MECCANO® Magazine

MARCH 1968 VOLUME 53 NUMBER 3

Meccano Magazine, founded 1916.

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FRONT COVER

An impression by Artist Laurie Bagley of the Caledonian Railway 4-2-2 No. 123 at full speed during the Railway Races of the last century, in which it worked trains between Carlisle and Aberdeen. The story of the Races appears on pages 128 and 129 of this issue.

NEXT MONTH

Full-size plans of Craig Breedlove's "Spirit of America," jet-powered, record-holding car for Jetex 50c operation, and half-size plans for an all balsa kite. Trackside Construction continues with a closed footbridge from Plasticard—again with full-size drawings; the A.B.C. of Railways describes the track terms and usage. For full-size railway fans we visit Britain's New Railway, the 25,000 volt L.M.R. electric system. Several interesting new Meccano models and Dinky Toy news, together with a simple Radio Receiver and Home Chemistry, make this an issue you can't afford to miss. The Exhibition pictures alone will make you want to treasure this issue.

Advertisement and Subscription Offices: Model Aeronautical Press Limited, 13-35 Bridge Street, Hemel Hempstead, Hertfordshire. Tel: Hemel Hempstead 2501-2-3.

Direct Subscription rate 35/- per annum. U.S.A. and Canada direct subscription rate $5 including current index.

Publishers of Aeromodeller, Model Boats, Model Cars, Model Engineer, Radio Control Models, Model Railway News.

MODEL AERONAUTICAL PRESS LTD.

13-35 BRIDGE STREET, HEMEL HEMPSTEAD, HERTFORDSHIRE

CONTENTS

WORKBENCH 127
News and Views by the Editor

RAILWAY RACES 128
A tale of speed and steam 70 years ago

AIR NEWS 130
John W. R. Taylor on Aviation

BABY DELTA 132
A twin "Jetex" powered Powerboat Racer, semi-scale

CATS ON STAMPS 135
James A. Mackay describes Stamps on a Theme

SIMPLE HOME CHEMISTRY 136
Concluding the Identification of Metals

SOLAR ENERGY 138
Man's efforts to harness the sun's power

PUSHAIR 140
A simple rubber-powered, free flight aircraft

TRACKSIDE CONSTRUCTION 143
Constructing an OO gauge signal box

MECCANO MOTOR CHASSIS 146
An advanced model for experienced constructors

GREAT ENGINEERS 153
No. 2. Marconi

MECCANO LINE PATTERN MACHINE 154
Another in the Meccanograph Series

MECCANO DIDDY DUMPER 156
An Outfit No. 4 model

AMONG THE MODEL BUILDERS 158
Meccano Model News from readers

SPECTRUM IS HERE 162
The latest Dinky Release from Captain Scarlet

FORD ESCORT FOR DINKY 163
A Dinky model of the new Ford Escort

HYDROPLANE RACING 164
An insight into Real Power Boat Racing

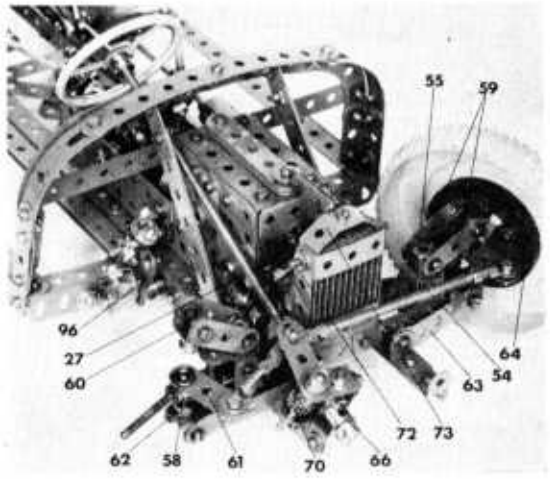
ELECTRONIC PHOTOSWITCH 165
Improving your Photoswitch

A.B.C. OF RAILWAYS 166
Passenger Rolling Stock

TABLE TOP BATTLES 168
ROCO Minitank Conversions

MONTE CARLO MINIS 170
The story of the "Fastest" fast Mini

THE COASTAL TRADE 172
Some of the New and Past Generation Coastal Ships



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 12½ in. Angle Girder 1, extended eleven holes by a 12½ in. Strip 2. Girders 1 are connected by a 2½ 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 2½ × 1 in. Double Angle Strip, to which a 7½ in. Angle Girder 5, overlayed by a 7½ in. Strip, is bolted.

Two rectangular arrangements are now each produced from two 2½ in. Angle Girders 6 and two 7½ 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 7½ in. Girders first overlayed by 7½ in. Strips. Bolted to each outside Girder 7 are a 7½ in. Strip 8 and a 2½ in. Strip 9, the latter extended by a Formed Slotted Strip 10. Strips 10 at each side are joined by a 5½ in. Strip 11. A 1½ in. Angle Girder, extended by a 2½ in. Stepped Curved Strip 12, is bolted to the inside of each Strip 9, then Curved Strips 12 are joined by a 7½ in. Curved Strip 13, attached to the centre of Strip 11 by an Angle Bracket, and by a compound 7½ in. strip 14, built up from two 4½ in. Strips. Two 5 in. supports, bolted one to each Angle Girder 1, are obtained from two 4½ in. Strips and are attached to Curved Strip 13 by Angle Brackets.

