NZFMM MAGAZINE

Volume 44, No. 4 November 2020

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- Club activity reports
- Digital motor control

Published by The New Zealand Federation of Meccano Modellers

Volume 44, No. 3
NZ Federation of Meccano Modellers Magazine

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Deadline for Feb issue is 20th January 2021

The NZFMM Magazine is published four times a year in February, May, August and November. The publisher is the NZ Federation of Meccano Modellers. The purpose of the magazine is to publish articles and photographs about Meccano and Meccano models, to report the meetings of New Zealand Meccano Clubs, to print letters expressing the views of Meccano modellers, to keep members informed of future events and to print advertisements of Meccano related things. The views expressed in the magazine are not necessarily those of the editor or of the Federation.

Subscriptions run from April to March & are payable annually in March. If the subscription has not been paid by the 30th of April, the 1st edition of the new subscription year [May/June] will not be released. Subscriptions may be paid by **personal cheque** [in most currencies] or by Bank Draft payable to "**NZFMM Magazine Account"**. Please mail to Peter Hancock, P.O.Box 9125, Bell Block, New Plymouth. **New Zealand**. Please enclose with your payment your: *full name, address, telephone number & email, if available.*
Subscriptions can be made by **funds transfer** from your bank account to the **NZFMM Magazine Bank Account: # 02-0136-0166165-000**. Ensure that you enter in the **"Particulars"** section your *initials or first name*: **"Code"** section, your *family name*: **"Reference"** section, '*2019-2020 sub'*.
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2020/2021 subscription rates:

Within New Zealand: Hard copy mailed: NZ$47.00; Electronic pdf copy NZ$15.
Overseas: Hard copy mailed: AU$50.00; CAN$52.00; USA$40; GB£30; (Euro no longer accepted by NZ banks.)
Overseas: Electronic pdf: AU$15; CAN$15; USA$12; GB£9; **Note**: Euro no longer accepted.
New Zealander's paying for overseas subscribers in NZ$: **Hard copy only mailed O/seas**: NZ$55.
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NZFMM Website:

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From the Editor

Kia ora Meccanomen

Another year has almost slipped away into the great toybox of history, and I daresay that there are not many amongst us who will mourn its passing. Covid did its viral best to disrupt our get-togethers but thanks to technology coupled with the basic human instinct to show off our latest creations Meccano remains alive and well.

This issue sports a masterclass in Meccano crane design from **Les Megget** (*we all wish you a speedy recovery, Les*). Two articles from MWTs **Viv Alexander** explore both the fascinating history of pre-war Meccano, (WW I that is,) together with an unusual take on the politics of Meccano after the re-match twenty years later.

As usual, catch up on what our friends are doing in various parts of the country. On an important note, now is the time to start planning for the **2021 Convention in Waikanae.** Your registration form is included. I note several large scale models are already under construction, so join the throng and let's make this the best Convention ever! **Reg Barlow** and his team have it all in hand and I can promise a very good time will be had by all. The facilities are excellent and without the big city crush all sensible Meccanomen shy away from. But it does need your participation to be a success.

See you there.
Best wishes
Richard

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Smallish-scale Liebherr Mobile Crane

(aka; cramming a lot into a small space)

by Les Megget (AMG)

This 1:20 scale model mobile crane (*Fig.1*) was completed during the first Coronavirus lockdown. It is based on the **Liebherr LTM1090-4.2** prototype, which has a capacity of 90 tonnes. My model began with 3-axles, similar to **Steve Butterworth's** model of a LTM1050-3.1 shown at the 2019 Meccano Skegex exhibition in Skegness, U.K. During lockdown a 4th axle was added with a corresponding length increase to the chassis.

Carrier Transmission:

I wanted to have axles 2, 3 and 4 driven and steered as in the real crane but there is limited space in a crane of this scale. The chassis rails were spaced out to 3½" to allow room for the narrow differentials and the steering universal joints shown in *Fig.2.* I used mini UJs these being only 1" long. A small, geared motor above the clutch and 4-speed and reverse all-pinion gearbox drives through a simple transfer gearbox on the front of axle 3's diff. The underside view of the carrier is shown in Fig.3. The drive is transferred to the differentials through double UJs using helical gear-sets as the crown wheels and pinions. A very simple suspension system is used for each axle, namely a large spring on a vertical axle running through the chassis rails! An H-pattern remote gear stick in the cab selects the correct gear.

Axles 1 and 2 are steered by the cab's steering wheel while the rear axles are steered via a hand-wheel above the passenger's seat (a la *Lego* style; whoops shouldn't use that name). Thus normal eight wheel or crab steering is possible.

Crane:

The crane is supported on the now traditional (**Bert Love** inspired) roller bearing incorporating 6" external diameter circular rings, circular plates and lots of Meccano ball bearings. Just four bolts connect the crane to its carrier.

Slewing: This is accomplished by a geared motor driving a 3:1 set of bevel gears, then a large tooth pinion meshing with a 6" large-tooth gear ring fixed to the top of the carrier, as seen in *Fig.4.*

Boom luffing: Another geared motor in the machinery box on the right hand side of the crane drives a 25-tooth pinion (after a 2:1 reduction), meshing with a small contrate at the base of the boom, seen in *Fig 4*, if you look carefully. The contrate drives a 6mm diameter threaded rod, which moves a large nut and the brass cylinder up the long red cylinder. The large nut is restrained from revolving by narrow strips bolted to the inside of the luffing cylinder. Full luffing takes about 2 minutes, similar timing to the prototype.

Boom construction: The 3-section telescopic boom has outer dimensions of 1½" square using the grey cube brackets seen in *Fig.1*. This allows the boom's second section to slide up the boom without hitting nuts and bolts in the bottom face. The second section uses 1" wide flat girders and is extended by another long 6mm threaded rod driven by a 12V-geared motor clamped in the bottom of section 1. Section 3 (more flat girders) is extended using a cord, while gravity is called upon to contract section 3. The boom-head has three 1" plastic pulleys allowing 6 cable drops to the hook but only a 2-pulley hook was used here.

Fly-jib: I built a fly-jib, which is positioned on the side of the boom as seen in *Fig.5*. To use this jib it must be swung out 180 degrees and connecting rods are used to clamp it in position. An "assembly rig" is used between the boom-head and the fly-jib and this can be used to vary the angle of the fly-jib relative to the boom. NB. A little more cross-bracing is required on the fly-jib to make it structurally sound but don't tell anybody!

Hoists: Small 6V geared motors drive the main and auxiliary hoists, seen in *Fig.6*. All the crane actions are controlled remotely using a control box and 12-wire umbilical cord and mini-switches (forward-off-reverse), which plugs into the rear of the crane.

Counterweights: The real crane uses a series of counterweights, some of which are stored on the engine cover behind the driver's cab. The main weight hangs from the rear of the crane and can be placed in 2 positions to allow greater lifting capacity with the weight in the rearward position. This can be done on the model too. Fig.6 shows the main counterweight in its rearward position. The real crane uses hydraulics to lift and position each counterweight but I was forced to use screwed rods.

Crane driver's cab: This cab can be tilted upwards by 30 degrees for better visibility using a screwed rod (hydraulics in the prototype). The tilting mechanism is visible in *Fig.6*.

Conclusions: I doubt if I could fit any more detail into this model. As it was I was often forced to amend things because of conflicts between parts, often bolt heads hitting something as parts moved around other parts.

