pivoted on a bolt screwed into the Collar. The other end of the  $2\frac{1}{2}$ " Strip is pivoted on a bolt screwed into a Collar 9. Collar 9 is fixed on a Threaded Pin screwed into one of the Short Couplings that support the stub axles, and the track rod 10 is pivoted on the same bolt. The Threaded Pin is locked by its nut in the Short Coupling. The track rod consists of a  $3\frac{1}{2}$ " Strip and a 2" Slotted Strip bolted together, and at its other end it is pivoted on a bolt screwed into a Collar mounted in the same way as the Collar 9.

## The Engine Unit, Clutch and Gear-Box

The sides of the engine unit are  $2\frac{1}{2}$ " x  $1\frac{1}{2}$ " Flanged Plates and these are connected at each end by a 6-hole Wheel Disc. The engine inlet manifold is represented by six  $2\frac{1}{2}$ " Strips and two 1" Corner Brackets attached to one of the Flanged Plates by  $\frac{1}{2}$ " Bolts. The carburetter is represented by a Threaded Boss screwed on to a  $\frac{1}{2}$ " Bolt passed through an Angle Bracket 11. The dynamo consists of two Chimney Adaptors bolted to one side of the engine and these support a  $1\frac{1}{2}$ " Rod that carries a  $\frac{1}{2}$ " Pulley 12. The fan is a Double Arm Crank free to turn on a  $\frac{3}{4}$ " Bolt, and held on the Bolt by two nuts. The Bolt is fixed by a nut in a 1" Triangular Plate that is attached to the front of the engine unit by two  $\frac{3}{8}$ " Bolts, but is spaced from the unit by three Washers on each Bolt. The framework for the gear-box consists of two  $3\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips 13 connected by a  $1\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip 14 and a  $1\frac{1}{2}$ " Flat Girder 15. The Flat Girder is spaced from the Double Angle Strips 13 by three Washers on each Bolt, and a  $1\frac{1}{2}$ " Strip is used to cover the slotted holes in the Flat Girder. Another  $1\frac{1}{2}$ " Flat Girder is bolted to Double Angle Strip 14.

A  $3\frac{1}{2}$ " Rod is passed through the centre holes of the two 6-hole Wheel Discs. This Rod carries a  $\frac{1}{2}$ " Pulley at the front, a  $\frac{5}{4}$ " Sprocket 16 inside the engine unit, and a 1" Pulley fitted with a Rubber Ring 17. The Rod projects only part of the way into the boss of the 1" Pulley. The Pulley forms the fixed member of the clutch unit and the sliding member is a  $1\frac{1}{8}$ " Flanged Wheel 18. The Flanged Wheel is freely mounted on a 2" Rod that carries a  $\frac{1}{2}$ " Pinion 19 and a  $\frac{5}{4}$ " Pinion 20. A bolt is fixed by a nut in each hole of the Flanged Wheel, which is pressed against the Rubber Ring 17 by a Compression Spring placed between Double Angle Strip 14 and the Flanged Wheel. A Collar fitted with two  $7/32$ " bolts is fixed on the Rod inside the Flanged Wheel, so that the bolts in the Collar engage the shanks of the bolts in the Flanged Wheel.

The gear-box output shaft is a 2" Rod that carries two  $\frac{3}{4}$ " Pinions 21 and 22. The Rod projects partly into the boss of Pinion 20. The gear-box layshaft is a 3" Rod mounted in the two  $1\frac{1}{2}$ " Flat Girders. This Rod carries a  $\frac{3}{4}$ " Pinion 23 and a  $\frac{1}{2}$ " Pinion 24 arranged with their bosses about  $3/16$ " apart. A Collar on the Rod limits the sliding movement. A  $\frac{1}{2}$ " reverse Pinion 25 is mounted freely on a  $\frac{3}{4}$ " Bolt held by a nut in a Fishplate. The Pinion is retained on the bolt by two nuts and the Fishplate is supported by one of the bolts that holds the Flat Girder 15. Pinion 25 must be in constant mesh with Pinion 22 and it must be arranged so that it can mesh also with Pinion 24.