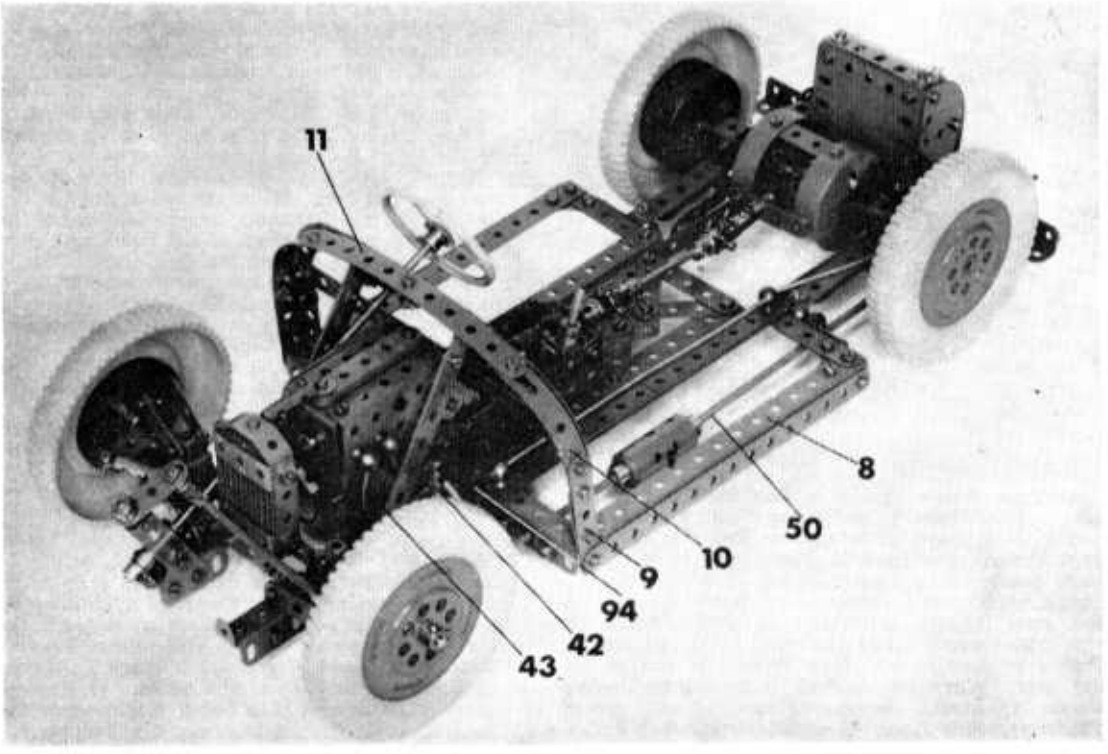
"Engine," clutch and gear box

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 2½ × 1½ in. Flanged Plates 15 are connected by two 2½ in. Angle Girders 16 and six 2½ in. Strips 17, placed one on top of the other. Bolted to the vertical flanges of the Angle Girders are two 2½ × 2½ 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 3½ × ½ 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 1½ in. Flat Girder 21, overlayed by a 1½ in. Strip. A 3½ in. Flat Girder 22 is bolted to the body of each Double Angle Strip.

Journalled in Flanged Plates 15 is a 3½ in. Rod, held in place by a Collar and a ½ 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 3½ 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 1½ in. Rod is fixed. Loose on this Rod and spaced from the Coupling by two Washers is a ½ 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 1½ × ½ in. Double Angle Strip 28, overlayed by a 1½ in. Flat Girder, and bolted, along with a 1 × ½ 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 1½ 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-

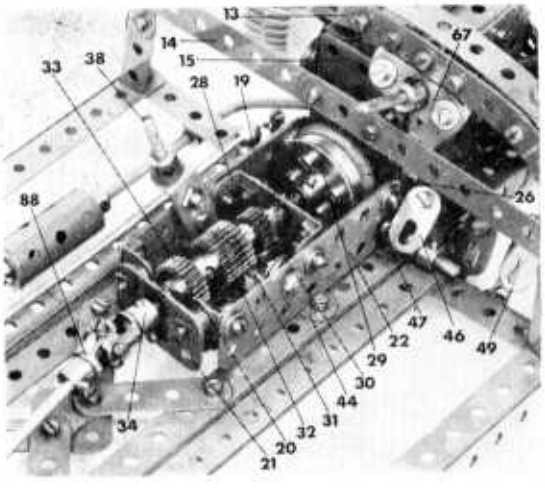


Originally built as a special display model, this Meccano Motor Chassis incorporates all the major features of a real-life motor chassis: steering, suspension, clutch, gear box and differential.

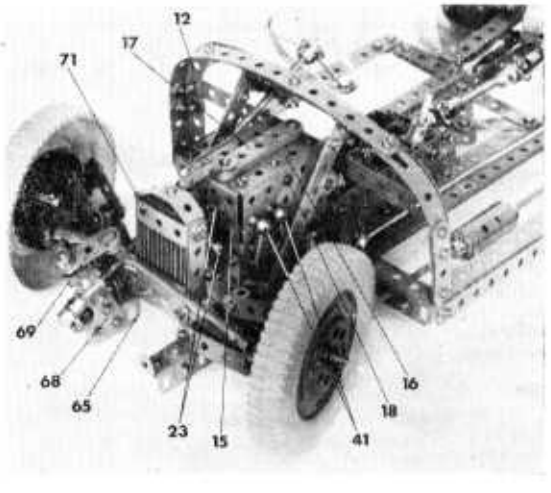
drawn. A Compression Spring on the Rod, between the Flanged Wheel and Double Angle Strip 28, keeps the Wheel in constant contact with the Rubber Ring.

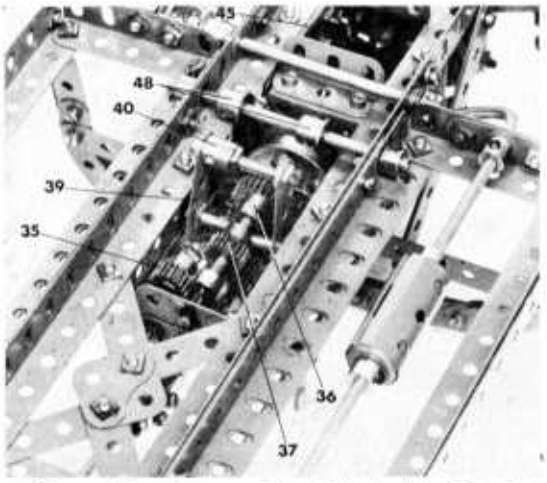
Also mounted on the 2 in. Rod, inside Double Angle Strip 28, is a ½ in. Pinion 30 and a ¾ in. Pinion 31, the latter so positioned that the end of the Rod is inserted in only half the bore of the Pinion. Inserted in the remaining half of its bore is another 2 in. Rod, journalled in Flat Girder 21, that carries two ¾ 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 × $\frac{1}{2}$ 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 × $\frac{1}{2}$ 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.