Les Megget
AMG

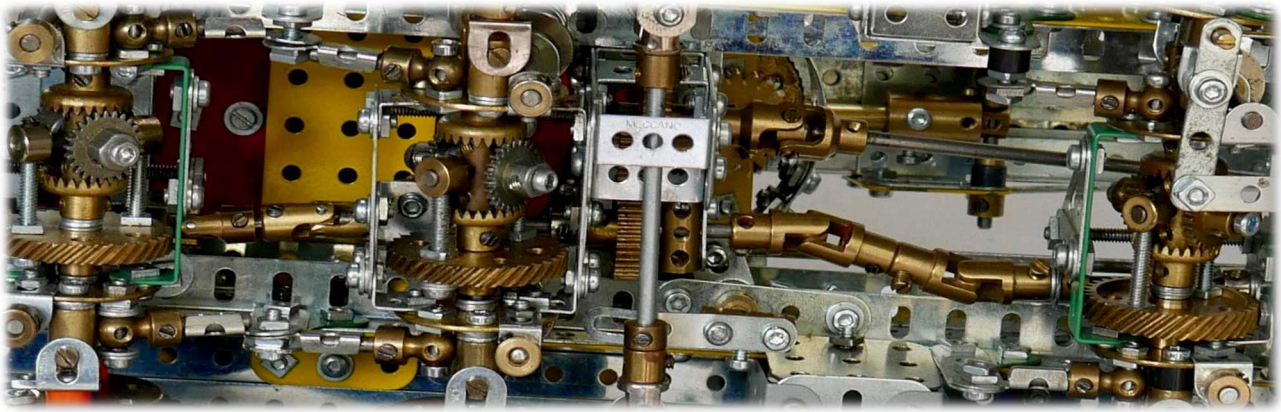


Fig 1

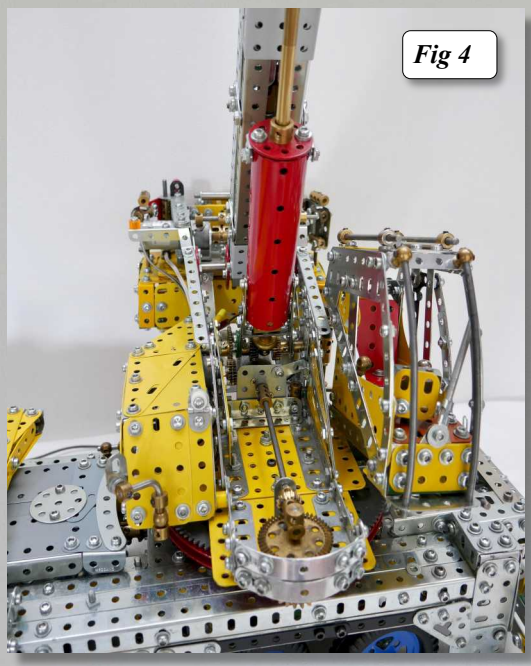


Fig 4

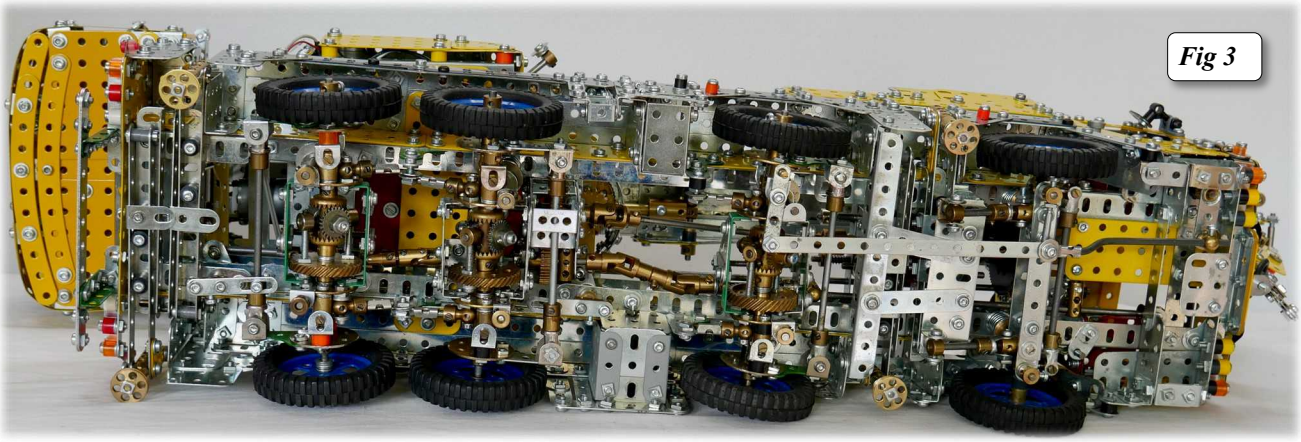


Fig 3


Fig 6

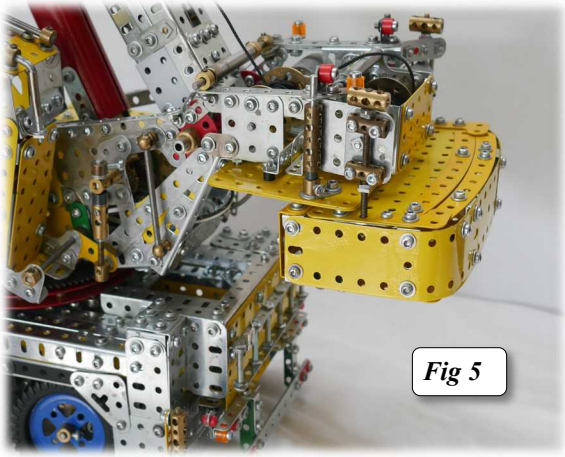


Fig 5

Liebherr LTM1090-4.2

This detailed 1:20 scale model mobile crane was completed by **Les Megget** during the first Coronavirus lockdown. It is based on the **Liebherr LTM1090-4.2** prototype, which has a capacity of 90 tonnes.

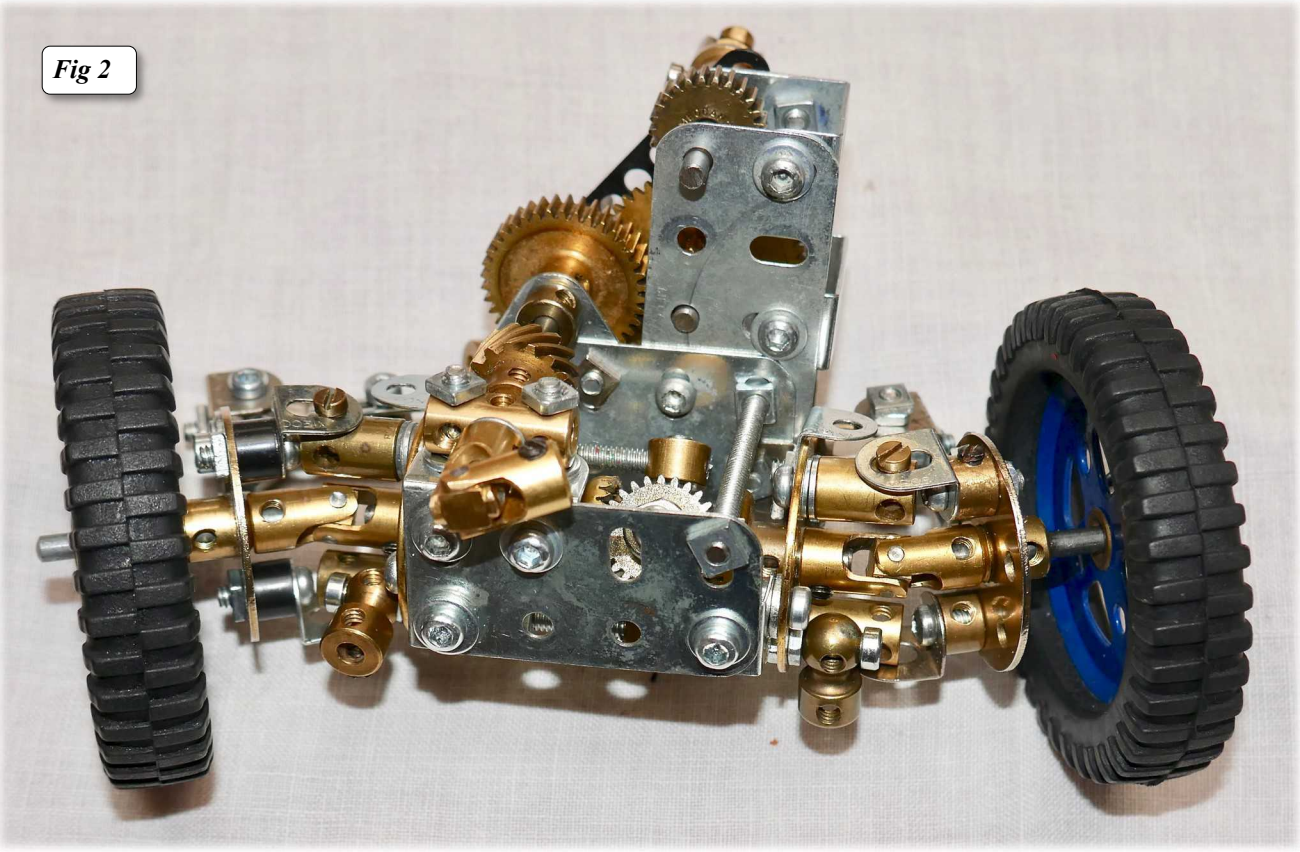


Fig 2

Wellington Meccano Club Newsletter

Reporter – Max George

Meeting Date: Friday 7th August 2020 at 7:30pm at Stan's place Paraparaumu.

Present: Don Flowers, Max George, Paul Roberts, Stephen Westmoreland, Simon Moody, Stan Baker, Trevor Green.

Apologies: Brian Petersen, Lou Nicholls, Reg Barlow.

RailX Taita: As well as Max displaying his Little Joe and Tricky Track, our Club has been invited to display models at the RailX display in Taita in November. So far **Stan Baker, Brian Petersen, Reg Barlow,** and **Stephen Westmoreland** have indicated that they will have models for the display.

Model Building:

The theme for the meeting was a model using a motor.

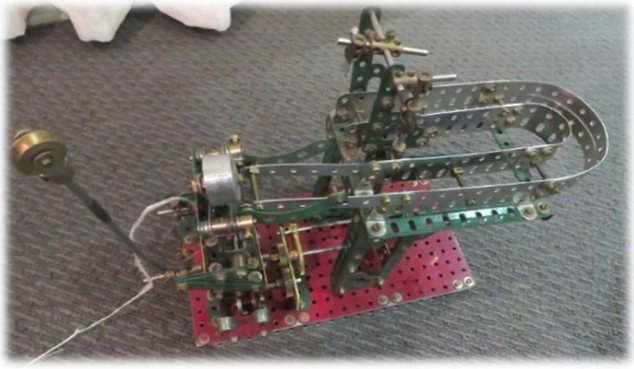
Stan Baker: Resurrected some models that he will try and get working again in time for the RailX display in Taita. The main model he wants to display is his Ball Roller that he displayed at Te Papa in 2015. At this meeting he only had one section of it and unfortunately due to the Meccano being up in his attic, the rubber holding some axles has perished and so work is required to get it in working condition.

Section of the Ball Roller from the Te Papa Expo.

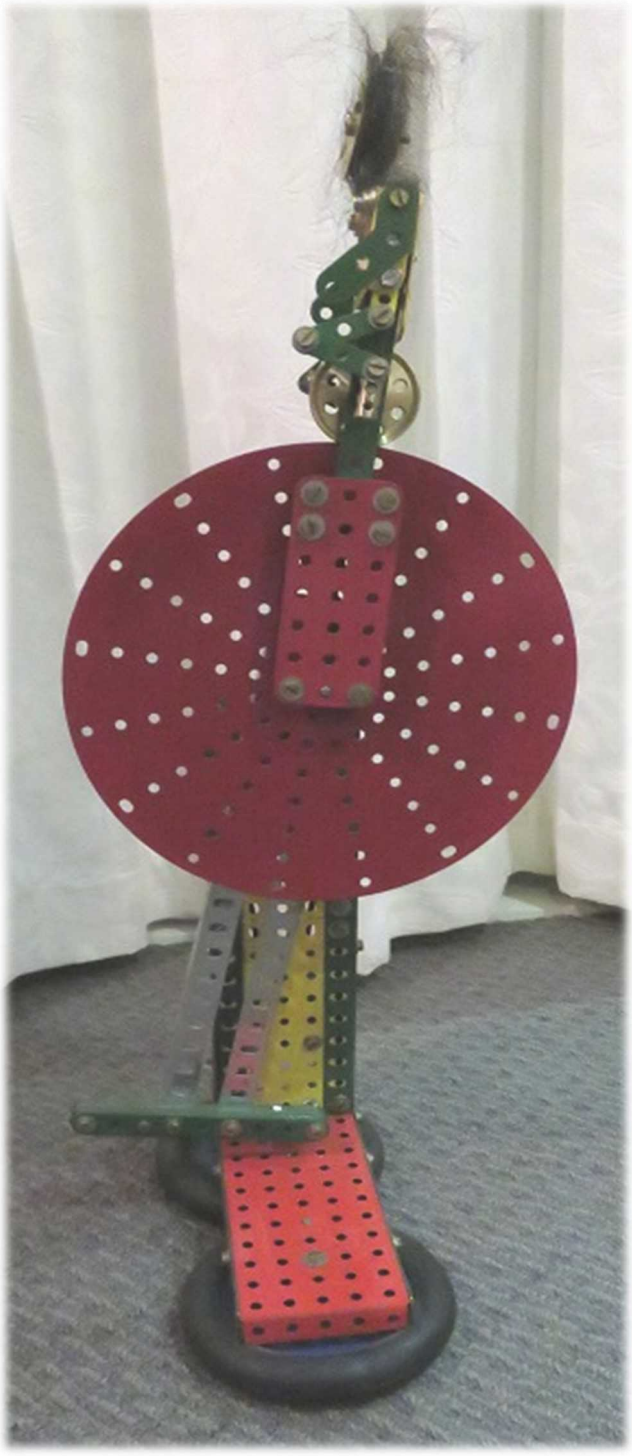
The portion at the bottom right of the picture is what needs repairing.