The engine unit is completed by bolting a  $5\frac{1}{2}$ " x  $1\frac{1}{2}$ " Flexible Plate 26 to the two Flanged Plates. The Flexible Plate is arranged to follow the shape of the 6-hole Wheel Discs. The top of the engine unit is a  $2\frac{1}{2}$ " Flat Girder attached by bolts to Threaded Bosses screwed to one of the Flanged Plates. A  $2\frac{1}{2}$ " Driving Band is placed round the  $\frac{1}{2}$ " Pulleys at the front of the engine and the boss of the fan.

### Assembly of the Rear Axle.

The housing for the rear axle is made by connecting two  $2\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips, one of them indicated at 27, by 2" Strips. At the front end of the housing four 2" Strips placed face to face are used to provide a bearing for the driving shaft. At one side two  $1\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips are bolted to the housing and are connected at their outer ends by a Wheel Disc. At the other side these Double Angle Strips are replaced by made-up 1" x

$\frac{1}{2}$ " double angle strips, each of which consists of two 1" x  $\frac{1}{2}$ " Angle Brackets.

The differential crown wheel is a  $1\frac{1}{2}$ " Contrate 28 fitted with two 1" Screwed Rods held in place by nuts. A Collar 29 is screwed on to each Screwed Rod and these Collars support a  $\frac{1}{2}$ " Rod that passes through the centre cross hole of a Coupling. Two  $\frac{3}{4}$ " Pinions 30 are free to turn on Pivot Bolts screwed into the Coupling. The differential half shafts are supported in the Wheel Discs and the Double Angle Strips 27, and each carries a  $\frac{3}{4}$ " Contrate that engages the Pinions 30.

At one side of the rear axle a simple brake is fitted. The brake shoe consists of three Washers on a  $\frac{3}{8}$ " Bolt fixed in a Crank 31. This Crank is held tightly on a 1" Rod passed through the Wheel Disc. The Rod carries also a Collar in which a  $\frac{1}{2}$ " Bolt 32 is screwed.

The complete axle is attached to the rear springs by two  $\frac{1}{2}$ " Reversed Angle Brackets 33 on each side.

### Arrangement of the chassis controls and the radiator

The clutch release levers are two 1" Screwed Rods arranged to engage the flange of the Flanged Wheel 18. Each Screwed Rod is locked by a nut in the threaded hole of a Collar, which is fixed on a 2" Rod mounted in two 1" Triangular Plates. Each Triangular Plate is bolted to a  $1\frac{1}{2}$ " Flat Girder 34 fixed to one of the Double Angle Strips 13. A Crank extended by a 2" Strip 35 is fixed on the 2" Rod between the two Collars.

The gear-box control lever is a Double Arm Crank extended by a  $4\frac{1}{2}$ " Strip 36. The Double Arm Crank is fixed on the shank of a Threaded Pin passed through one of the Double Angle Strips 13. A  $\frac{3}{8}$ " Bolt is fixed by two nuts in the Double Arm Crank, and its head engages between the Pinions 23 and 24.

The brake pedal is a Double Arm Crank that pivots on a  $\frac{3}{4}$ " Bolt attached to the chassis by two nuts. A  $3\frac{1}{2}$ " Strip 37 is lock-nutted to the brake pedal and to a Double Arm Crank 38 fixed on a  $3\frac{1}{2}$ " Rod mounted in  $1\frac{1}{2}$ " Strips bolted to the chassis. This Rod carries a Crank 39 extended by a  $2\frac{1}{2}$ " Strip. A length of cord 40 is tied between the Double Arm Crank 38 and the Bolt 32.

The engine unit and the gear-box are attached to the chassis by Angle Brackets. An Angle Bracket is bolted to each of the Double Angle Strips 13 and to each side-member of the chassis, and two Angle Brackets are fixed to the 6-hole Wheel Disc at the front of the engine unit. These Angle Brackets support a 1" Triangular Plate that is bolted to the Double Angle Strip 2. A Universal Coupling is fixed on the gear-box output shaft and is connected to a similar Coupling on a 1" Rod that carries a  $\frac{1}{2}$ " Pinion 41.

The radiator frame consists of two 2" and two  $2\frac{1}{2}$ " Angle Girders. Two 3" Screwed Rods are passed through the frame and Spring Cord looped round them represents the radiator tubes. The upper end of the radiator is completed by two  $2\frac{1}{2}$ " Curved Strips and a  $2\frac{1}{2}$ " Strip supported by nuts on a  $\frac{3}{4}$ " Bolt. The radiator is bolted to the front ends of the chassis side-members.