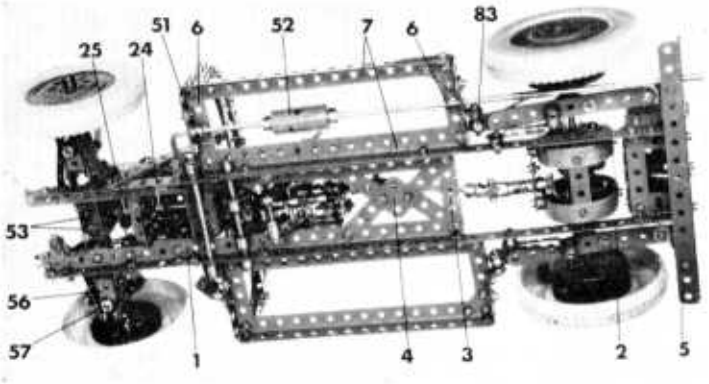
An exhaust system is built up from an $11\frac{1}{2}$ in. Rod 50, bent to shape and held in a Crank 51 bolted to appropriate Angle Girder 6. Mounted on this Rod is a silencer represented by two Chimney Adaptors, each held by two Collars, joined by a Sleeve Piece 52. The Rod is extended rearwards, via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

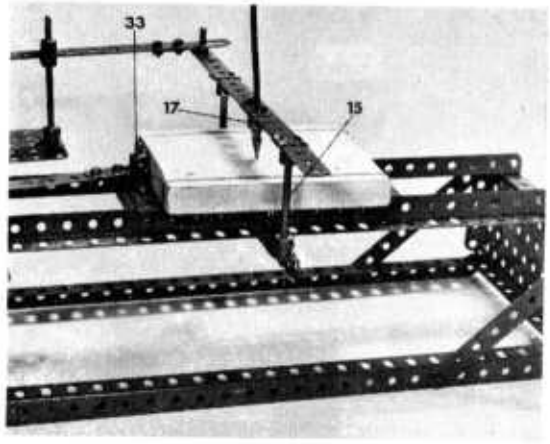
Two Bolts, on each of which a $1\frac{1}{2}$ in. Strip 59 is loosely held by a Nut, are screwed into opposite tapped bores of Rod Socket 55. The Nuts will allow the Bolts to be fixed tight in the bores while still allowing movement of the $1\frac{1}{2}$ in. Strips, the free ends of which are lock-nutted 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.



Angle Girder; then the compound girders are connected at one end by a 5½ in. Angle Girder 2 and at the other by a 5½ × 2½ in. Flanged Plate 3.

Bolted to each Girder 1, as shown, are two 7½ in. Angle Girders 4, joined at the top by a 4½ in. Angle Girder 5 and, six holes down, by a 4½ in. Strip 6. The centres of Girder 5 and Strip 6 at one side are joined by a 3 in. Strip 7, Girders 5 at each side then being connected by a 5½ × ½ in. Double Angle Strip 8 while Strips 6 are connected by another, similar, Double Angle Strip 9

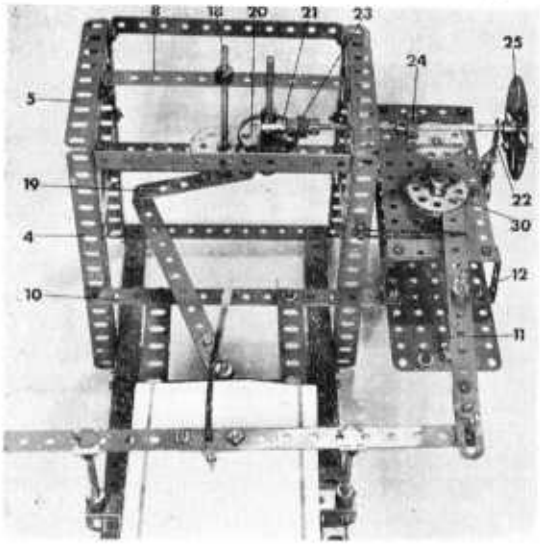
Bolted between opposite Girders 4 at each side are two 5½ × ½ in. Double Angle Strips and two 9½ in. Angle Girders 10 which project a distance of six holes in one direction only. Attached to the projecting part of these Girders is a 7½ × 2½ in. compound flat plate 11, obtained from two 4½ × 2½ in. Flat Plates. The Bolts securing the plate to the Angle Girders also fix in place four 1½ × ½ in. Double Angle Strips 12, the upper lugs of which provide anchoring points for a 5½ × 2½ in. Flat Plate 13. Inside Angle Girder 10 is

VARIABLE LINE PATTERN MACHINE

Another in the Meccanograph machine series by SPANNER

IN MECCANO Magazine over the years we have featured various types of designing machines. These have included straight-forward "Meccanographs," producing completely circular patterns, and even a more complicated "Spiralograph" where the chosen pattern spirals to the centre of the material on which it is being drawn. Thanks to Mr. H. Revvar we are now able to expand the series with an interesting model which I have titled a "Variable Line Pattern Machine." Although this may sound rather complicated, it is, in fact, a machine that draws "wavy" lines, but, before you dismiss it as being beneath your interest, let me say that with skill and practice, some very intricate designs can be produced.

To get down to actual construction, however, two 17 in. compound angle girders 1 are each built up from a 12½ in. Angle Girder extended nine holes by a 5½ in.



joined to Flanged Plate 3 by two 12½ in. Angle Girders 14, bracing between the Plate and Girders being supplied by two 4½ in. Strips.

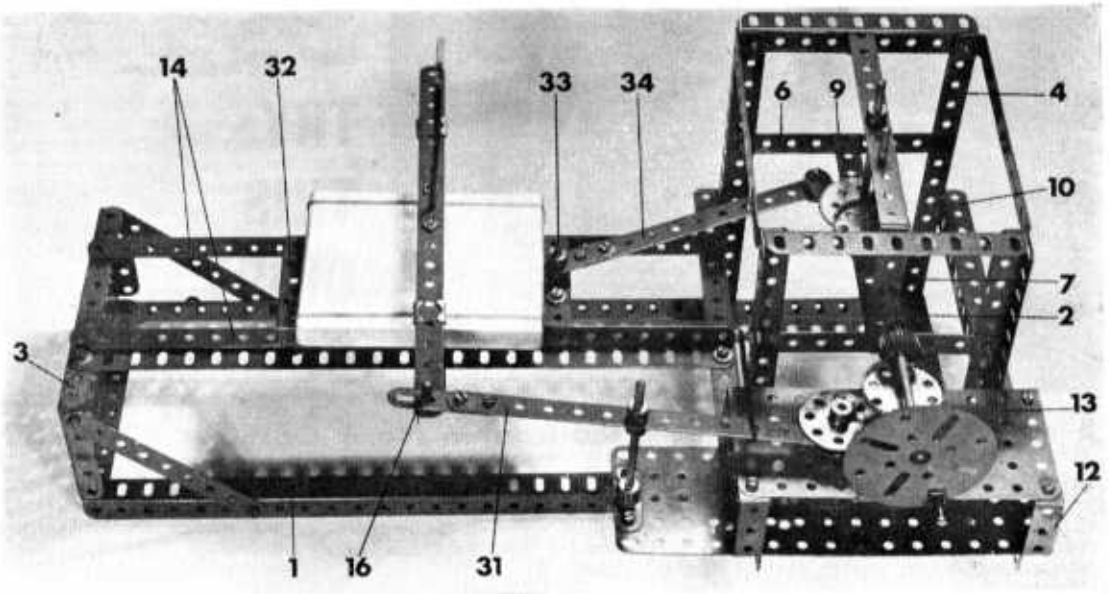
Having dealt with the general framework, we now come to the pen arm mounting. A 5½ in. Angle Girder is fixed to Girders 14, through their fourteenth holes, by ⅜ in. Bolts, two Washers on the shank of each Bolt serving as spacers between the Girders. Two Rod Sockets, carrying 2½ in. Rods 15, are fixed one in each end hole of the 5½ in. Girder, then a Slide Piece is mounted on the top of each Rod. Held in these Slide Pieces is a 9½ in. Strip in one end hole of which a Threaded Pin 16 is fixed and to the underside of which is bolted a Double Arm Crank 17, its boss coinciding with the eleventh hole in the Strip, counting from the Threaded Pin end.

