

Special Display Model

MECCANO

MOTOR

CHASSIS

by Spanner

For this detailed view of the steering mechanism the front off-side wheel has been removed, while Large Fork Piece 60 has been disconnected from its vertical Rod.

EVERY MONTH we try to give readers an advanced Meccano model to study and I don't mind admitting that this can prove pretty difficult at times. Take it from me, good advanced models are hard to find! We believe however that we have overcome the problem—not only for this issue, but also for the next—thanks to the detailed Motor Chassis featured here. It covers two months, by the way, because we do not have sufficient space in one issue to deal with the whole model. I will therefore describe as much as possible, here, and finish the description next month.

Many years of experience have shown that a motor chassis, including genuine working detail such as a gear box, clutch, differential, etc., is among the most popular subjects for advanced builders and so I am confident that the model will be well received. It was actually built exclusively for display purposes, mounted on a wooden plinth and driven by chain from an electric motor hidden inside the plinth. The effect was excellent.

Chassis

Dealing first with the chassis framework, two longitudinal members are each built up from a $12\frac{1}{2}$ in. Angle Girder 1, extended eleven holes by a $12\frac{1}{2}$ in. Strip 2. Girders 1 are connected by a $2\frac{1}{2}$ in. Strip 3 and a cross arrangement 4, obtained from four 2 in. Strips bolted to two 1 in. Corner Brackets, as shown, while Strips 2 are joined by a $2\frac{1}{2} \times 1$ in. Double Angle Strip, to which a $7\frac{1}{2}$ in. Angle Girder 5, overlayed by a $7\frac{1}{2}$ in. Strip, is bolted.

Two rectangular arrangements are now each produced from two $2\frac{1}{2}$ in. Angle Girders 6 and two $7\frac{1}{2}$ in. Angle Girders 7, a 1 in. Corner Bracket being used at one corner; then the completed arrangements are fixed to the longitudinal chassis members in the positions shown, the inner $7\frac{1}{2}$ in. Girders first overlayed by $7\frac{1}{2}$ in. Strips. Bolted to each outside Girder 7 are a $7\frac{1}{2}$ in. Strip 8 and a $2\frac{1}{2}$ in. Strip 9, the latter extended by a Formed Slotted Strip 10. Strips 10 at each side are joined by a $5\frac{1}{2}$ in. Strip 11. A $1\frac{1}{2}$ in. Angle Girder, extended by a $2\frac{1}{2}$ in. Stepped Curved Strip 12, is bolted to the inside of each Strip 9, then Curved Strips 12 are joined by a $7\frac{1}{2}$ in. Curved Strip 13, attached to the centre of Strip 11 by an Angle Bracket, and by a compound $7\frac{1}{2}$ in. strip 14, built up from two $4\frac{1}{2}$ in. Strips. Two 5 in. supports, bolted one to each Angle Girder 1,

are obtained from two $4\frac{1}{2}$ in. Strips and are attached to Curved Strip 13 by Angle Brackets.