### Details of the Base

Each side of the base consists of two  $18\frac{1}{2}$ " Angle Girders connected by  $4\frac{1}{2}$ " Angle Girders. The rear side is filled in by four  $9\frac{1}{2}$ " x  $2\frac{1}{2}$ " Strip Plates, and the front is partly filled in by four  $5\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flexible Plates strengthened by  $4\frac{1}{2}$ " Strips. The sides are connected by  $7\frac{1}{2}$ " Angle Girders and each end is completed by four  $4\frac{1}{2}$ " x  $2\frac{1}{2}$ " Flexible Plates. Two  $7\frac{1}{2}$ " Angle Girders 42 are bolted across the top of the base and a similar Girder 43 is fixed in position.

At the front a  $7\frac{1}{2}$ " Angle Girder 44 is bolted in position and to this are fixed two  $5\frac{1}{2}$ " Angle Girders 45. These are connected at their outer ends by a  $7\frac{1}{2}$ " Angle Girder that supports two  $1\frac{1}{2}$ " Angle Girders 46. Two overlapped  $5\frac{1}{2}$ " x  $1\frac{1}{2}$ " Flexible Plates edged by a  $7\frac{1}{2}$ " Strip are fixed to Girders 46, and two overlapped  $5\frac{1}{2}$ " Strips 47 are bolted between the Girders 46 and Angle Brackets fixed to the base.

The rear end of the chassis is supported by two Corner Gussets bolted to  $4\frac{1}{2}$ " Angle Girders. The front also is supported by two Corner Gussets. These are attached to a  $7\frac{1}{2}$ " Angle Girder fixed across the base and they are connected to Double Angle Strip 2 by Angle Brackets.

### Arrangement of the Controls.

The clutch and brake pedals each consist of two  $4\frac{1}{2}$ " Strips connected at their upper ends by Bolts screwed into a Coupling. A  $3$ " x  $1\frac{1}{2}$ " Flat Plate is attached to the Coupling by two Bolts, and the lower ends of the Strips are spaced apart by Washers on a  $\frac{1}{2}$ " Bolt. Each pedal pivots on a  $2$ " Rod passed through the lower next to end holes in the Strips. The Rod is supported in two Trunnions bolted to  $7\frac{1}{2}$ " Angle Girders 48 and is held in place by Collars.

Two  $7\frac{1}{2}$ " Angle Girders are fixed across the base and these support another  $7\frac{1}{2}$ " Angle Girder 49. A  $3\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip fixed to this Girder carries a  $4$ " Rod 50. Two  $5\frac{1}{2}$ " Strips are connected by  $1\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strips and these are bolted to the Girders 42. Two  $2$ " Rods 51 and 52 are held in the  $5\frac{1}{2}$ " Strips by Collars.

A length of Cord tied to the lower end of the clutch pedal 53 is passed under Rod 50 and over Rod 52. It is taken round Rod 51 and is tied to Strip 35. Another Cord tied to the lower end of the brake pedal 54 is passed under Rod 50, over a Pivot Bolt 55 and round the Rod 52. Finally this Cord is tied to the end of the Strip bolted to Crank 39. Springs are arranged between the clutch and brake pedals and the front of the control panel to return the pedals to the normal positions. The gear lever 56 is a  $5$ " Rod that carries a Threaded Coupling to which three  $1$ " loose Pulleys are attached by a  $\frac{3}{4}$ " Bolt. The lower end of the Rod is fixed in a Coupling that pivots on a  $2$ " Rod supported in two Trunnions 57. A Compression Spring between the Coupling and one of the Trunnions presses the lever to the left.

A Swivel Bearing 58 is mounted on the gear lever between two Collars and is connected by a Rod to a Collar screwed on to a bolt passed through a Crank 59. The Crank is fixed on a vertical Rod mounted in the top of the base and in a  $3\frac{1}{2}$ " x  $\frac{1}{2}$ " Double Angle Strip 60. A Fishplate bolted to the Crank is used to cover the slotted hole. A lever 61 fixed to the vertical Rod consists of a Crank extended by a  $3\frac{1}{2}$ " Strip, and it is linked to the gear change lever 36 by a Rod 62 and two Swivel Bearings. A rack to hold the gear lever in the desired positions consists of Fishplates bolted to a  $3\frac{1}{2}$ " Flat Girder 63 that is supported by nuts on  $1\frac{1}{8}$ " Bolts.