Gearing and drive

As this model is hand-driven, we are saved any complications involved in fitting a motor, but a fairly detailed gearing system must still be included to convert the single input drive to the two output movements, one controlling the work-table and the other the pen arm. A 4 in. Rod 18, carrying a 60-teeth Gear is journalled in Double Angle Strips 8 and 9, being held by a Collar and a Double Arm Crank extended by a 3 in. Strip 19. The Gear Wheel meshes with a ½ in. Pinion on a 3½ in. Rod also journalled in Double Angle Strips 8 and 9 and carrying, in addition to the Pinion, a 1½ in. Contrate Wheel 20 and a Short Coupling 21, the latter loose on the Rod, but prevented from rising up it by a Collar.

Free in the longitudinal bore of the Short Coupling is a 5½ in. Rod journalled in one Strip 7 and a 2 in. Strip 22 attached to Flat Plate 13 by a Trunnion. Mounted on the Rod are a ½ in. Pinion 23 in mesh with Contrate 20, a Collar against Strip 7, a ¾ in. Pinion 24 and a Faceplate 25 in which a Threaded Pin is fixed

Above, a close-up view of the pen arm and work table. Spanner used a ball-point refill for the pen which was kept in contact with the work table by a Compression Spring. Left, the "business" end of the machine showing the general layout of the gearing and drive mechanism. Note the Driving Band which keeps the pen arm connecting strip located between Bush Wheels 30.



to serve as a handle. Pinion 24 meshes with another $1\frac{1}{2}$ in. Contrate Wheel on a $3\frac{1}{2}$ in. Rod held by a Collar in Flat Plates 11 and 13. Also mounted on this Rod, between the Plates, are a 50-teeth Gear Wheel 26 and a 1 in. Gear 27, the former engaging with a $\frac{3}{4}$ in. Pinion 28 and the latter with another 1 in. Gear 29, both on a 3 in. Rod, at the top of which two 8-hole Bush Wheels 30 are secured. Note that both Gears 26 and 27 cannot be used to transmit the drive at the same time. One must be loose on its Rod while the other is fixed in mesh. The design of the pattern will, of course, vary according to which Gear is in use.

Engaging between Bush Wheels 30 is a $7\frac{1}{2}$ in. Strip 31, extended by a 2 in. Slotted Strip and pivotally held by Collars on a 3 in. Rod mounted in the boss of a Double Arm Crank bolted to compound flat plate 11. Threaded Pin 16 engages in the slot of the Slotted Strip. Bolts are inserted in the holes in the faces of Bush Wheels 30 and Strip 31 is held against these by the tensioning action of a $2\frac{1}{2}$ in. Driving Band slipped over both the Strip and a $\frac{3}{8}$ in. Bolt held by Nuts in nearby Girder 4. Alterations in the movement of the pen arm are effected by changing the number and positions of the Bolts in Bush Wheels 30.

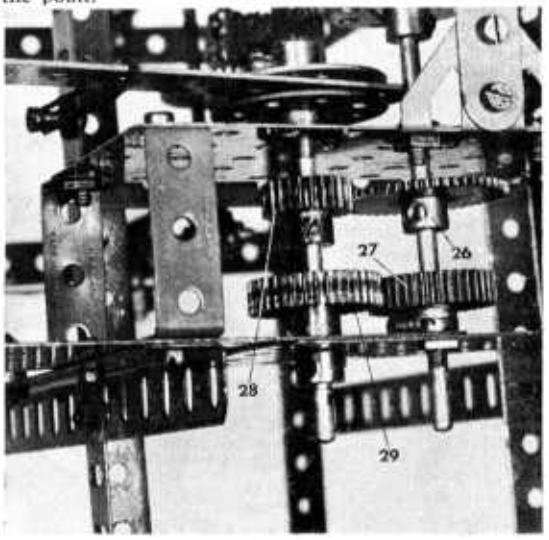
PARTS REQUIRED

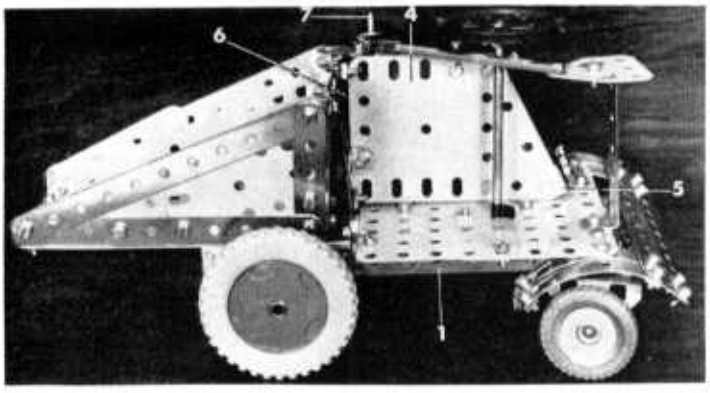
1	—	1a	2	—	17	2	—	50
1	—	1b	2	—	18b	2	—	52
1	—	2	2	—	24	2	—	53a
4	—	2a	2	—	25	1	—	55a
2	—	4	1	—	26	9	—	59
1	—	6	1	—	26c	4	—	62b
4	—	8	1	—	27	1	—	63d
2	—	8a	1	—	27a	1	—	70
4	—	8b	2	—	28	1	—	109
4	—	9	2	—	31	3	—	111c
2	—	9a	70	—	37a	3	—	115
1	—	14a	62	—	37b	4	—	125
1	—	15b	30	—	38	1	—	126
2	—	16	4	—	48	2	—	179
2	—	16b	4	—	48d	1		186

Above, a general view of the completed Variable Line Pattern Machine for producing " wavyline " designs. Right, a close-up view showing the gearing transferring the drive to the pen arm oscillator cam. Note that Gear 27 must be left free on its rod when Gear 26 is in mesh with Pinion 28, and vice versa.