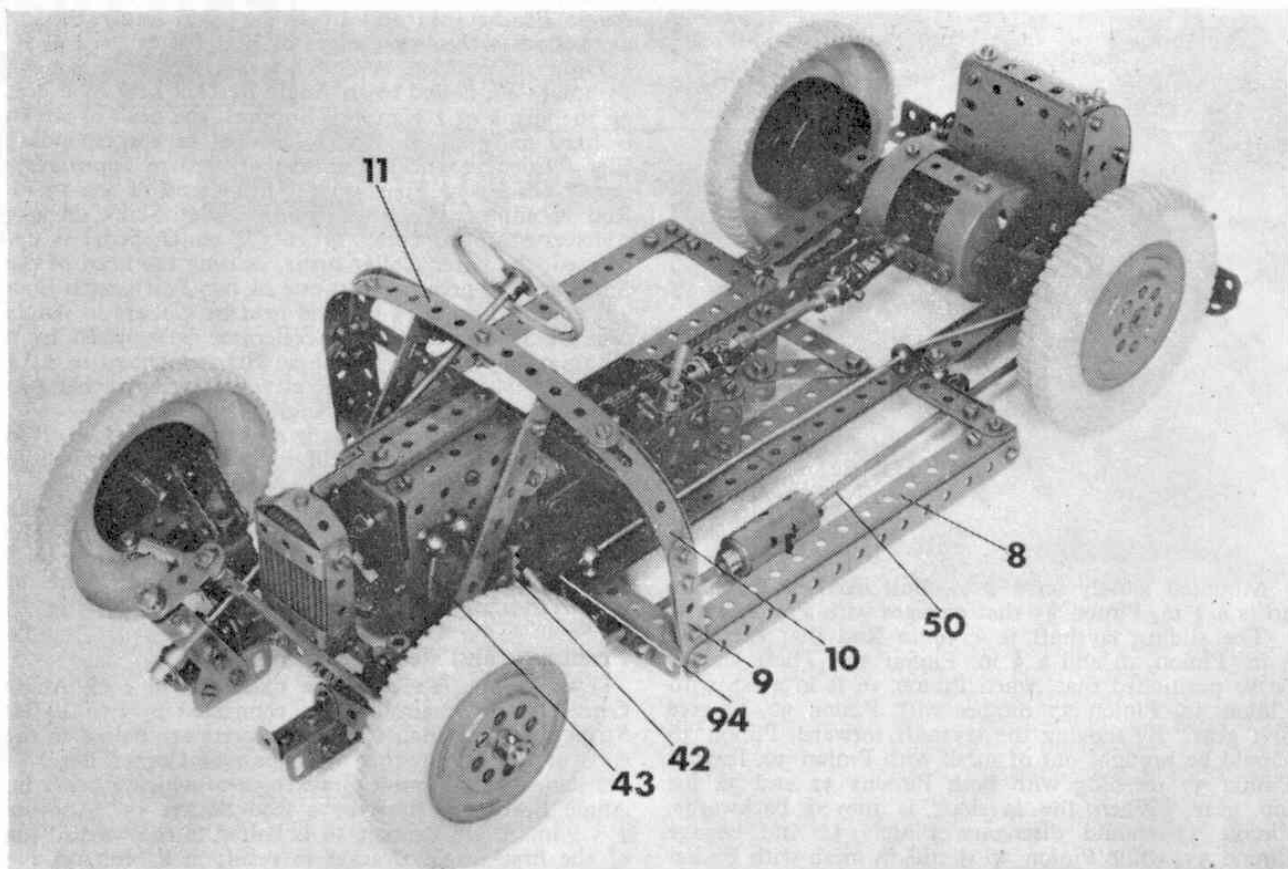
"Engine," clutch and gear box

As the model was designed solely for display purposes, a realistic-looking, but none-the-less imitation, engine was mocked-up from standard Meccano parts. Two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plates 15 are connected by two $2\frac{1}{2}$ in. Angle Girders 16 and six $2\frac{1}{2}$ in. Strips 17, placed one on top of the other. Bolted to the vertical flanges of the Angle Girders are two $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plates 18, secured to the Flanged Plates by Angle Brackets. The Bolts fixing the rear Angle Brackets to the corresponding Flanged Plate also fix two $3\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 19 to the Flanged Plate. Bolted to the other, free, lugs of these Double Angle Strips, but spaced from them by three Washers and a Fishplate 20 on the shank of one securing Bolt and by three Washers on the shank of the other Bolt, is a $1\frac{1}{2}$ in. Flat Girder 21, overlayed by a $1\frac{1}{2}$ in. Strip. A $3\frac{1}{2}$ in. Flat Girder 22 is bolted to the body of each Double Angle Strip.

Journalled in Flanged Plates 15 is a $3\frac{1}{2}$ in. Rod, held in place by a Collar and a $\frac{1}{2}$ in. Pulley with Boss. Two Three-way Rod Connectors 23 are mounted on this Rod and are clamped against the Pulley, by a Collar, to represent the fan. Also journalled in the Flanged Plates is a $3\frac{1}{2}$ in. Rod, carrying a 1 in. Sprocket Wheel 24 and held in place by a 1 in. Pulley 25 and a 1 in. Pulley with Rubber Ring 26.

Attached to off-side Flat Plate 18 is a Coupling 27, in which a $1\frac{1}{2}$ in. Rod is fixed. Loose on this Rod and spaced from the Coupling by two Washers is a $\frac{1}{2}$ in. Pulley with Boss, held by a Collar. A 6 in. Driving Band is passed around this pulley as well as around Pulley 25 and the "fan."

In line with the Rod carrying Pulley 25 but journalled in $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 28, overlayed by a $1\frac{1}{2}$ in. Flat Girder, and bolted, along with a $1 \times \frac{1}{2}$ in. Angle Bracket at each side to Double Angle Strips 19 is a 2 in. Rod on the forward end of which a Collar is fixed by two Set Screws. Loose on the Rod is a $1\frac{1}{8}$ in. Flanged Wheel 29 with four Bolts held by Nuts in its face. When this Flanged Wheel is pressed against the Rubber Ring, the shanks of the four Bolts should engage with the Set Screws in the Collar, disengaging when the Flanged Wheel is with-



Originally built as a special display model, this Meccano Motor Chassis incorporates all the major features of a real-life motor chassis: steering, suspension, clutch, gear box and differential.