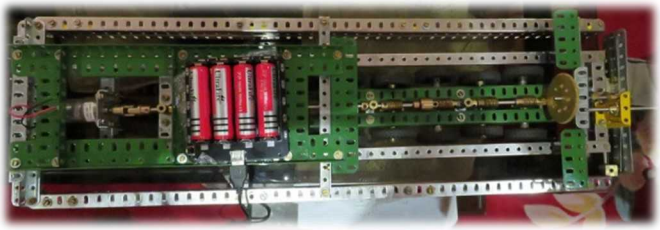
The second model is 'Percy the Ping Pong Ball Roller' where Percy tips the ping pong ball onto a loop track and while the ball is rolling, Percy moves across to catch the ball and bring it back to the start. This need repairing as well.

Another model is his Cyclist. (*Right*)



Finally his Domino stacker. (*Above*)





There is plenty of work required on all Stan's models to get them ready for the Taita RailX display

Stephen Westmoreland: Has built a double decker bus which he intends motorising to go back and forth along a road for displaying at RailX 2020.

He also brought along his two tractors that he displayed at the last meeting on which he has improved the steering.

Trevor Green: Trevor kept with this week's theme by making a fan powered by a motor. He was working on how many gears and band drives you could get off one motor geared down.

Next Meeting:

Will be on 4th August at **Trevor Green's** place in Tawa.

No theme was discussed as many will be building / repairing models for the Taita RailX.

Top left: **Stan Baker** — Domino stacker
Above: **Trevor Green** — motorized fan
Below: **Stephen Westmoreland** — double decker bus for RailX 2020 exhibition.

MWT Meccano Club Model report 8th August 2020

by Robin Rye

Model Challenge: Model incorporating 1 or more table tennis balls.

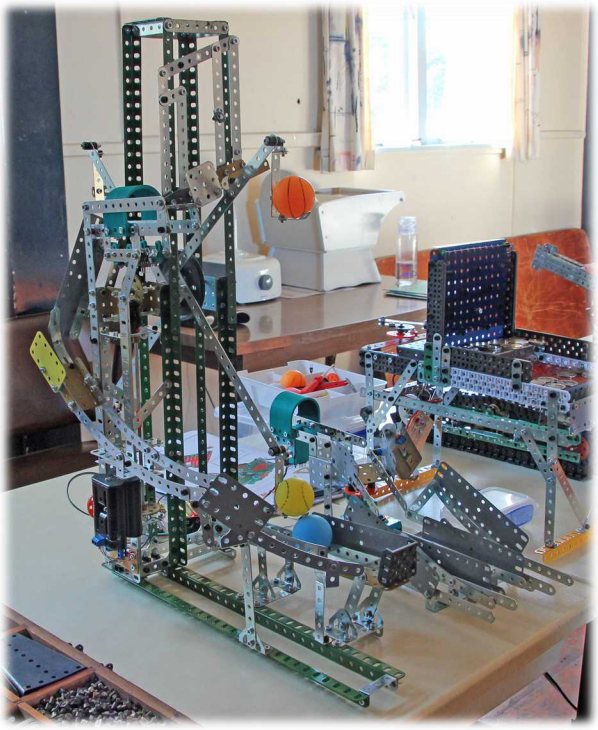
Hugh Ramage: Hand controlled gimbal.
Richard Feltham: Navigation device for a space-ship — aka an orrery. (*Challenge winner*)
Mikayla and **Stuart Lindsay**: Table tennis game.
Bruce Durdle: *One*: Duke of York ping pong ball machine. *Two*: An ingenious electronic colour selector that steered ping-pong balls of different colour automatically down separate pathways.

Model tour:
Graham Hawtree: He had to buy 6 sets of 4 wheels to obtain the 4 wheels he wanted, so, 5 sets for sale.

Mikayla and **Stuart Lindsay:** Some of their parts chests on display.

John Freer: Some sub-assemblies of his forth coming exhibition model, a big wheel coal excavator model of the gigantic one now retired in the former East Germany.

Bruce Durdle: Tipping point machine. A moving table to move coins forward over three layers.



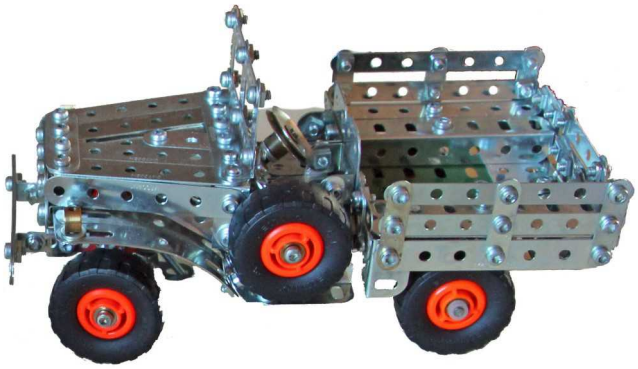
Viv Alexander: Ex **John Ince** 1911 Meccano Set 6 with an unfathomable label on the box lid (number 7 with some further letter suffixes). From the 1930's era, No.1 and No. 3 Meccano storage boxes, both imported from England each with parts within, many the rare (in NZ) gold strips with the more common blue hatch plates. (*See page 11 - Ed*)

Daryl Anderson: From 1937/39, a green No. 10 outfit box completely empty. He once had the correct period manual but sold it as he did not have the set. Interestingly, the same key would turn the locks on Daryl's and Viv's Meccano boxes.

Chris Morton: A display of near current and current new unopened Meccano sets.

Peter Hancock: Showed made up one of the 3 that can be made, 18211 current car set. A new style motor, and batteries that to replace means partial model dismantle. The wheels fly off when energized but the LED lights are novel.

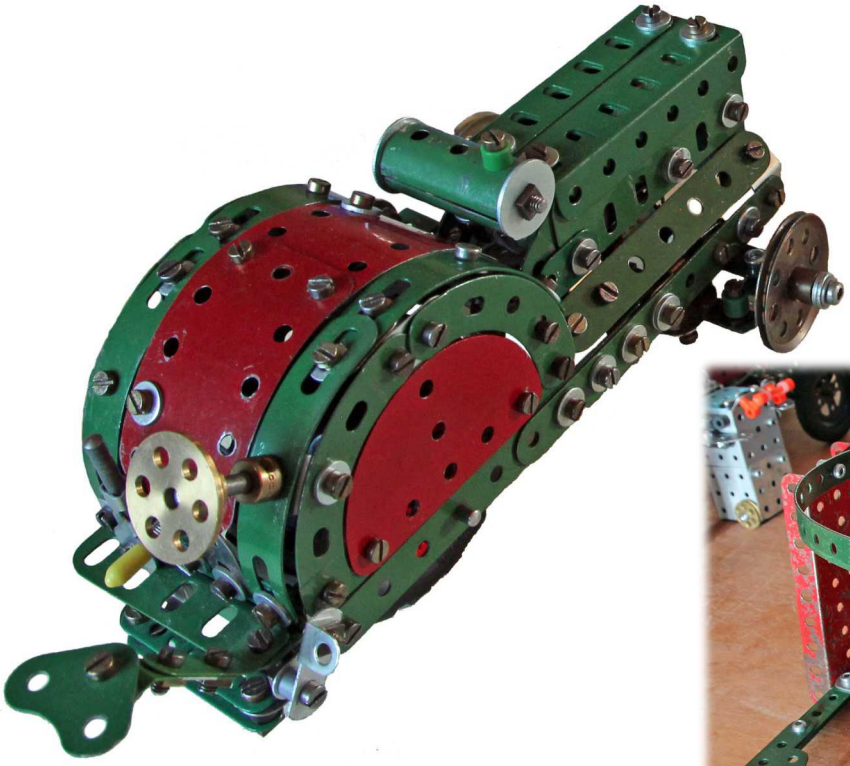
Bruce Geange: Assembled small car set 17309 to find that reverse was the only option. Forward, gear mesh was lost. A motorized model of an Emerson tractor. A non-motorized but very detailed Dodge WC truck of WW II era. Model engineer Bruce has assembled a scratch built Jeep. Jaws dropped!

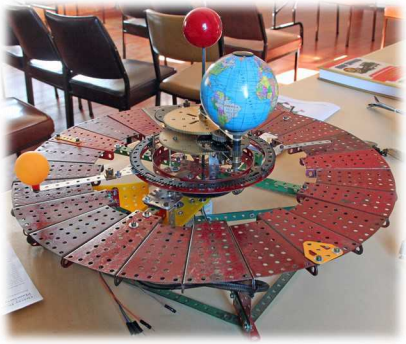


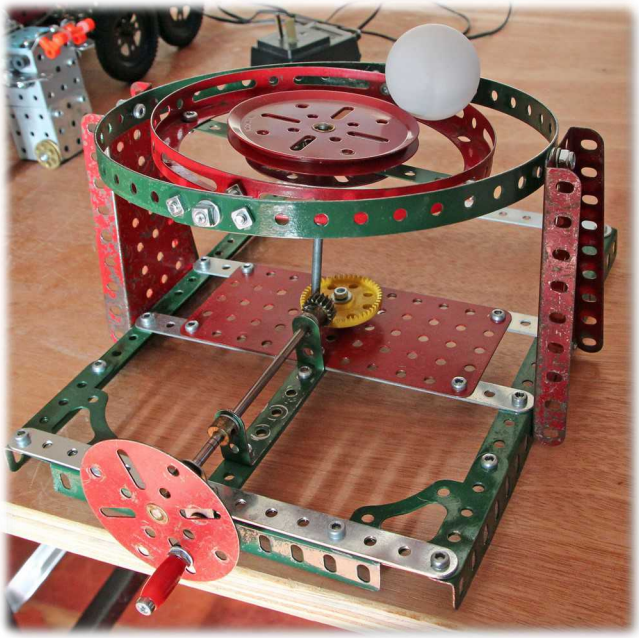
Robin Rye: A box of 6 Hornby Dublo Platelayers huts with the year code 1962 in the box. One shilling each at the time. The brand new 100 years Hornby book.

Peter Winter: Over the Trump disease lockdown, Peter went through his Meccano on a major storage revision. Pieces on display included a set of **Jeff Clark** brass seconds (quality), WW I era 2 inch pulleys, the thought to be 111b bolts and some Set Screws.