We are now left with the work-table which consists of a block of wood approximately $4\frac{1}{2}$ in. long by $3\frac{3}{4}$ in. wide by $\frac{1}{2}$ in. thick, to the underside of which a $5\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate 32 is fixed with small wood screws. The Flanged Plate slides on the vertical flanges of Angle Girders 14, four guides being provided by four Reversed Angle Brackets beneath the Plate. Bolted to the top of the Flanged Plate, at one end, is a Double Arm Crank in the boss of which a 1 in. Rod 33 is held. This Rod is connected to a Threaded Pin fixed in the end of Strip 19 by a 6 in. compound strip 34, obtained from a $1\frac{1}{2}$ in. and a $5\frac{1}{2}$ in. Strip, Collars holding the strip in place.

Finally, the marking instrument (we used a ball-point pen refill) is carried loose in the boss of Double Arm Crank 17, the point being held against the work-table by a Compression Spring between the Crank and the point.





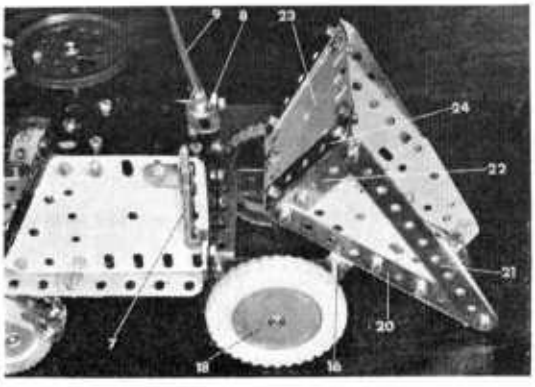
An interesting model of a Dumper Truck built with Meccano Outfit No. 4. Features include simple working steering and a tipping hopper.

TRY THIS DIDDY DUMPER

A model that can be constructed from a No. 4 Outfit by SPANNER

BUILDING SITES—you either like 'em or loath 'em! To some people a building site means nothing more than an ugly, unfinished structure surrounded by dirt, mud, and sprawling piles of junk. It means snarling machines, bangs, crashes, raucous shouts; in short, a maelstrom of jarring noise, muck and confusion. To other people, however, a building site means something altogether different. They see a place of mystery, activity and fascination. What's going on behind that high protective fence surrounding the site? Exactly what are they building? How far have they advanced? They see people scurrying about their allotted tasks; wagons coming and going with material; cranes and excavators hauling and dumping; in short they see the fascinating sight of men and machines turning what might have been an empty plot into what may turn out to be a soaring great wonder of civil engineering!

Whichever way you look at them, there's no getting away from the fact that building sites contain a wealth of material for the Meccano modeller on the look-out for subjects to reproduce. Just reflect for a moment on the enormous variety of equipment to be found on a typical site. Tower cranes, compressor units, bulldozers, excavators, concrete-mixers and dumper trucks are some of the things that immediately spring to mind, and each one of them lends itself ideally to reproduction in Meccano—almost as though it were designed for the job! Much as I would like to, I am quite unable to feature an example of every such type of machine here, but I have plenty of room for one of them. Which one? Obviously the small or, to use a currently favourable term, "diddy" (with apologies to Ken Dodd) Dumper illustrated in the accompanying pictures. If you decide to try it, all you require is a bit of spare time and Outfit No. 4.



In this view of the Dumper, the hopper is shown in the "dumping" position. The hopper is held in the travelling position by a lever operated from the cab.

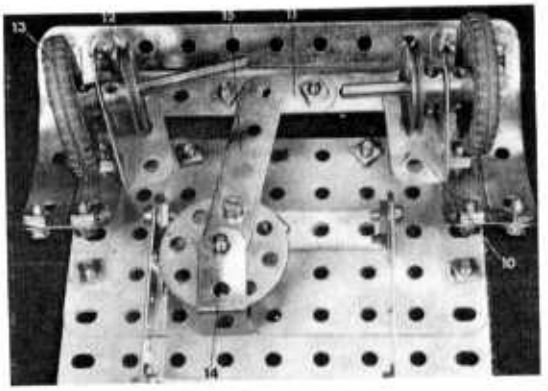
Chassis

It is best to begin construction with the chassis. Two $5\frac{1}{2}$ in. Strips 1 are connected by three $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 2, to the foremost two of which is bolted a $4\frac{1}{2} \times 4$ in. compound flat plate 3 obtained from two $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plates overlapped two holes. Before going any further, however, the engine housing should be added, being difficult to fit at a later stage. Each side of the housing consists of a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 4, extended by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plate, and the sides are joined by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 5, to which are bolted two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Plastic Plates, themselves joined by an Obtuse Angle Bracket. Fixed by one flange to the front end of the upper Plate is a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate to which a $4\frac{1}{2} \times 2\frac{1}{2}$ in. compound plastic plate 6 is bolted. Obtained from two $2\frac{1}{2} \times 2\frac{1}{2}$ in. Plastic Plates, this compound plate is also attached to Flexible Plates 4 by Angle Brackets. An exhaust pipe is represented by a 2 in. Rod 7 carried in a right-angled Rod and Strip Connector bolted to one Plate 4.

Before fixing the completed housing in place, it is advisable to fit the catch which will later hold the hopper in the travelling position. It consists of a Rod and Strip Connector 8, extended by a Fishplate, lock-nutted to the upper $2\frac{1}{2} \times 1\frac{1}{2}$ in. Plastic Plate. A $3\frac{1}{2}$ in. Rod 9 is held in the Rod and Strip Connector. When this has been done, the housing is fixed to compound flat plate 3 by an Obtuse Angle Bracket, bolted to Double Angle Strip 5, and the lower flange of the above-mentioned $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate, compound plastic plate 6 also being connected to compound flat plate 3, in this case by an ordinary Angle Bracket.