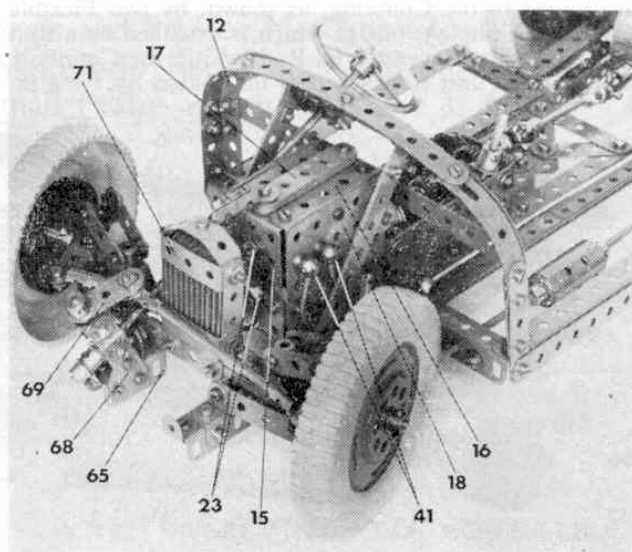
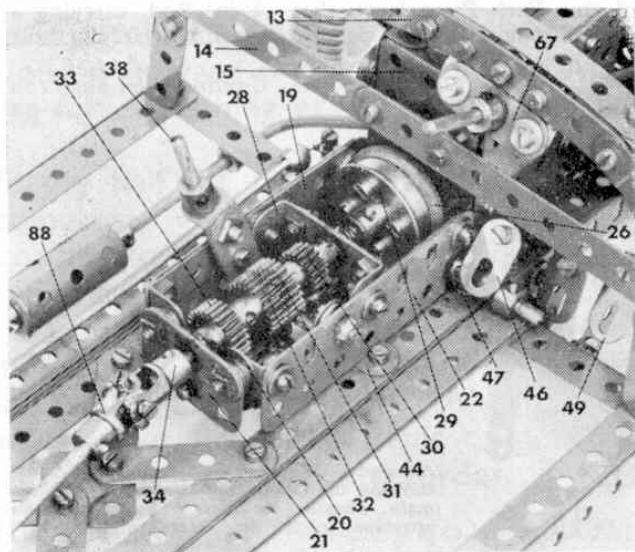
drawn. A Compression Spring on the Rod, between the Flanged Wheel and Double Angle Strip 28, keeps the Wheel in constant contact with the Rubber Ring.

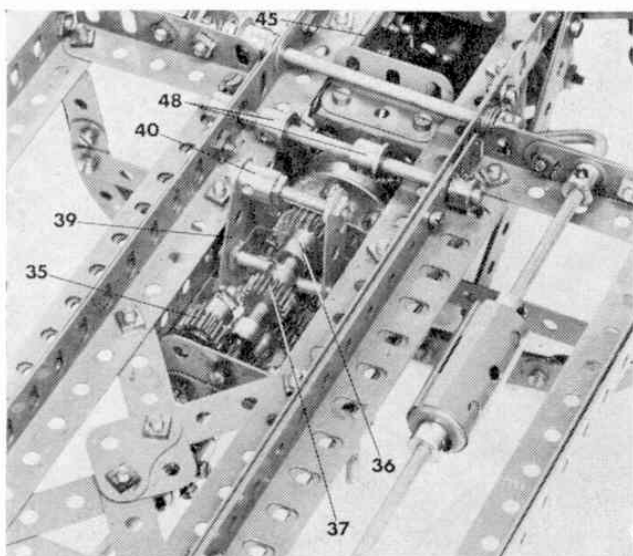
Also mounted on the 2 in. Rod, inside Double Angle Strip 28, is a $\frac{1}{2}$ in. Pinion 30 and a $\frac{3}{4}$ in. Pinion 31,

the latter so positioned that the end of the Rod is inserted in only half the bore of the Pinion. Inserted in the remaining half of its bore is another 2 in. Rod, journaled in Flat Girder 21, that carries two $\frac{3}{4}$ in. Pinions 32 and 33, plus a Universal Coupling 34.

A close-up view of the clutch and gear box, the latter giving one reverse and two forward speeds. The highly simple clutch operates extremely well despite its uncomplicated nature.

In this close-up view of the front of the model, construction of the simulated "engine" and radiator-grille is clearly shown.





Mounted loosely on a $\frac{3}{4}$ in. Bolt fixed in Fishplate 20 is a $\frac{1}{2}$ in. Pinion 35 that engages with Pinion 33.