Hugh Ramage: A clever mechanism to clamp a rubbish bin and lift it and tip into the 6 wheel rubbish truck as seen on NZ streets. The bin was pretty nifty too. (*See back cover*)



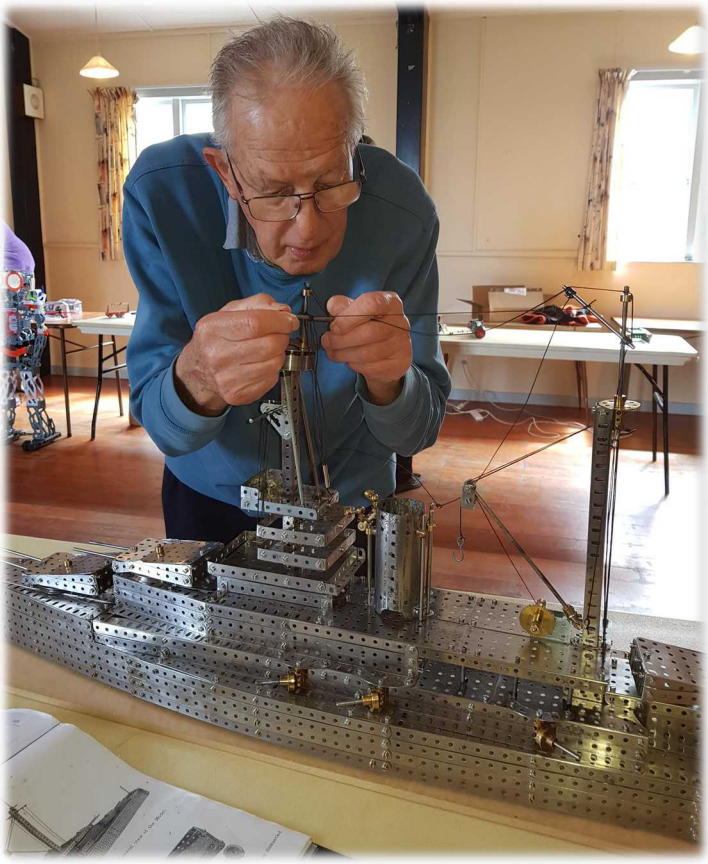




Above: Emerson tractor by **Bruce Geange**
Right: Gimbal by **Hugh Ramage**
Below: **MWT** stalwarts await important announcement from Hon Sec**, Robin Rye**

From left to right: (seated) Robin Rye, (*standing*) Richard Feltham, Daryl Anderson, Peter Hancock, Stuart Lindsay, Mikala Lindsay, Bruce Durdle. (*seated*) Peter Winter, Paul Vodanovich, John Freer, Viv Alexander, Hugh Ramage.

(Note: Other MWT pictures on page 26)



Paul Vodanovich adjusts the rigging on his detailed model of the battleship HMS Vanguard. Made entirely from parts he has restored to a nickel-like finish the effect is quite stunning.

Viv Alexander points out a salient feature on one of his immaculate Anglo-French sets from the 1940s. Made for the German market these were an attempt to boost the British export economy immediately following World War Two.

2021 CONVENTION NEWS

VENUE: Waikanae Memorial Hall
7 Pehi Kupa Street
Waikanae

DATES: Friday 19th March - set up and members only day. AGM
Saturday 20th Public admission
Sunday 21st Public admission

REGISTRATION FORMS: These are included in the this issue.

TROPHIES: Reg Barlow reports we are still missing the **Junior** and **Club Trophies**. If anyone has any information that might help track them down please get in touch with Reg.

Email: *reg_barlow123@hotmail.com*
Phone: 021 955 488

How old is my set?

By Viv Alexander

Those of you who read my article last time will realise that I love dating my Meccano items. Of course, Mr Hornby made it easier from the early 1930s by including dated guarantee slips and if those are present they give both month and year.

However the early sets don't give us this luxury and this month's set is in this category. But in this case the set can be dated to within 12—16 months. When I purchased it I was told it was from 1916, probably because such parts as No *#52* were blackened, which was certainly the case in 1916, possibly to save nickel during WW I , but it appeared earlier than that to me, as some blackened parts appeared as early as 1911. (*See Don Blakeborough's monumental work on Meccano*)

The first clue is the label. (There used to be one on the outside of the lid but only the outline remains.) The first true 'Meccano' label appeared in 1908, showing both a boy and a girl. This lasted less than a year, and another label featuring both genders didn't appear until 1978, and again only lasted one year. These labels were apparently not appreciated by males, who were the main purchasers of Meccano.

The label on this box lasted from 1909 until 1911, when it as changed to show the boy looking in the other direction. This gives us a definite starting point. But the end date is not so certain, as Mr Hornby was thrifty, and used up any leftovers, so this label may have continued for another year or so.

In 1907 the numbering of sets was changed from O - E to 1 - 6 , the contents remaining almost identical. E.g. the largest sets contained 168 of part No *#1*. However in 1911 a major revision was made and the larger set disappeared and was not reintroduced, in a smaller size, until 1922. The largest set now contained only 48 of part No *#1*, as in this set. So this set must be either an earlier No 5, or a No 6 after 1910. But this set contains parts No *#52*, *#53* and *#54*, which were introduced in 1911, so it can't be earlier than that, hence the definite starting date of 1911.

Now let's work backwards from the other end. Most of the gears and pulleys are housed on metal pins attached to a metal base, which must have been an expensive way to display and house the parts. They are also covered by a separate transparent lid. This lid was discontinued by 1914, although the pins remained in use. This makes 1914 the upper limit. 1911 also saw the introduction of the collar, which was the first part to be fixed in place by a set screw. The worm gear, part No *#31*, was also tapped that same year. All the remaining gears continued using the tunnel and spring clip system. The set screw fixing became universal in 1912. As all these parts in this set have tunnel fixing, except parts Nos *#31* and *#58*, this set must be 1911, or possibly early 1912, depending on exactly when the tapped parts were introduced.

So this set is 1911 or early 1912 - **QED**!.

Now for some help from you, please. I took this set to the club meeting to see if I could get any enlightenment on the strange letters appearing on the label, which one club member described as 'unfathomable'. Can anyone out there help me with this? They are on a small label stuck over to cover what is probably a '**B**'. Unfortunately it is too fragile to remove safely. The lettering is a large **7** a capital **M**, followed by what is probably a capital K, with lower case '**an**' underneath. Was this a special label Mr Hornby used especially for the USA, where Meccano was first marketed in 1909, or was this the result of collaboration with the A. C. Gilbert of '**Erector**' fame, with whom Hornby had a number of dealings with; or just the prank of some kid?. Hoping to hear from someone….

Viv Alexander
MWT

CHRISTCHURCH MECCANO CLUB

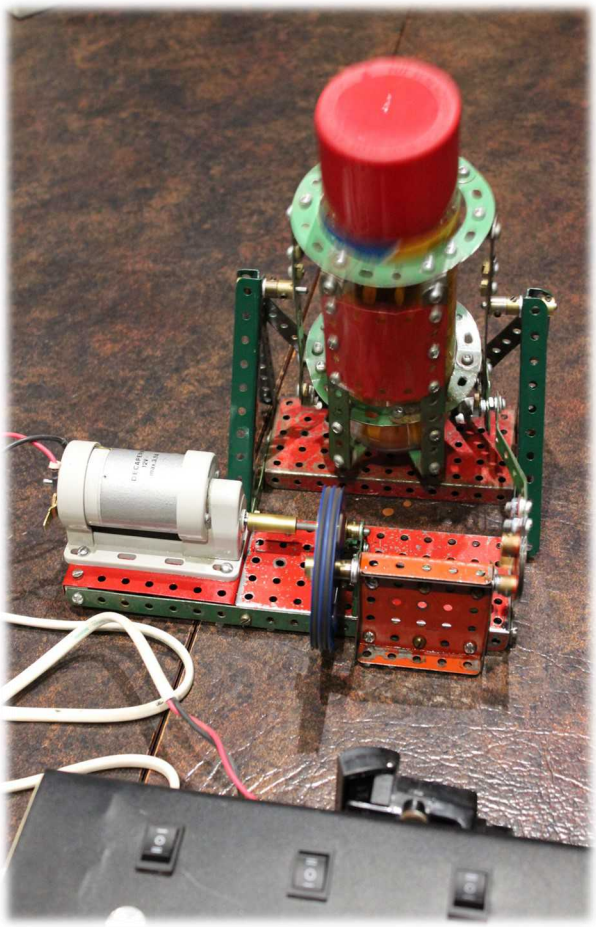
The club has had three well-attended meetings. Main Topic was the show over Labour Weekend at the Arts Centre. The location will be familiar to many of you. We will not pay rent, and all door takings will go to the Arts Centre as they are short of money and receive nothing from the local Council. The local Libraries agreed to display a poster, advertising the event, so this may well result in a good attendance.

We have two new members; **Russel Falconer** and **Stephen Sykes.** Stephen has been building models for about 6 months. Two of his creations are pictured. Peter has also started restoring Meccano, while I have just finished, so I was able to pass on the oven I use for baking parts after painting. A great bit of re-use.

Kevin Downie is building a "Hullet Coal Unloader". It will be a large model when completed. Pictured is the base, without the Gantry legs, which gives some indication of its size.

A full report of the show will be included in the February magazine. In the meantime best wishes from all of us in the Christchurch Club.