At this stage, the steering system can be added to the model. Two Double Brackets are bolted to the underside of compound plate 3, then a Trunnion 10 is lock-nutted to the free lugs of each of these. The Trunnions are connected by a compound $3\frac{1}{2}$ in. strip 11, built up from two $2\frac{1}{2}$ in. Strips, which is lock-nutted in position. Journalled in the apex holes of one Trunnion is a 2 in. Rod carrying a 1 in. Pulley 12 and

A close-up view of the simple steering arrangement controlled by a 2½ in. Strip bolted to a Bush Wheel on the lower end of the steering column.



a 1 in. Pulley with Motor Tyre 13, while similar parts are mounted on a 1½ in. Rod journalled in the apex hole of the other Trunnion.

Serving as the steering column is a 4 in. Rod journalled in compound plate 3 and in a 1 × 1 in. Double Bracket 14 bolted to the underside of the plate. Mounted on the Rod between the lugs of this Double Bracket is an 8-hole Bush Wheel, a Spring Clip being fixed on the Rod above the plate. Bolted to the Bush Wheel is a 2½ in. Strip 15, the other end of which is located between the shanks of two Bolts held by Nuts in compound strip 11. The steering wheel is represented by a 2 in. Pulley.

At the rear of the chassis, a 2½ in. Stepped Curved Strip 16 is attached to each Strip 1, being held in position at the back by a 3½ in. Rod 17, fixed by Spring Clips. This Rod will later form the hopper pivot. Journalled in the centre holes of Curved Strips 16 is a 4 in. Rod on the ends of which 2½ in. Road Wheels 18 are mounted.

Turning now to the hopper, this is built up from two 4½ × 2½ in. Flexible Plates overlapped eight holes to form a 5 × 2½ in. compound plate 19. Bolted to the rear end of this is a 2½ × ½ in. Double Angle Strip to each lug of which is fixed a 2½ × 1½ in. Triangular Flexible Plate edged by a 5½ in. Strip 20 and a compound 5 in. strip 21 obtained from a 3½ in. and a 2½ in. Strip. Strips 20 and 21 are then joined by a 2½ in. Strip 22 and the intervening space is filled in by a 2½ × 1½ in. Flexible Plate.

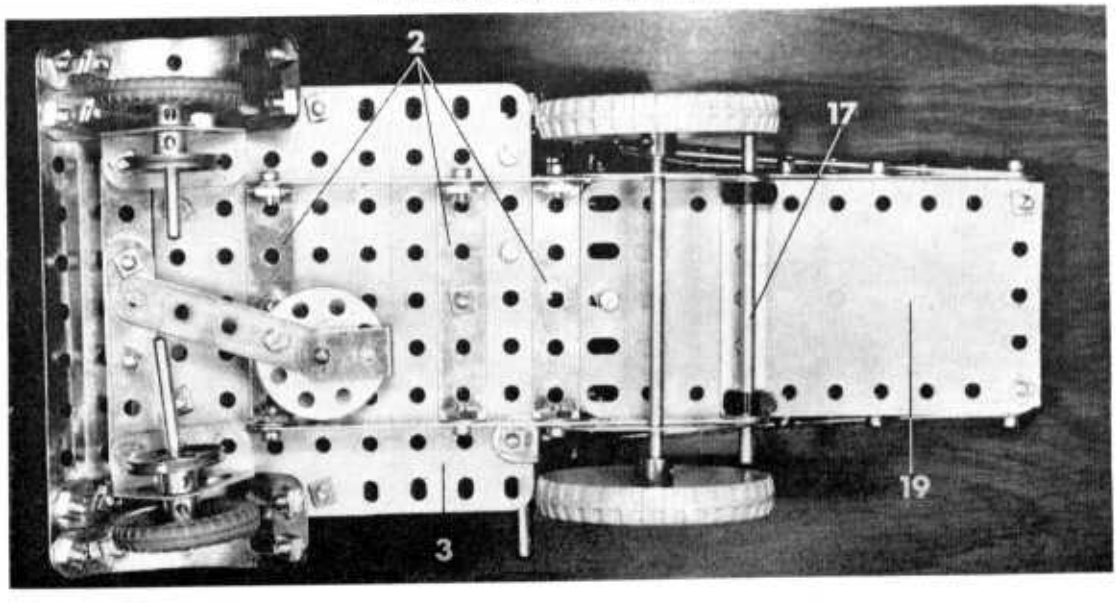
The back of the hopper consists of a 2½ × 2½ in. Flexible Plate 23 attached to Strip 21 at each side by an Angle Bracket and to Strip 20 by an Angle Bracket extended by a Fishplate, at the same time fixing a 2½ in. Strip 24 in position. A 2½ × ½ in. Double Angle Strip is bolted to the underside of Plate 19, this then being mounted on Rod 17.

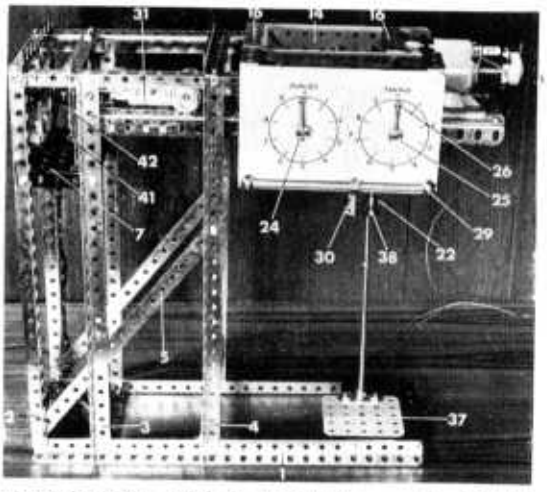
Finally, front mudguards are each provided by two Formed Slotted Strips 25, connected by a Fishplate, the inside Strip being bolted to compound flat plate 3. Both mudguards are then joined by two 5½ in. Strips 26, as shown, and a seat is obtained from a Flat Trunnion 27, attached to compound plate 3 by a 2½ × ½ in. Double Angle Strip.