The sliding layshaft is a $3\frac{1}{2}$ in. Rod that carries a $\frac{3}{4}$ in. Pinion 36 and a $\frac{1}{2}$ in. Pinion 37. These should be so positioned that, when Pinion 36 is in mesh with Pinion 30, Pinion 37 meshes with Pinion 32, to give first gear. By moving the layshaft forward, Pinion 36 should be brought out of mesh with Pinion 30, leaving Pinion 37 meshing with both Pinions 31 and 32 for top gear. When the layshaft is moved backwards, Pinion 37 should disengage Pinion 32 and engage Pinion 35, while Pinion 36 is still in mesh with Pinion 30, to give reverse gear.

A gear-change lever is provided by a 1 in. Rod 38, held in a Rod Socket attached to the short lug of a $1 \times \frac{1}{2}$ in. Angle Bracket, lock-nutted to one Flat Girder 22 and extended three holes by a $2\frac{1}{2}$ in. Strip. Another $2\frac{1}{2}$ in. Strip 39 is lock-nutted to the other Flat Girder 22, then its lower end is connected to the first Strip by a 1 in. Screwed Rod in a Threaded Boss 40, fixed to Strip 39. Half-inch Bolts held by Nuts in the $1\frac{1}{2}$ in. Strips engage between Pinions 36 and 37.

Before the engine and gearbox unit is fitted to the chassis an imitation exhaust manifold is added. Two Handrail Supports 41 and a Coupling 42 are fixed to left-hand Flat Plate 18, then the Handrail Supports are joined to the Coupling, as shown, by two Flexible Coupling Units 43, one of which is extended by a Rod Connector fitted over a 1 in. Rod held in the Coupling. The finished unit is attached to the chassis by $1 \times \frac{1}{2}$ in.

Angle Brackets 44 and by two $1\frac{1}{2}$ in. Angle Girders 45, bolted to the lower edges of Flat Plates 18.

Once in position, a clutch pedal is supplied by a Fishplate 46, bolted to an Angle Bracket held by a Nut on the shank of a Handrail Support, the head of which is fixed on a $1\frac{1}{2}$ in. Rod journalled in corresponding Flat Girder 22 and a Collar 47 bolted to appropriate Angle Girder 7. Fixed on the inside end of the $1\frac{1}{2}$ in. Rod is another Collar carrying a Set Screw in one transverse tapped bore. When the clutch pedal is depressed, the latter Collar turns, causing the head of the Set Screw to press against one of two Pawls with Boss 48, mounted on a $3\frac{1}{2}$ in. Rod held by Collars in Angle Girders 1. An imitation accelerator is supplied by a Fishplate 49 fixed to an Angle Bracket bolted to a $1\frac{1}{2}$ in. Strip which is, in turn, attached by a further two Angle Brackets to near-by Angle Girder 6.

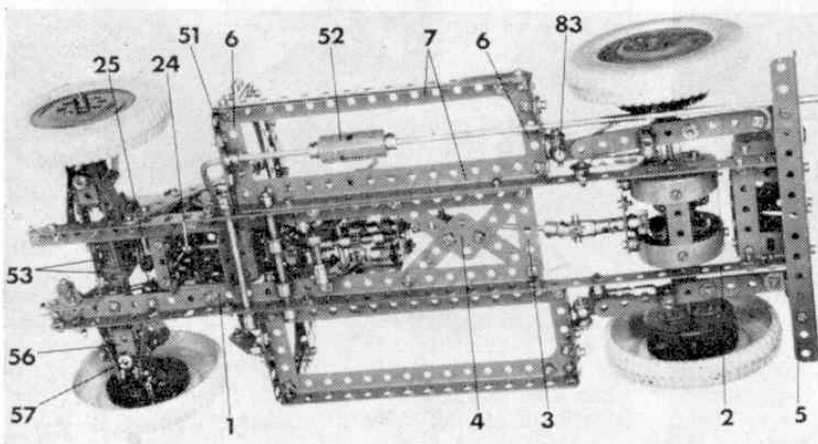
An exhaust system is built up from an $11\frac{1}{2}$ in. Rod 50, bent to shape and held in a Crank 51 bolted to appropriate Angle Girder 6. Mounted on this Rod is a silencer represented by two Chimney Adaptors, each held by two Collars, joined by a Sleeve Piece 52. The Rod is extended rearwards, via a Rod Connector, by a $4\frac{1}{2}$ in. Rod on the end of which another Rod Connector is fixed to represent the tail pipe.