Roland Jaspers
CMC

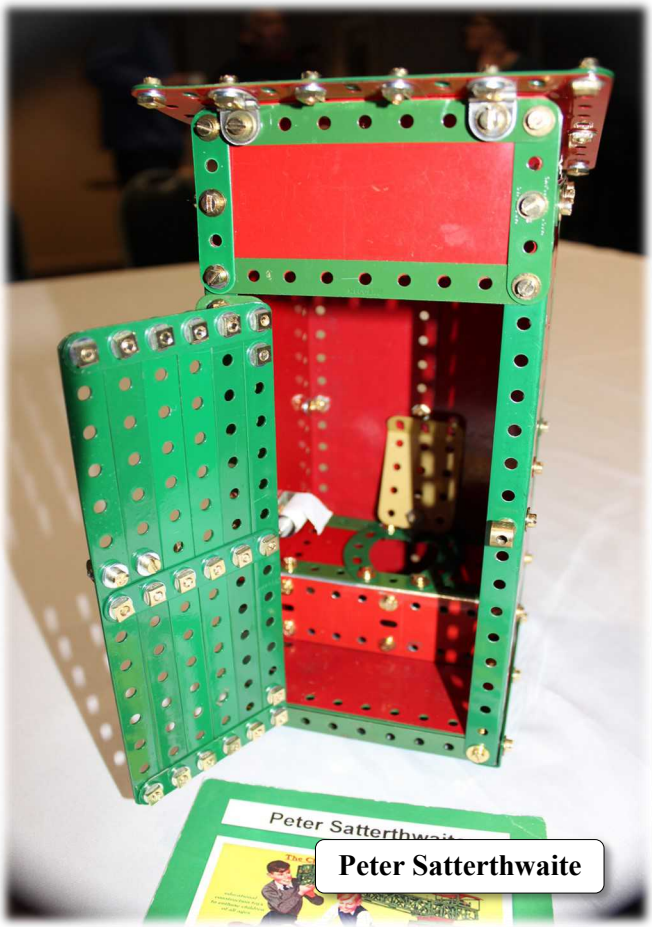


Top: **Stephen Styles'** spray can agitator.
Left: Grandfather clock.
Right: **Kevin Downie** and his Hullet Coal Unloader

Stephen Sykes

John Hamlyn

Nathan Lang



Peter Satterthwaite

A MESSAGE FROM THE NZFMM PRESIDENT

As the Federation President I am asking the Membership what should be on the agenda for the biennial AGM to be held in March 2021. Obviously a financial report, but does anyone have any other burning issues to raise? For example, how do we elevate the profile of our hobby in the eyes of the general public, so that Meccano stays alive.

I look forward to seeing as many of you as possible at the Convention in 2021.

Until then, best wishes for the Festive Season.
Chris Morton
President NZFMM.

POLITICAL MECCANO

By Viv Alexander

After WW II Britain had to set about restoring her export trade, and naturally Meccano was involved in this. They made overseas trade their first priority, and this included Europe as well as the British Empire and other foreign countries. This initially seems to have involved collaboration between Liverpool and the French factory. The first three sets shown (*opposite*) are the result of this. They were produced for the German market. Such sets are not that common, as Marklin held the major market share for these types of construction sets in Germany. Most German Meccano sets seen were sold in the German speaking cantons of Switzerland, the Swiss being quite affluent. (I've only seen one set intended for the French areas of Switzerland and none for the Italian cantons.) These are identified by the letters S. G. (standing for Switzerland German) on the manuals or guarantee slips (*Fig 1*)

The box labels are in French, (*fig 2*) which in itself is unusual for items intended for Germany, but may be an indication of the low sales in the country, so not many labels would be required. However, the guarantee slips are all in German and dated 1949, just four years after the end of the war. The labels say "Fabrique en France", and the sets contain the lovely (to me!!) blue and gold crosshatched flexible plates and gold strips, a colour scheme that France continued to use for a number of years post war, until eventually removing the crosshatching.

The manual is naturally in German, and has the word 'German' on the cover to indicate its intended area of sale. (*Fig 3*) These manuals were printed in England as shown by the words "*Gedruckt in England* " printed on the back cover. This is part of the collaboration between the two countries. The sets are all unused and have never been removed from their backing cards. I bought them from a seller in the USA, of all places, where they had apparently been languishing for about 40 years. What ever happened to set 1, I have no idea, but I wouldn't mind one to complete the sequence.

The set 4A is from 1959, (*Figs 4,5,6*) when things had settled down. The box, label and manual were all made in England, with 'German" on both the label and manual. It is again mint and in the post war red and green.

Postscript: From a political point of view it is interesting that Britain and France combined to woo trade from the enemy of WW II. The quest for gold makes for some strange bedfellows.

Viv Alexander
MWT

Fig 2

Fig 6

Fig 3

Fig 1

Fig 4

Fig 5

Smarten Up Your Meccano

Part 6: Controlling Motors

By Bruce Durdle
MWT

We've looked at the individual components in a "smart" system – now it's time to start putting them together. Since motors will probably be used in most smart Meccano projects, we'll look at how they can be controlled from an electronic system. We will look at ways to control the common permanent magnet DC motor first, then go into more detail on stepper motors and RC-type servomotors.

Permanent Magnet DC motors

In a standard DC motor such as those found in small toys or recent Meccano models, the speed depends on the applied voltage, and the torque is proportional to the current drawn. These motors are ideal for applications where we want to adjust the speed. A typical motor of this type will have a nominal voltage of between 3 and 5 V, and draw up to 1 A.

To control the speed of this type of motor, we need to somehow adjust the voltage used to supply the motor. Standard sources such as batteries are fixed -voltage – in order to use them, we somehow have to reduce the available voltage down to the required level. The easiest way to reduce voltage is to use a resistance, but because the voltage drop depends on current draw and therefore on the torque, a change in load will cause a large change in speed. As the battery ages, its output voltage also falls, making performance less predictable. The resistor option also wastes a lot of power and may cause heating problems.

We could reduce the impact of torque changes by using an electronic voltage regulator to drop the source voltage to a controlled level. However, the power dissipated in the regulating device is found by multiplying the voltage dropped by the current passing through it. If a regulating device has a relatively high voltage drop and is carrying a reasonable current, the power it must dissipate is high. For Meccano motors, the voltage range is relatively low and this can also be a limiting factor. It can be difficult to connect a digital device which primarily uses binary or two-valued signal levels to these regulators which require an analogue or multi-valued control signal.

We need a way to adjust the level of a DC voltage from a source that doesn't involve dissipating power or require carefully regulated source voltages. Fortunately, there is a technique that can be used for this – Pulse Width Modulation (PWM). This uses the energy storage capabilities of a magnetic field to convert a stream of fast pulses into an effective voltage that depends on the proportion of time that the pulse is applied. So if we take a 10 V source and switch it on and off rapidly, so that a complete On/Off cycle takes only a few milliseconds, the effect on a connected motor is the same as if we had applied a reduced voltage. If the voltage is ON for say 0.2 ms and OFF for 0.8 ms, the effective voltage that results is 2 V. If the ON time is increased to 0.75 ms and reduce the OFF time accordingly, the effective voltage is 7.5 V. (*See Fig 2 page 18)*

An ON switch may handle a heavy current, but because the voltage across it is very low the power dissipation is also low. When the switch is OFF, it draws little or no current so even with a high voltage the power dissipation is again low.

If we want to control the direction of movement as well as the speed, we need to change the polarity of the voltage applied to the motor. The A750 and A761 EMO2/battery box combinations include a reversing switch for this function.

Stepper motors

With the PMDC motor, it is not possible to drive the motor to a specific position without some sort of external sensor. If one of these is driven at a fixed speed until it reaches a target position, and is then switched off, inertia will usually mean that it will overshoot to some extent. In many applications we want to know exactly where the motor is, or be able to drive it to a specified location.

The stepper motor is capable of very precise movement. It is ideally suited for these applications. There are several variants. All have several sets of windings, called "phases", which are energised in a particular sequence. In the commonest version, a permanent magnet rotates to line up with the magnetic field set up by the energised coils. In a reluctance motor, a permanent magnet is not used: a specially shaped pole piece is used on the rotor instead.

In the diagram, a very simple two-phase stepper motor is shown. (*See fig 1 page 18)* (In practice, a motor will have a number of pairs of magnets and associated windings, called "poles".) In the first position, phase A is energised with the polarity shown, and the magnet aligns with the phase winding. If winding A is de-energised and B energised as shown the magnet moves to the second position. In the third position, phase A is again energised, but in the reverse direction. The sequence to move this motor anti-clockwise through a complete rotation is A+ - B+ - A– - B– - A+ - B+ … To move in reverse, the sequence is reversed.

It is possible to make the steps half the size by energising the second phase, then de-energising the first. This is known as half-stepping. In this case, the sequence for a complete anticlockwise rotation is (A+, B0) - (A+, B+) - (A0, B+) - (A–, B+) - (A–, B0) - (A–, B–) - (A0, B–) - (A+, B–) …

Stepper Motor Performance

The usual mode for a stepper motor is to be in a fixed position. With the more common permanent magnet motor, the magnet will tend to lock in to the iron core of the winding, and will stay there unless the load torque is too high. When the next phase is energised, it has to accelerate from rest and move to the next position. This all takes time, and there will be a limit to the maximum speed of rotation which depends on the current available to accelerate the rotor and connected load. When the rotor reaches the next position, inertia will take it a bit beyond before it settles back and there may be some vibration effects that can be amplified by other mechanical elements in the system.

To move a stepper motor continuously, or through some distance, a series of pulses must be applied to each phase in the correct sequence. The difference between these pulses and those we looked at for the PMDC motor is that the pulse rate of the stepper motor must be matched to the natural behaviour of the rotor and load, whereas there is a lot of flexibility in setting the pulse rate for the PMDC motor as long as the pulses are brief enough. Usually, with the PMDC motor, each pulse is too short to allow significant movement of the shaft.

RC Servomotors.

RC servomotors are different from both brushless DC motors and stepper motors in that they contain quite a lot of electronics internally. A RC motor will have a 3-pin connection, with two of the pins carrying the power and the third a signal controlling position. The position signal is all that has to be produced by the "smart" system.

The control signal for an RC servo is often referred to as a form of Pulse Width Modulation. However, instead of the motor performance being directly related to the width of the pulse as a proportion of the pulse period, the motor position is set by the actual pulse width. In most cases, the position will go from one extreme for a pulse width of 1 ms or thereabouts to the other with a pulse width of around 2 ms. The pulse repetition period is not critical but is usually about 20 ms.

The H-bridge Circuit.

The stepper motor and the PMDC motor can both be controlled by rapidly switching the voltage applied to the motor windings. Some sort of electronic circuit is needed for this – we could use relays, but for control the timing of the switches needs to be changed fairly rapidly (much faster for the PMDC). Electronics is well suited for this, and the switching itself can also be done using electronics devices. A common circuit that handles the switching requirement is the H-bridge. The name is pretty obvious when you look at the circuit arrangement. It uses 4 switches or switching devices with the motor connected as the central arm of the "H", and each end can be connected either to positive or negative. Switch A1 or A2 can be used to control the direction, with PWM on switch B2 or B1 to control speed.

The diagram shows mechanical switches: in practice, various forms of transistor will be used as electronic switches. There are a few complications to be considered: (*See fig 3 page 18)*

- If the two switches in one side of the "H" are closed at the same time, the power supply will be short-circuited.
- Suddenly opening a circuit containing magnetic elements can result in very high surge voltage levels (see "Technical Stuff" below.)
- Turning off both switches in the bottom half, or both in the top half, of the bridge will have no ill-effects – in fact, it will act as a brake.
- The voltage needed to operate the motor will usually be different from those used for the control element. Even if the two levels are compatible, it is wise to separate the high-current motor circuit from the low-current processor supply.