PARTS REQUIRED

6—2	4—22	2—126
2—3	1—24	1—126a
9—5	3—35	2—142c
5—10	94—37a	2—187
2—11	84—37b	2—188
1—11a	3—38	3—190
10—12	1—48	2—191
2—12c	6—48a	2—194
2—15b	1—51	2—194a
2—16	2—53a	1—212
1—17	3—90a	1—212a
1—18a	6—111c	4—215
1—20a	1—125	4—221

An underside view of the Dumper showing the layout of the chassis. Note that the rearmost 2½ x ½ in. Double Angle Strip is not bolted to the main chassis members.





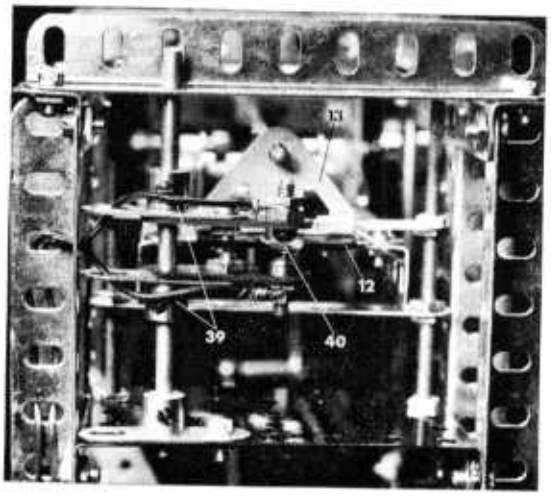
Among the Model Builders with SPANNER

A Weighing Machine with a Self-Balancing Steelyard by Ron Fail

Designed by Mr. Ron Fail of Bedford, this amazingly accurate Weighing Machine has the unique feature of a self-balancing steelyard or "weighbeam." The self-balancing action is controlled by a Power Drive Unit.

TRADITION HAS it that "Among the Model-Builders" be devoted to several items supplied by, or of interest to, readers. Traditions, however, can be broken from time to time, and this month I intend to do just that by devoting the entire article to one complete model designed by a reader, Mr. Ron Fail of Bedford. The model in question is a Weighing Machine; not an unusual Meccano subject in itself, but unique in this case in having a self-balancing steelyard! The steelyard, of course, is the balancing arm that carries the object to be weighed as well as the movable counterweight.

Mr. Fail is an extremely capable modeller who has the proven ability not only to design new models, but to design new models that are realistically useful. Already we have featured a superb Self-winding Clock produced by him and, having myself built his Weighing Machine, I can guarantee that its technical excellence is well up to standard. The model, in fact, gives a highly accurate reading once the exact weight of the counterweight has been determined, but it is important to remember that the counterweight is critical. When building the model, incidentally, study the photographs to see where elongated holes and where circular holes are used in the Girders.



The electrical system fitted to the model is extremely simple, as this picture shows. Besides the spacing of the contacts, the only essential thing to remember is that the Contact Screws must be isolated from the metal parts of the model. This is done by fixing them to 1½ in. Insulating Strips.

Mainframe

To get down to business, the mainframe is built up from two 3½ × 2½ in. Flanged Plates joined by two 12½ in. Angle Girders 1. Another three 12½ in. Angle Girders 2, 3 and 4 are then bolted to each Girder 1 through its first, fifth and twelfth holes respectively, then a 9½ in. Strip 5 is fixed, as shown, between Girders 2 and 4 for bracing purposes. At the top, Girders 2, 3 and 4 are connected by a 9½ in. Angle Girder 6.

Bolted to Girders 2 and 3 at each side is a third 3½ × 2½ in. Flanged Plate 7, the securing Bolts passing through the seventh holes from the tops of the Girders while Girders 6 are joined by two 4½ in. Angle Girders 8 and a 4½ in. Strip 9. Girders 4 at each side are braced by a 9½ in. Strip, as shown.

Mainframe

The steelyard or weighbeam is the most complicated section of the model. Two 12½ in. Angle Girders 10 are connected at one end by a 2½ × 2½ in. Flat Plate 11 and, at the other by a 2½ in. Strip to which are bolted a 1½ in. Insulating Flat Girder 12 (Electrikit Part No. 508) and a Trunnion 13. Now fixed to one Girder 10 is a 5½ × 2½ in. Flat Plate 14, so positioned that the end of the Girder protrudes a distance of four holes past the Plate. Fixed in a similar position on the other Girder 10 is a 5½ × 3½ in. Flat Plate 15, the Plate protruding a distance of two holes beneath the Girder. The securing Bolts in both these Plates should be at the upper limits of the elongated holes in the Girders. The Plates, themselves, are joined by two 2½ × ½ in. Double Angle Strips 16. Another Double Angle Strip 17 is also bolted between the Flat Plates, one lug coinciding with the centre hole in Plate 14.

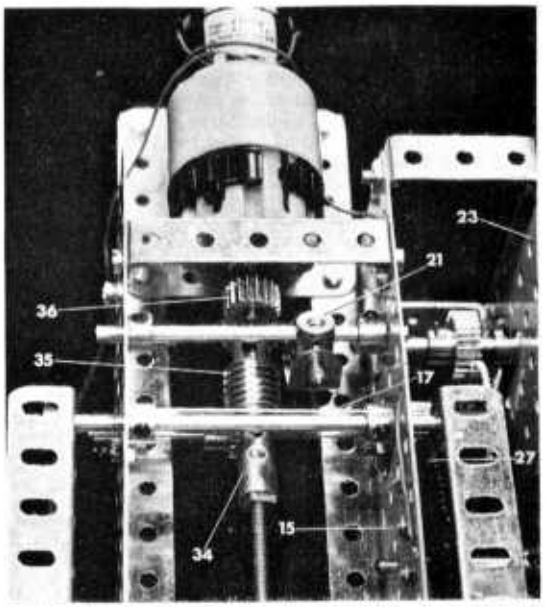
Journalled in Plates 14 and 15 is a 4 in. Rod 18 carrying a ½ in. Pinion between the Plates and another ½ in. Pininon 19, as well as a 50-teeth Gear Wheel 20, outside Plate 15. Also journalled in the Plates, and held by Collars, is a 3 in. Rod, on which a Short Coupling 21 is mounted. A large Fork Piece, carrying a 3½ in. Rod 22 in its boss, is pivotally attached to the Short Coupling by a 1 in. Rod fixed in one of its transverse bores. The weight pan will later be connected to Rod 22.