Front axle and steering arrangement

Two Double Brackets are fixed one to each Angle Girder 1, and their lugs are connected by two $4\frac{1}{2}$ in. Strips 53. One inch Corner Brackets are bolted to the ends of the Strips, then each pair of Corner Brackets are joined by a Double Bracket 54 to which a 1×1 in. Angle Bracket is fixed by a Rod Socket 55. Another 1×1 in. Angle Bracket 56 is bolted to the vertical lug of the first Angle Bracket to result in a built-up 1×1 in. double bracket, its lugs pointing outwards. Journalled in these lugs is a $1\frac{1}{2}$ in. Rod, held in place by a Collar 57 beneath the lower lug and by a Short Coupling above it. Above the Short Coupling but below the upper lug of the double bracket are, in order, a Fishplate 58, a Washer and a Compression Spring. Note that the Rod passes through the elongated hole of the Fishplate.

Two Bolts, on each of which a $1\frac{1}{2}$ in. Strip 59 is loosely held by a Nut, are screwed into opposite tapped bores of Rod Socket 55. The Nuts will allow the Bolts to be fixed tight in the bores while still allowing movement of the $1\frac{1}{2}$ in. Strips, the free ends of which are lock-nutted to a Large Fork Piece 60. Fixed in the boss of this Fork Piece is another $1\frac{1}{2}$ in. Rod, carrying a loose Crank 61, which passes through the circular hole

Continued on page 160



Another view of the gear box as seen from beneath shown at the head of this page. The correct adjustment of Pinion 35 is critical and may take a little time to get just right.

An underside view, at left, of the model showing the layout and construction of the main chassis members. Pay particular attention to the two rectangular "box" members.

Double Arm Cranks 39 are adjusted so that the Wiper Arm has a vertical movement of only $1/64$ in. each way from the balanced position, while the actual steelyard should be allowed a movement of no more than $1/8$ in. each way. Stops to prevent further movement are provided by a $3\frac{1}{2}$ in. Strip 41 and Fishplates 42, fixed by Nuts on two $3\frac{1}{2}$ in. Screwed Rods mounted in Flanged Plate 7 and Strip 9.

To operate the model, two batteries of at least $4\frac{1}{2}$ volts each are required. (I used Ever Ready 126's.) The positive terminal of one battery is connected to the negative terminal of the other and to either of these terminals is also connected one of the motor leads. The other motor lead is connected to Wiper Arm 40, while the remaining battery terminals are connected, one each, to the Contact Screws in the model.

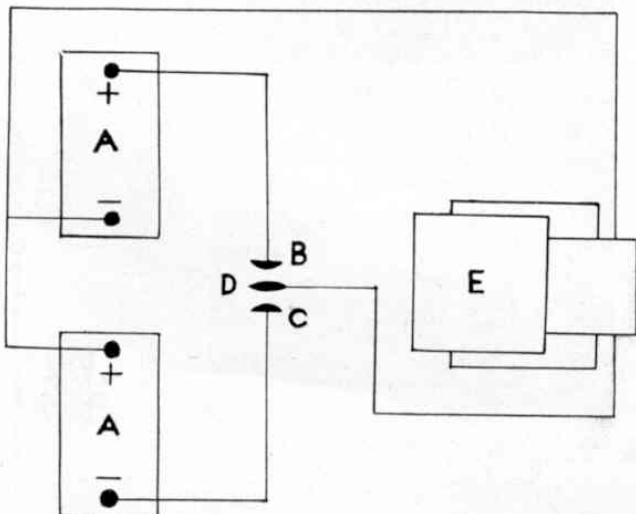
Finally, a scale is prepared from cardboard and attached to Flat Plate 23, Rods 24 and 25 protruding through holes made in the cardboard. Calibration is not difficult. Two circles are drawn around the holes through which the rods will protrude, then each of these circles is marked into ten equal parts and numbered 0-9. With the scale in place, the dial for Rod 24 indicates ounces and that for Rod 25, tenths of ounces.

PARTS REQUIRED		
2-1a	2-20b	1-63c
2-1b	1-23a	1-70
2-2a	1-25	2-72
1-3	3-26	4-74
3-5	1-27	1-79
11-6a	1-27c	2-80a
10-8	1-32	6-111
2-8a	75-37a	1-111c
2-9a	96-37b	1-116
2-10	9-38	1-126
1-14	2-38d	1-128
1-14a	4-48	2-136
1-15a	3-48a	2-136a
2-15b	2-52a	1-147b
1-16	3-53	2-503
3-17	12-59	1-508
2-18a	3-62b	1-531
2-18b	1-63	2-543

I Power Drive Unit

In operation, Mr. Fail's Weighing Machine is amazingly sensitive. As I have already said, however, the counterweight is critical and, while the unit as described will give pretty accurate results, you will probably find it necessary to add one or two Bolts to

WIRING DIAGRAM: A— $4\frac{1}{2}$ volt batteries. B—upper Contact Screw. C—Lower Contact Screw. D—Wiper Arm. E—Power Drive Unit.



get the weight exactly right. You will know when this is so, of course, when the dials show the correct reading for a known weight placed in the pan. If you do not have a commercially-produced "known" weight, then use British silver coins. Five shillings worth equal one ounce!