A practical circuit can use opto-isolators to keep the motor supply and control circuitry separate, and provide a simple way to make sure the supply cannot be shorted. The configuration can be adapted without too much trouble to run relatively large motors from relatively high voltages – I've driven a washing machine motor using a three-phase configuration from a 48V battery array.

Arduino-compatible H-bridge modules are also available and relatively easy to use. They often include two H-bridges to allow use with stepper motors, or a pair of standard motors.

Controlling a motor.

The number of connections to a motor controller will depend on the application. A minimum of two outputs is needed– three are used per motor for a standard Arduino shield. There will also need to be some external command capability – this could be as simple as an ON/OFF switch which could be hard-wired, or could include advanced features such as some sequencing from the control logic or position feedback.

With most of the processors available, it is relatively easy to set up a pulse-width modulation capability. The logic then becomes simply deciding when to start and stop the motor, and also how fast it should move. The actual generation of the PWM pulses can be left to the processor internals.

A typical sequence will be:

- Initialise the system by defining the terminals used to control the motor, setting up any PWM capability required, and setting the variables associated with motor control to a low setting.
- Wait for a START command from the control inputs. This could be combined with permissions to ensure the system is good to go.
- When permissions are satisfied, and the start command is received, start looping through the run logic. This will involve
    - monitoring the system for faults
    - monitoring any feedback signals or operator commands
    - if necessary, adjusting the timing of the PWM system to meet the new requirements.

Technical Stuff

We've seen that motors rely on the interaction between magnetic fields to develop a torque. In most cases, one of the fields is set up by a permanent magnet while the other is produced by an electric current.

Developing a magnetic field from a current is a "good news – bad news" thing. In simple electric circuits, the applied voltage and the resulting current have a direct relationship, with the current resulting from an applied voltage being directly proportional to the voltage (Ohm's Law). With circuits involving magnetism, any changes to the magnetic field will also develop a voltage component and Ohm's Law must be modified to take this into account. The extra voltage component is proportional to the rate of change of the magnetic field strength.

Changes in the field can come from two causes. If the configuration of the magnetic elements (the magnetic circuit) changes, or if the magnetic field is set up by a moving magnet, a voltage will be developed – this is the process that allows us to generate electricity in the first place. However, if the magnetic circuit is more or less fixed, we can still alter the field strength by varying the current – this is how a transformer works. In this case, the magnetic component of the voltage depends on how fast the current is changing.

1. Switching Magnetic Circuits

If a direct voltage is applied to a magnetic element, the current cannot increase immediately to the final value as set by Ohm's Law but will start to change with an initial rate that depends on the applied voltage. The increase in current causes an induced voltage due to the increasing magnetic field strength, that opposes the applied voltage. As the current increases, the rate of change falls off until the current reaches a steady value set by the element's electrical resistance and Ohm's Law. There are usually no problems with this action.

However, when the voltage is removed, the reverse happens. The current will start to fall, but this causes the magnetic field to fall as well. The falling magnetic field results in an induced voltage that acts to maintain the current flow. For any switching device, this induced voltage is of the opposite polarity to the original source voltage. The voltage level will depend on the circuit resistance: if the resistance is high, a much higher voltage will be induced than if the resistance is low. A high-voltage surge will last for a shorter time than a low voltage one.

The reason for this is that energy is stored in the magnetic field, and this energy is dependent on the current I (it is actually proportional to I^2). To build up the field when a current is first applied, energy must be added and this takes time. Conversely, when the current is removed, the energy stored in the field must be removed and until this is done the current will continue. When breaking a circuit, the easy option to handle the energy is to dissipate it in resistance – since electric power is proportional to $I^2 \times R$, the energy will be dissipated faster if the resistance is high. However, a high resistance means a high voltage. (In electric vehicles, the usual way to deal with this is by using the induced voltage to return energy to the battery rather than dissipating it in brakes or resistance as heat.)

The bad news is that if we try to control the current in a magnetic element using electronic devices, the induced voltage when breaking the circuit can increase to destructive levels. Additional components are usually needed to deal with this. Microcontrollers such as the Arduino and equivalents can handle only very low levels of energy and special interfacing circuits must be used. They must also cope with a reversal of voltage. If a mechanical switch is used to break the circuit mechanically, the induced voltage **WILL** increase to a level that causes sparking across the switch contacts.

The good news is that, by switching the control circuit fast enough, the magnetic field can be maintained through the switching cycle.

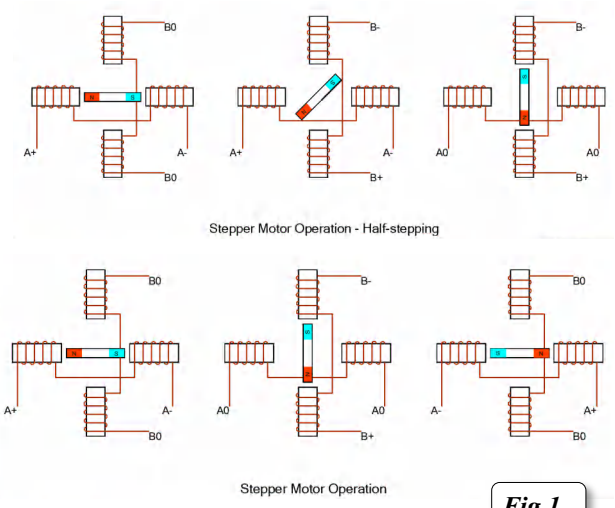


Fig 1

2. Generator Action

When an electric circuit is moving in a magnetic field, a voltage is induced in the circuit – the "back EMF". For a motor, this voltage opposes the driving voltage and reduces the effective voltage. Initially, the motor is stationary and does not produce any back EMF, and the motor current is limited only by its resistance. Since the current is high, the torque developed is also at a maximum.

Once the motor starts to move, a small back EMF is produced and this effectively reduces the voltage across the motor internal resistance – the current falls, and the torque also drops. While the motor torque is more than the load torque, the motor and load will continue to accelerate – the speed increases - the back EMF increases – the current drops – the torque drops. When the motor is at a speed where the torque produced matches the load torque, it reaches an equilibrium. However, any change in load torque will also affect the speed.

If the load manages to drive the motor – such as a fan driven above its normal running speed by a gust of wind – it may accelerate the motor to a point where the current is reversed and the motor will try to supply power to the source. There are two things that can be affected by this action. If the motor is stalled or has too much load torque applied, the motor current will rise. If this is maintained for too long, there could be damage to the motor or the drive circuit. If mechanical energy drives the motor and load faster

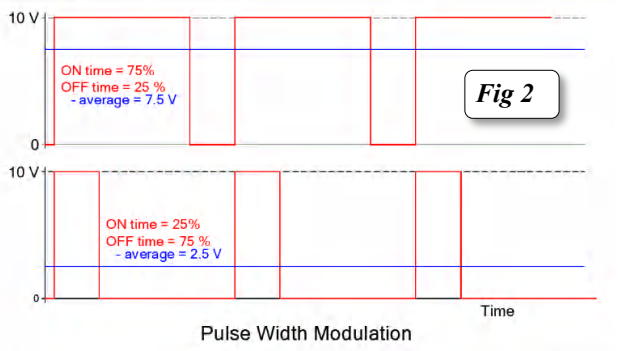
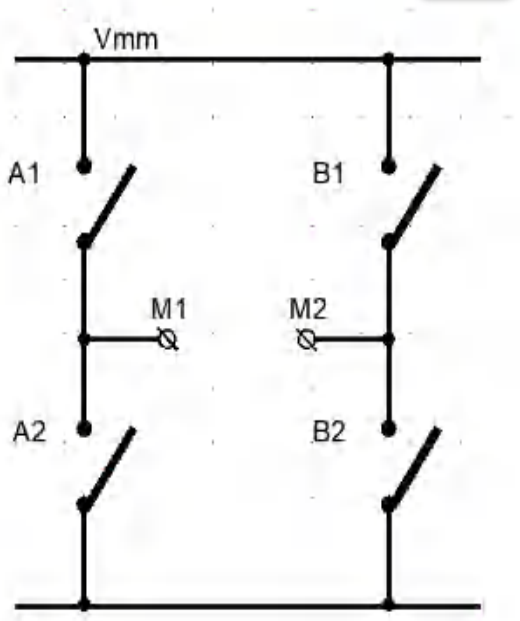


Fig 2

than the speed corresponding to the drive voltage, the back EMF will be greater than the applied voltage from the power source. This would normally cause the motor current to flow in reverse. With electronic control equipment, the drive circuits must be able to handle this reverse current. The overvoltage can also cause damage. With large motors, it may be wise to include some form of current monitoring with a high-current or reverse-current capability.

Fig 3



COME TO THE CONVENTION IN 2021

WAIKANAE
The Home of your next Convention.

On behalf of the Wellington Meccano Club convention committee, we are looking forward to seeing as many of you as possible at the National Convention to be held **March 19th, 20th, 21, 2021.**

Remember, this is NOT Easter weekend!
And this is not a registration, the idea of this regular blog is to keep you up to date with progress and other bits and pieces you may be interested in ☺

Elsewhere in this magazine are registration details. A little bit about the location. Waikanae is a small town, one hours drive north of Wellington. It has been known as the place to retire, going by the number of rest homes here, and they are still building more, but this is changing, more young families are moving here, due to house prices as compared to Wellington, better climate, lots of beaches and once Transmission gully is completed, it will be an easy commute to the capital.

The Venue we have chosen is the Waikanae Memorial Hall, run by the Kapiti Council. Photos of the outside are at the end of this blog.

It is situated in **Pehi Kupa Street Waikanae.** Adjacent to the main rail link to Wellington (Metlink), you can get off the train, and walk into the Hall. For cars, there is ample parking, with no restrictions.

Just across the railway line is the main shopping centre of Waikanae. Two supermarkets, Art Gallery, cafes, banks, and even a small independent hardware shop, where you can always find little treasures, or that tool you have always wanted to buy, but could never find it. I am speaking from experience. All of this is only a five minute stroll from the Hall.

Part of the welcome pack will be list of accommodation nearby and distances to the Hall, and also attractions in the area, plus a map. I can personally recommend Southwards Car Museum, Well worth a visit.

Across the road from the Hall is the Waikanae Club, if any of you are members of a chartered club, you will be more than welcome and we will be having the Saturday night function here.

We have access to the Hall from 4pm Thursday 18th, then all day Friday for set up and all the usual activities. Then Saturday and Sunday 10am to 4pm for the public.

This is, of course, dependent on nasty little Covid behaves itself and stays away. We have had to make certain decisions due to these uncertain times that we are in, which may not suit you all, but I'm sure you will understand that we are working towards a very successful event.
If anyone wants any information at all please, my details are below.
Happy modelling everyone.