At this stage, however, a second 5½ × 3½ in. Flat Plate 23 is attached to Plate 15 by four 1½ × ½ in. Double Angle Strips, one at each corner. Mounted in these two Plates are two 2 in. Rods 24 and 25, both held in place by two Collars fixed one each side of Plate 23, each Collar carrying a ¾ in. Bolt 26 in one tapped bore. The Bolt in the outside Collar will serve as a pointer, while that on the inside is to counterweight it and so must point in an exactly opposite direction. In addition to the Collars, Rod 24 carries a 2½ in. Gear Wheel 27, in mesh with Pinion 19, while Rod 25 carries a ¾ in. Pinion 28, in mesh with Gear Wheel 20. Note, incidentally, that the lower Double Angle Strips are fixed to Plate 23, not by Bolts, but by Handrail Supports 29. Mounted in these is a 5½ in. Rod carrying a Collar to which a ½ in. Pulley 30 is attached by a Pivot Bolt to form a zero adjusting weight. The Collar must be able to slide on the Rod.

Next we have the travelling counterweight which consists of eleven 1½ in. Strips and four 1½ × 1½ in. Flat Plates 31, bolted between two 2½ in. Strips. Journalled in one end of these 2½ in. Strips is a 1½ in. Rod carrying two ¾ in. Flanged Wheels 32, each spaced from its Strip by two Washers. Journalled in the other end of the 2½ in. Strips is a 1 in. Rod carrying a Coupling 33, the Rod passing through the lower smooth bore of the Coupling. Screwed into the upper tapped bore of the Coupling is an 8 in. Screwed Rod extended, via a Threaded Coupling 34, by a 2 in. Rod. This is journalled in Double Angle Strip 17, while the Screwed Rod is journalled in the apex hole of Trunnion 13. Flanged Wheels 32, of course, run on Angle Girders 10.

Mounted on the 2 in. Rod are a Worm 35 and a ½ in. Pinion, the former in mesh with the Pinion between Plates 14 and 15 on Rod 18. The latter, on the other hand, is meshed with a ½ in. Pinion 36 on the output shaft of a Power Drive Unit, bolted in the centre of Flat Plate 11. The 12 : 1 ratio should be in use.

The weight pan is provided by a 2½ × 2½ in. Flat Plate 37 to which a Double Arm Crank is bolted. Fixed in the boss of this Crank is a 6½ in. Rod, to the top of which a Handrail Coupling 38 is secured. Another Handrail Coupling is mounted on the lower end of Rod 22, then the two are joined by a 1½ in. Rod.

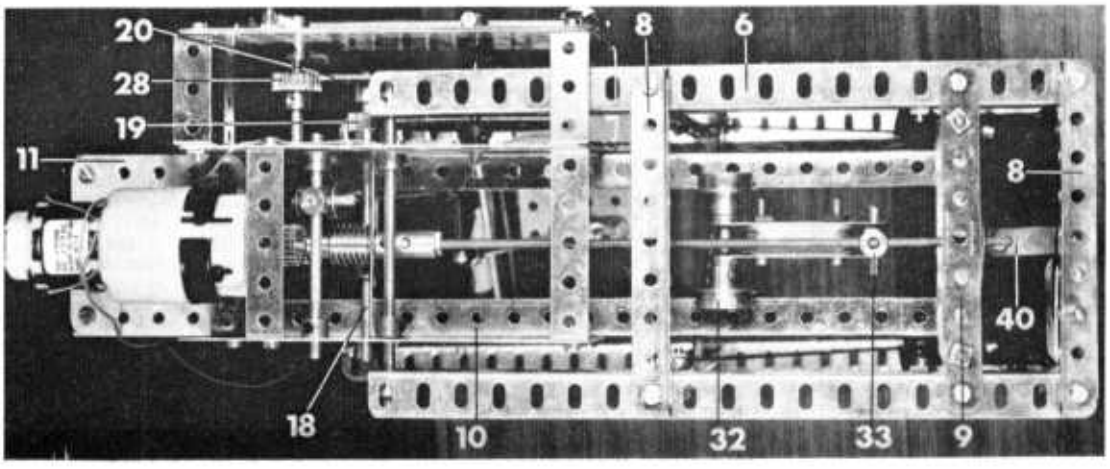


In this close-up view of the motor mounting, the method of transferring the drive both to the travelling counterweight and the weight indicators is clearly shown.

Electrics

You will have realised that the self-balancing action of the model is controlled by the Power Drive Unit, for which an electrical contact system is required. This, I am pleased to say, is not complicated. A 3½ in. Rod is mounted in a Double Arm Crank bolted to Flanged Plate 7. Fixed on the Rod are another two Double Arm Cranks 39, each extended one hole by a 1½ in. Insulating Strip (Electrikit Part No. 503), to which a Contact Screw (Electrikit Part No. 543) is attached. Located between the Contact Screws is a 1 in. Wiper Arm 40 (Electrikit Part No. 531) which is bolted to Insulating Flat Girder 12.

A plan view of the Weighing Machine showing the layout and construction of the steelyard as well as its position in relation to the mainframe.



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 $\frac{1}{8}$ 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 conected 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 though 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

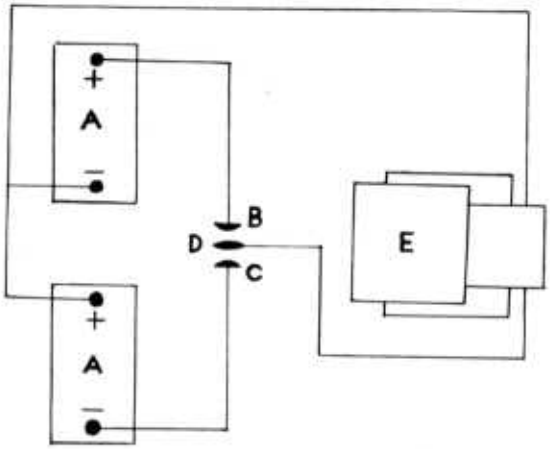
2—1a	2—20b	1—63c
2—1b	1—23a	1—70
2—2a	1—25	2—72
1—3	3—26	4—74
3—5	1—27	1—79
11—6a	1—27c	2—80a
10—8	1—32	6—111
2—8a	75—37a	1—111c
2—9a	96—37b	1—116
2—10	9—38	1—126
1—14	2—38d	1—128
1—14a	4—48	2—136
1—15a	3—48a	2—136a
2—15b	2—52a	1—147b
1—16	3—53	2—503
3—17	12—59	1—508
2—18a	3—62b	1—531
2—18b	1—63	2—543

1 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 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.

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



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 overlayed 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 $\frac{1}{2}$ 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.