A last word now about the zero adjusting weight. Assuming the main counterweight is correct, you may find, after weighing something, that the scale pointers do not return exactly to zero, owing to backlash in the gears. This is where the zero adjusting weight comes in as it enables the pointers to be easily re-set before anything else is weighed.

Special Display Model

MECCANO MOTOR CHASSIS

Continued from page 146

in Fishplate 58 and into the boss of another Large Fork Piece 62. Lock-nutted to the lugs of the latter Fork Piece are two shaped $2\frac{1}{2}$ in. Strips 63, attached to Girder 1 by one right-hand and one left-hand Corner Angle Bracket. A Long Threaded Pin is screwed into one tapped bore in the boss of Crank 61 and on this is loosely mounted a $4\frac{1}{4}$ in. Road Wheel to which a Wheel Flange 64 is bolted. A Collar holds the Road Wheel in place. Note that the Threaded Pin must not grip the Rod in the boss of Crank 61 and is prevented from doing so by adding an extra Bolt to the Pin.

To the front end of the right-hand Girder 1 a $1\frac{1}{2}$ in. Angle Girder 65 is fixed, the front securing Bolt also fixing a right-hand Corner Angle Bracket in place. The upper lug of this Bracket is bent forward slightly to provide one bearing for an 8 in. Rod which serves as the steering column and which carries a Worm 66. The other bearing for the Rod is provided by a $1\frac{1}{2}$ in. Strip 67, attached to Curved Strip 13 by Obtuse Angle Brackets. Collars hold the Rod in place.

Bolted to Angle Girder 65 is a 1 in. Triangular Plate, extended by a $1\frac{1}{2}$ in. Strip 68, to the top of which a $1 \times \frac{1}{2}$ in. Angle Bracket overlaid by a Fishplate is secured. Journalled in this Angle Bracket/Fishplate is a 2 in. Rod, held in place by a Crank 69 and a $1\frac{1}{8}$ in. Pinion 70, the latter in mesh with Worm 66. A lower mounting for the Rod is provided by a Collar attached to Angle Girder 1 by a Bolt passed through the Girder and into one transverse tapped bore of the Collar. Lock-nutted to the arm of Crank 69 are two Rod and Strip Connectors which are connected to further Rod and Strip Connectors, lock-nutted to Cranks 61, by a 1 in. Rod and a 4 in. Rod respectively.

A radiator is now built up from two $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 71, the lugs of which are joined by two 2 in. Strips held by two 2 in. Screwed Rods 72. Mounted on these Rods are eleven 2 in. Strips, each spaced from the next by two Washers. A shaped $2\frac{1}{2}$ in. Strip 73 is added to the top as shown, then the finished radiator is attached to front Strip 53 by one left-hand and one right-hand Corner Angle Bracket. Two Rod and Strip Connectors joined by a 1 in. Rod represent a water hose running between the top of the radiator and the engine.

NEXT MONTH: We conclude the Motor Chassis with constructional details of the rear axle, differential and working brake.

Meccano Motor Chassis

by Spanner

Started last month, this concludes the first advanced Meccano model for experienced constructors. Last month "Spanner" dealt with the Chassis, Engine, Clutch, Gearbox, Front Axle and Steering.

SO FAR in this two-part article featuring the Meccano special display Motor Chassis introduced last month we have dealt with construction of the basic chassis, engine, clutch, gearbox and front wheel arrangements. We are now left with the rear axle, differential and a rather ingenious working cable brake operated from a foot pedal in the driving position.

Rear axle and differential

The basic rear axle and differential arrangement fitted to this model is more or less the standard Meccano construction found in many models. A 4 in. Rod carrying, in order, a Boiler End, a Collar, a Washer, a 1½ in. Contrate Wheel 74, two more Washers and a ¾ in. Contrate Wheel 75, is loosely inserted half way into the longitudinal bore of a Coupling. Loosely inserted into the other half of the Coupling is a 3½ in. Rod that also carries a Boiler End in addition to a ¾ in. Contrate Wheel, spaced from the Boiler End 76 by three Washers.