Reg Barlow
Convener

Contact email: reg_barlow123@hotmail.
Mobile: 021 955 488

That's it, until next time;
back to model making !!!

Greater Waikato Meccano Club

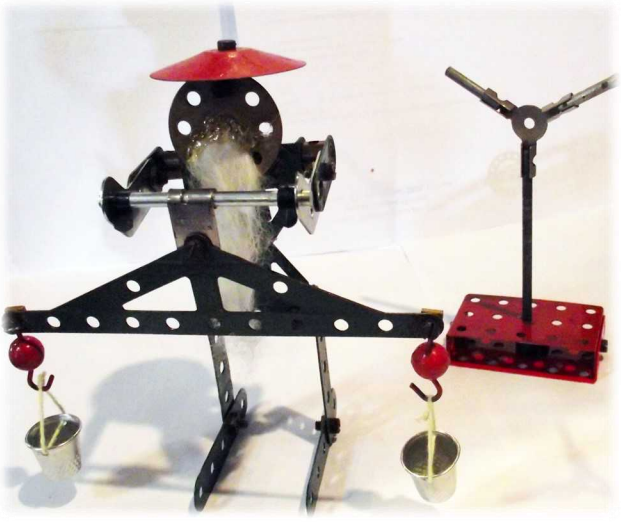
Meeting Notes for July and September 2020

We had to cancel our meetings for May and July due to the Covid19 lockdown but we were able to have a *Coffee Catch-up* in late July (25th) at **Brian Hickson's** place in Putaruru which turned out as good as any meeting. Several of us were able to attend including welcome appearances from **Jeff Clark** (Te Awamutu) and **Barry McKee** (Tauranga).
Our September meeting was able to go ahead as usual and seven members made the muster. This was also a successful meeting (preceded by our short AGM) and was thoroughly enjoyed by all.

We had a "Useless Parts" club challenge for July and September which presented a variety of unusual small models. This was a great late lockdown activity to stop us getting bored!

In July **Graham Stuart** showed us a rack-and-pinion steering mechanism in his Go-cart model using the Rack Strip (part no. 110) and a demonstration model of the difficulties of using the Toothed Quadrant 129.

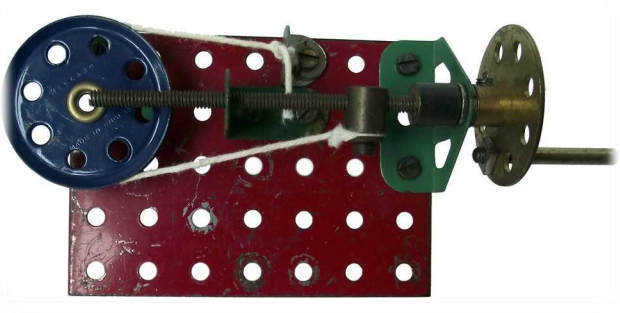
For September **Clive Nicols** had built a couple of minimalistic but realistic models: one of a Chinaman using the Conical Disc (part no.187a) and the Girder frame 113; the other of an Aerial including the Triple Rod Connector 213a.



Brian Hickson showed a slick strip-bender which used the Adaptor for Screwed Rod 173a and **John Rickit** had built up an extremely smooth and serviceable flywheel using Triple Rod Connectors 213 a/b in the hub (*above, right*).

Graeme Wrightson had modified the jib of the blue 20-Multi-Model Set Crane using the Girder Frame

113. There was also a 1929 Set No.1 tractor (using the sector plate 54); an efficient and powerful band-brake utilising the Adaptor for Screwed Rod 173a and the Threaded Boss 64 ; and a small Windmill No.1 using the Rod Socket 79 which served a double purpose of securing the top of the tower.. Brian H also exhibited the large model of his wonderfully detailed Valentine tank which is still under development. It is powered by two No. 2 clockwork motors. This also modelled the very simple but effective suspension that was incorporated in the track system.



Thomas Campbell had built a lovely little Micronoid which chirped away quite happily and **Hamish Campbell** displayed a small new Meccano tractor (18208) complete with backhoe and a front-end loader.

Unfortunately **Mike Walmsley's** model was entirely invisible but we did get to see his Meccano room which had all sorts of surprises in it ! ☺ ☺

Members enjoyed some time of convivial fellowship over afternoon tea and the group dispersed at 4.30pm.

Report compiled by Mike Walmsley and Graeme Wrightson. Photos by Graeme Wrightson

Fig 1: Multikit crane }
Fig 2: 1929 Tractor } by **Graeme Wrightson**
Fig 3: Windmill }
Fig 4: **Brian Hickson's** strip bender
Fig 5: **Hamish & Thomas Campbell** Micronoid/tractor
Figs 6 & 6a: **Brian Hickson's** Valentine tank

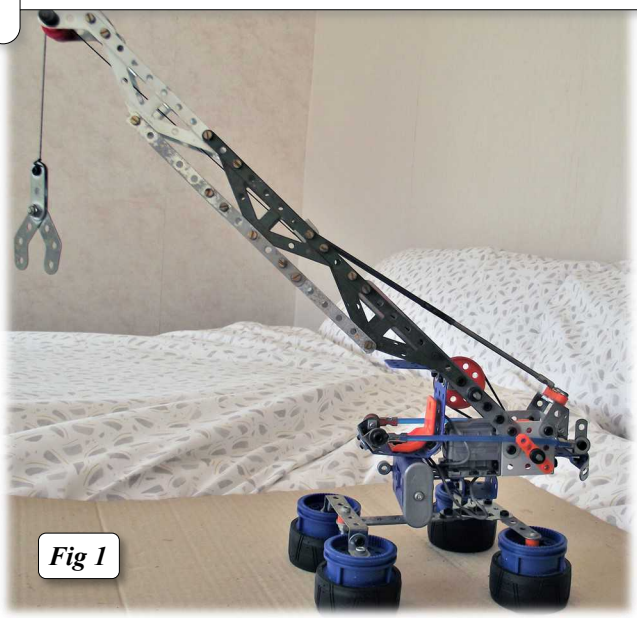


Fig 1

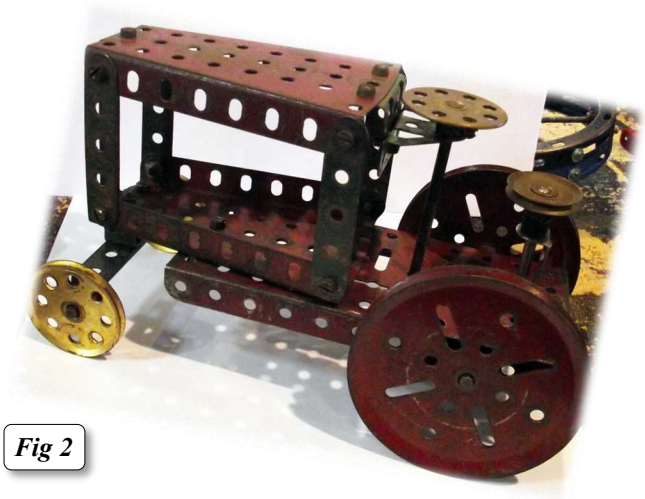


Fig 2


Fig 6a


Fig 3

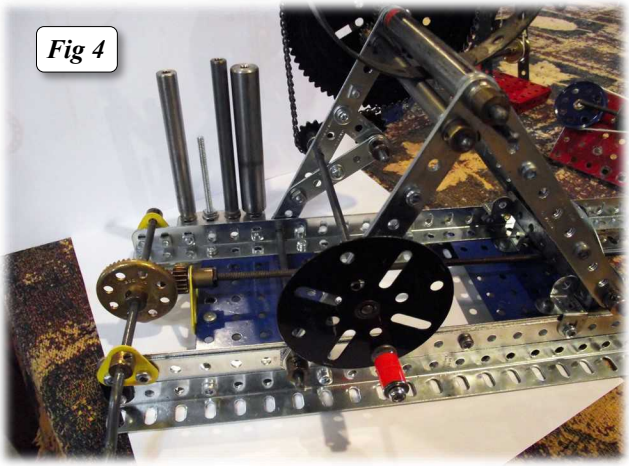


Fig 4

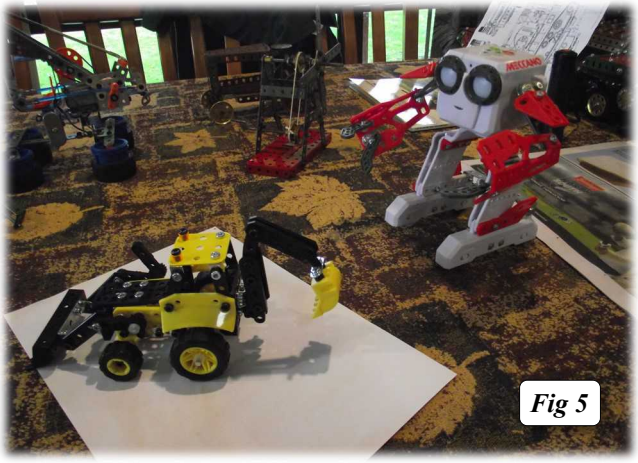


Fig 5

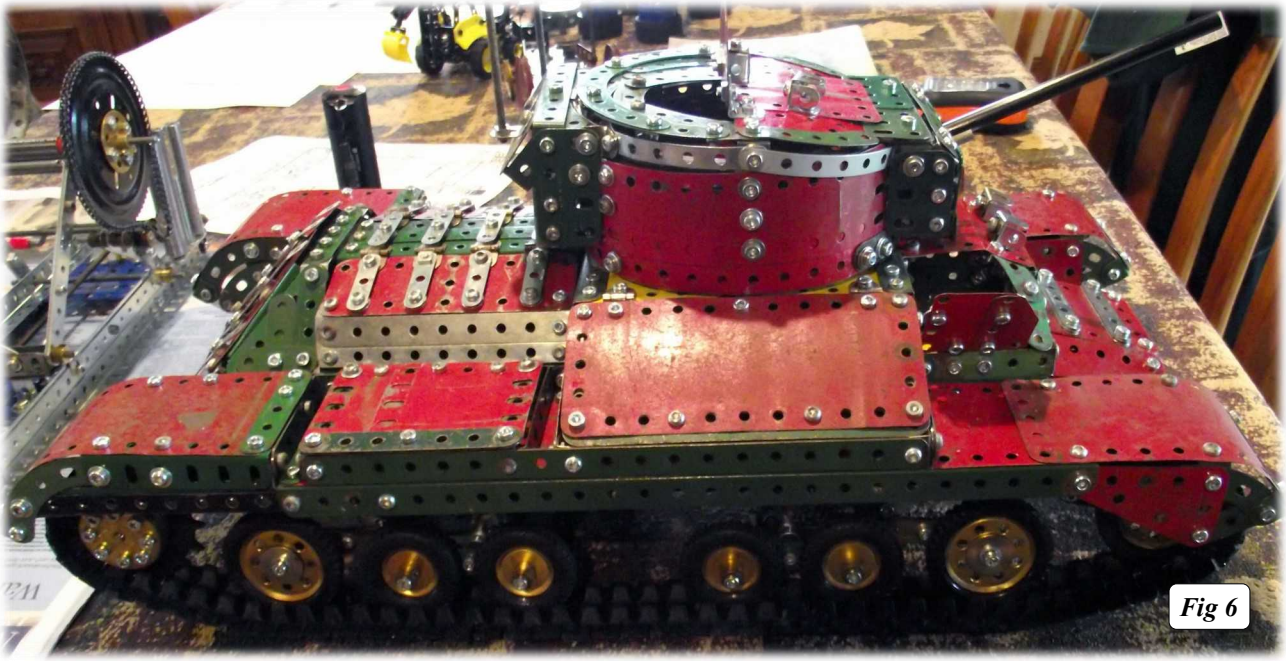


Fig 6

The Wellington Meccano Club Newsletter

Reporter – Max George

Meeting Date: Friday 4th September 2020 at 7:30pm at Max's place Tawa.