### The Driving Mechanism

An E20RS Electric Motor is fixed to two  $7\frac{1}{2}$ " Angle Girders bolted across the base. A  $4$ " Rod 64 is fixed in a Collar screwed on to a bolt passed through the upper arm of the motor switch. A  $\frac{1}{2}$ " Pinion on the Motor shaft drives a 57-tooth Gear on a  $2\frac{1}{2}$ " Rod mounted in the side-plates, and a  $\frac{1}{2}$ " Pinion on the same Rod engages a 57-tooth Gear on a  $3$ " Rod supported in the upper corner holes of the side-plates. The  $3$ " Rod is held in place by a Collar and it carries a  $\frac{1}{2}$ " Pinion that drives a  $2\frac{1}{2}$ " Gear 65. This Gear is mounted on a  $5$ " Rod supported in one end of the base and in one of the Girders 42. A  $\frac{3}{4}$ " Sprocket on the  $5$ " Rod is connected by Chain to the Sprocket 16.

Adjusting the Controls

The gear-box provides two forward speeds and reverse. Top gear is obtained by sliding the layshaft to bring Pinion 24 into mesh with both the Pinions 20 and 21. Low gear is obtained by sliding the layshaft so that Pinions 20 and 24 disengage and Pinion 23 moves into mesh with Pinion 19. Reverse gear is provided when Pinion 24 engages Pinion 25 and Pinion 23 meshes with Pinion 19. The positions of the Cranks of the selector mechanism and the arrangement of the Fishplates that locate the gear lever should be adjusted carefully so that the correct gears are engaged when the lever is moved.

The length of the Cord from the clutch pedal should be adjusted so that when the pedal is fully depressed the Flanged Wheel 18 is moved just clear of the rubber ring 17. The brake cord should be adjusted so that when its pedal is depressed the Crank 31 is brought into contact with a Boiler End bolted to the rear wheel.

PARTS REQUIRED

6 of No. 1b	1 of No. 16a	4 of No. 48a	6 of No. 111a
14 " " 2	4 " " 16b	4 " " 48b	6 " " 111c
21 " " 2a	7 " " 17	2 " " 51	4 " " 111d
5 " " 3	3 " " 18a	1 " " 55a	3 " " 115
6 " " 4	6 " " 18b	1 " " 58	2 " " 120b
12 " " 5	1 " " 20	40 " " 59	4 " " 125
9 " " 6	4 " " 20a	5 " " 62	6 " " 126
1 " " 6a	3 " " 22a	4 " " 62b	1 " " 133
4 " " 7a	3 " " 23a	4 " " 63	2 " " 133a
2 " " 8	2 " " 24a	1 " " 63c	2 " " 140
17 " " 8b	2 " " 24c	2 " " 63r	4 " " 142a
2 " " 9	6 " " 25 ✓	2 " " 64	2 " " 147b
2 " " 9a	7 " " 26 ✓	3 " " 77	4 " " 155
1 " " 9c	1 " " 26c ✓	2 " " 80c	2 " " 162a
2 " " 9d	2 " " 27a ✓	2 " " 82	2 " " 164
2 " " 9e	1 " " 27c ✓	2 " " 89b	3 " " 165
2 " " 9f	1 " " 28 ✓	4 " " 90	1 " " 185
14 " " 10	2 " " 29 ✓	2 " " 90a	1 " " 186
21 " " 12 ✓	1 " " 32 ✓	1 " " 94	2 " " 188
6 " " 12b	353 " " 37a ✓	2 " " 96a	5 " " 189
8 " " 12c	301 " " 37b ✓	1 " " 103d	16 " " 191
4 " " 15 ✓	102 " " 38 ✓	1 " " 103f	6 " " 192
1 " " 15a	1 " " 40	4 " " 103h	4 " " 196
2 " " 15b	3 " " 43	4 " " 108	1 E2ORS Electric Motor.
4 " " 16	5 " " 48	2 " " 111	