Held in the centre transverse smooth bore of the Coupling is a 1½ in. Rod on each end of which a Collar is fixed. Each Collar is connected to Contrate 74 by a 1 in. Screwed Rod 77, held by Nuts in the face of the Contrate and screwed into one tapped bore of the Collar. Screwed into the centre transverse smooth bores of the Coupling are two Pivot Bolts, each carrying a loose ¾ in. Pinion 78 that meshes with the ¾ in. Contrates.

Attached to each Boiler End by two 1½ × ½ in. Double Angle Strips 79 is a Wheel Flange 92 to the inside of which an 8-hole Wheel Disc is bolted to provide a bearing for the corresponding axle Rod. The two Boiler Ends themselves are now joined by four 2 in. Strips, one of which is spaced from the Boiler Ends by three Washers on the shanks of the securing Bolts. This Strip is overlaid by a Double Arm Crank 80.

Bolted to each pair of Double Angle Strips 79 is a Double Bent Strip 81 to the lugs of which a built-up leaf spring is fixed, the forward securing Bolt being screwed into the tapped bore of a Collar 82 instead of carrying a Nut. Two Washers space the Collar from the spring, which is built up from one 5½ in., one 4½ in., one 3½ in., one 2½ in. and one 1½ in. Strip. A right-angled Rod and Strip Connector is bolted to the rear end of the 5½ in. Strip while a Handrail Support 83 is bolted to the forward end of the Strip. This Handrail Support is loose on the shank of a ¾ in. Bolt,

held by a Nut in the short lug of a 1 × ½ in. Angle Bracket fixed to rear Angle Girder 6. The Rod and Strip Connector is loose on another ¾ in. Bolt held by Nuts in a Fishplate and Reversed Angle Bracket 84 lock-nutted to a second 1 × ½ in. Angle Bracket fixed to Angle Girder 5.

Mounted, along with three Washers, on the shank of a ½ in. Bolt loose in the bore of Collar 82 is a Rod and Strip Connector which is fixed by a 1 in. Rod to another Rod and Strip Connector, bolted to Strip 2, but spaced from it by a Collar 85 on the shank of the securing Bolt.

At this point, the transmission to the rear axle can be completed. A 1½ in. Rod is held, by a ½ in. Pinion 86 and a Universal Coupling 87, in the boss of Double Arm Crank 80. Pinion 86 meshes with Contrate 74, while Universal Coupling 87 is connected by a 2½ in. Rod to another Universal Coupling 88 on the output shaft of the gearbox.

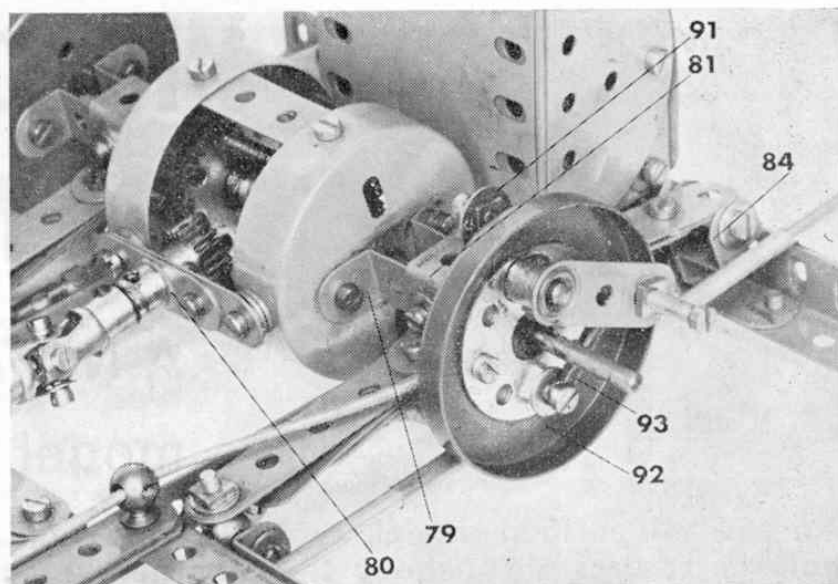
At the rear of the model, a petrol tank is obtained from two vertically-mounted 2½ in. Angle Girders joined at the top by another, similar, Angle Girder. Bolted to their lower ends are two horizontally mounted 1½ in. Angle Girders joined by a 2½ × 1½ in. Flanged Plate 89. The front of the tank is then enclosed by a 2½ × 2½ in. Flexible Plate, while the back is covered by a 3½ × 2½ in. Flexible Plate and each side by a Semi-circular Plate. The finished item is attached to Strips 2 by a 2½ × ½ in. Double Angle Strip 90.

Working brake

The rear wheels are 4½ in. Road Wheels bolted to Wheel Flanges, but, before they are fitted, a special working brake is added to the nearside rear wheel. A Fishplate 91 is fixed on a Threaded Pin which is then journaled in Wheel Flange 92, being held by a Crank, to the arm of which a ¾ in. Bolt is secured by two Nuts. Attached to this bolt and to a ¾ in. Bolt held by Nuts in the lowest hole of the Wheel Flange is a tensioning spring 93, obtained from a short length of Spring Cord.

A rather ingenious cable brake is now built up from a 10 in. length of Spring Cord, through the centre of which a length of thin wire is threaded. The cable is then mounted in two Handrail Supports, fixed to appropriate Angle Girder 7, and in a Collar mounted on the Bolt securing forward Double Angle Strip 79 to Wheel Flange 92. It is important to remember, how-

Fitted to the Motor Chassis is a working cable brake. In this view, the rear near-side wheel has been removed to show the construction of the brake mechanism.



ever, that the Grub Screws securing the cable must grip only the Spring Cord and not depress the Cord so as to foul the wire in the centre.

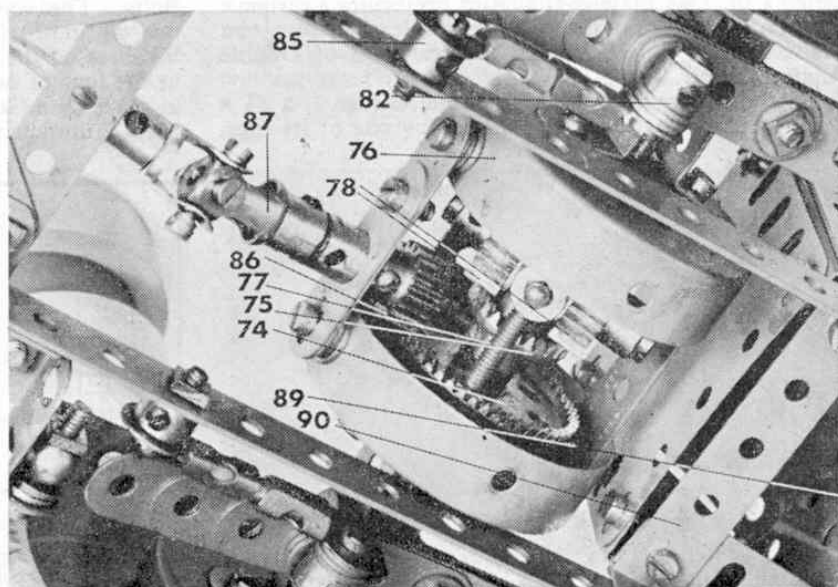
Finally, the ends of the wire are looped, then one end is secured to a Bolt held by Nuts in Fishplate 91, while the other is fixed to a $\frac{1}{2}$ in. Bolt screwed into a Collar 94. This Collar is mounted on one end of a 3 in. Rod journalled in Angle Girders 1 and held in place at its other end by a Crank 96. A Fishplate is attached to the arm of this Crank by an Angle Bracket to act as a brake pedal. Note that extended bearings for the Rod are provided by two $1\frac{1}{2}$ in. Strips bolted one to each Angle Girder 1.

As mentioned at the beginning of this article, the motor chassis described here was built specially for display purpose. When on show, it was mounted on a wooden plinth inside which a slow-running electric motor was fixed. The motor was connected by Sprocket Chain to Sprocket Wheel 24 so that all the mechanisms were shown to be in "working" trim.

PARTS REQUIRED:

2-1	1-16a	3-63	2-140
5-1b	2-17	2-63d	2-147a
3-2	7-18a	1-64	2-147b
10-2a	4-18b	2-72	3-154a
2-3	1-20	1-77	2-154b
32-5	2-22	2-81	1-155
9-6	2-23a	3-82	2-162a
12-6a	6-25	1-89	1-163
2-8	4-26	2-90a	2-164
5-8b	1-28	1-96	2-175
9-9d	2-29	2-103d	2-179
9-9f	150-37	2-103h	1-185a
11-10	70-38	4-111	1-186a
6-11	2-45	4-111a	4-187b
13-12	1-46	8-111c	1-190
4-12a	6-48	1-115	1-190a
8-12b	1-48a	2-115a	10-212
2-12c	2-48b	4-116	2-212a
1-13	3-51	2-120b	2-213
1-13a	1-58	2-125	2-213a
1-15a	24-59	8-133a	2-214
2-15b	4-62	6-136	2-215
6-16	2-62b		

Approx. 2 n. of thin wire



An underside view of the rear suspension and differential in close-up. The differential is a fairly standard Meccano construction and could be fitted as a complete unit into many model vehicles.