RailX Taita: As well as Max displaying his Little Joe and Tricky Track, our Club has been invited to display models at the RailX display in Taita in November. So far we have 9 modellers displaying.

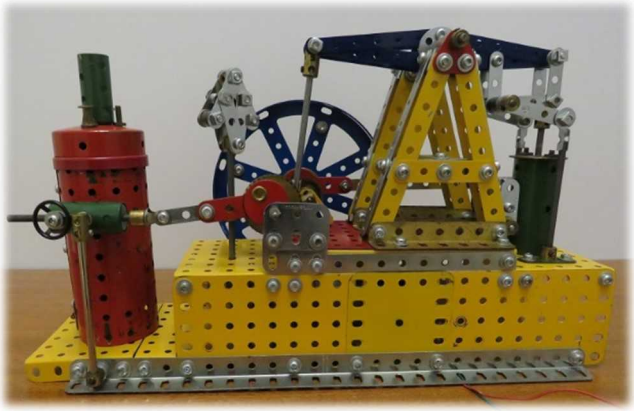
Model Building:

There was no theme for the meeting but there were plenty of models on display.

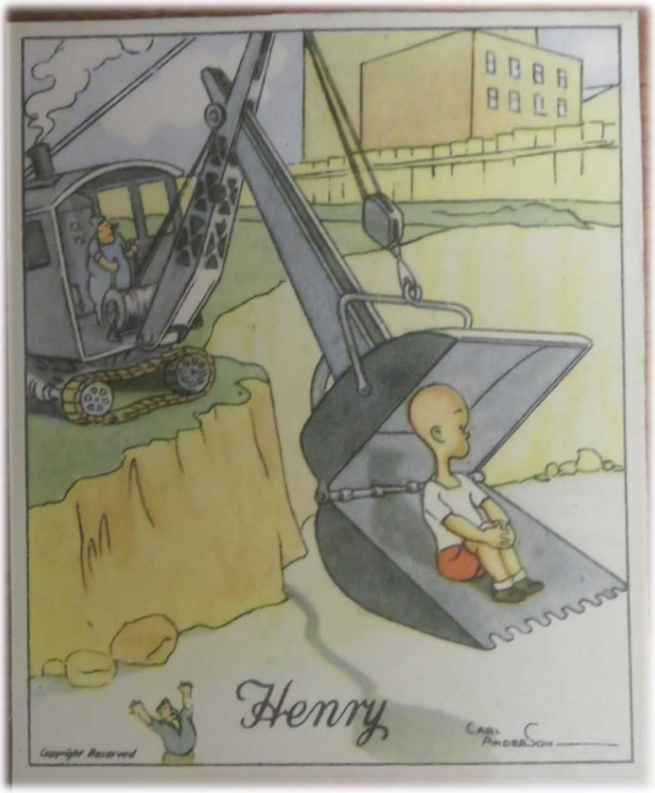
After all the models were viewed we watched some DVD's of previous conventions and displays.

Franz Schleicher: Has started building the No2 Clock. He has restored all the parts for the frame and hand painted the dark red. It looks quite spectacular instead of the plain zinc colour.

Lou Nichols: Has made a very smooth working Beam engine showing well the principle of the Watt Steam engine. The design is from a North Midlands Meccano magazine.

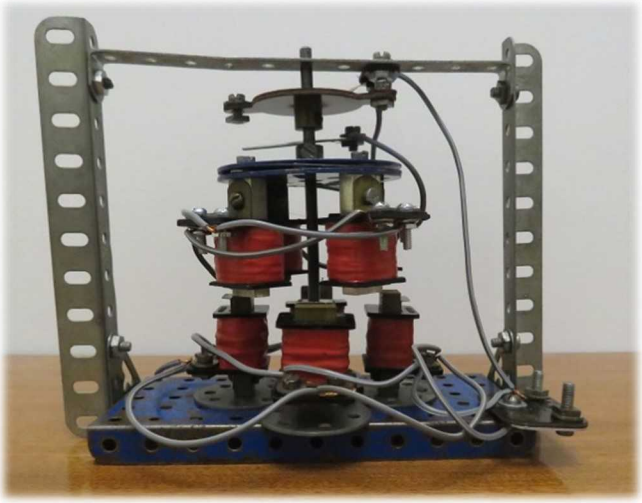


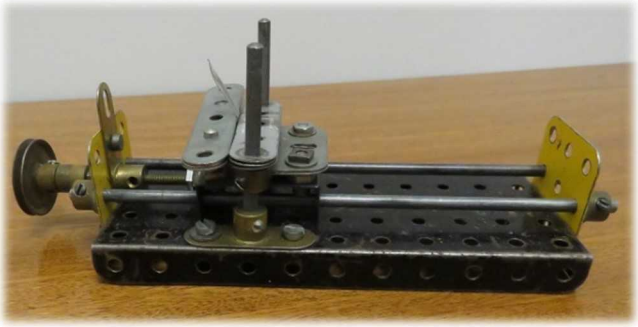
Lou has been a collector of cigarette cards for many years and brought along an enlarged one of Henry in a bucket. Henry is the star being in 5 sets of 25 cards which came out in the 1930's. He thinks the artist Carl Anderson is an Englishman.



Paul Roberts: Is getting very inventive with the models he is building. This time he brought along a gravity electrikit motor with eight solenoids, one from his electrikit set and the other seven were ones he had made himself. He did show us it working although the solenoids need to be at the correct height for it to work. It is powered by 12V and he runs it for only 30 seconds at a time because of the heat generated. (*Following page*)

Paul brought along a jig made out of Meccano that he uses to make the metal connections for the electrikit lamp holders he is making.

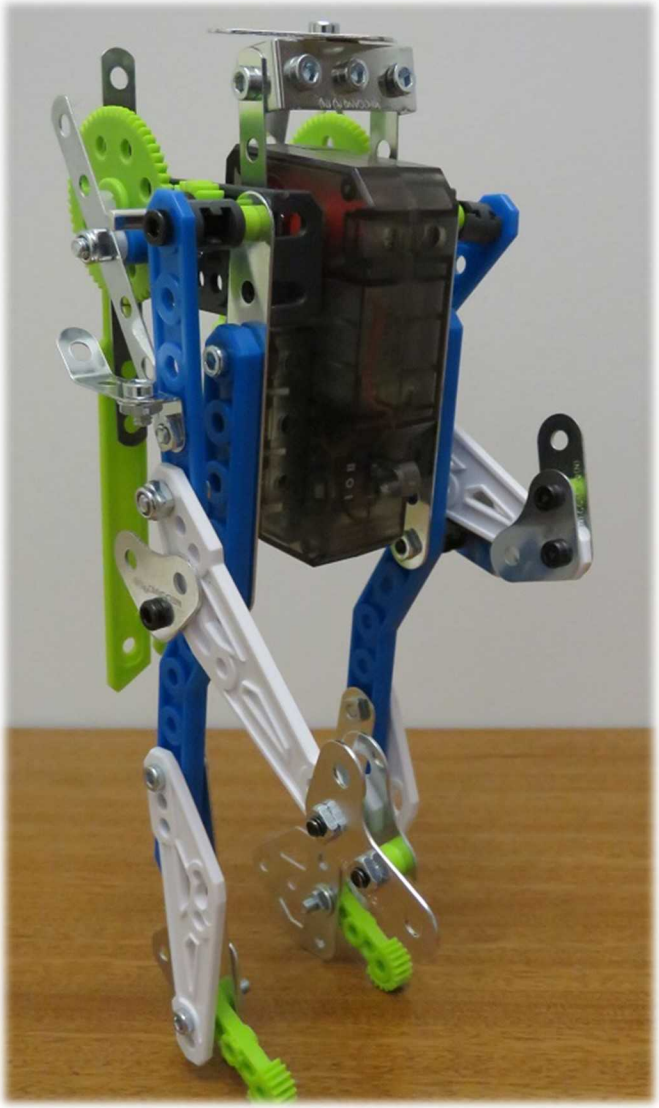




Reg Barlow: Built a Robot from the new Meccano Series boxed sets. It comes with instructions for 4 models with another couple on the web. It uses 3 AA batteries to move the arms. This model was constructed from instructions on the web.

Robot built from Motorised Movers Set 19602.

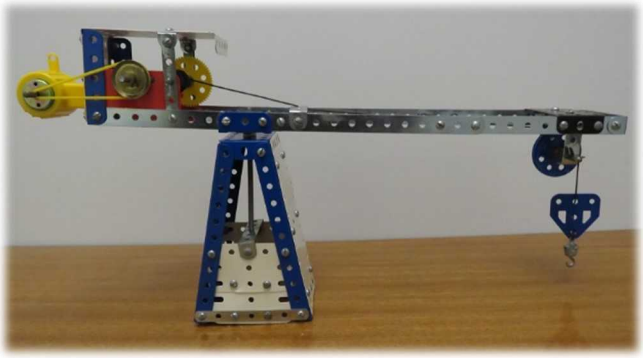
Stephen Westmoreland: Is continually improving his Double Decker bus which he as now motorised to go back and forth along a road for displaying at RailX. He uses two motors using auto reversing but at this stage he is having trouble controlling how far it travels as it goes 2m one way and 1.2m the other. It will be great to see it working correctly.



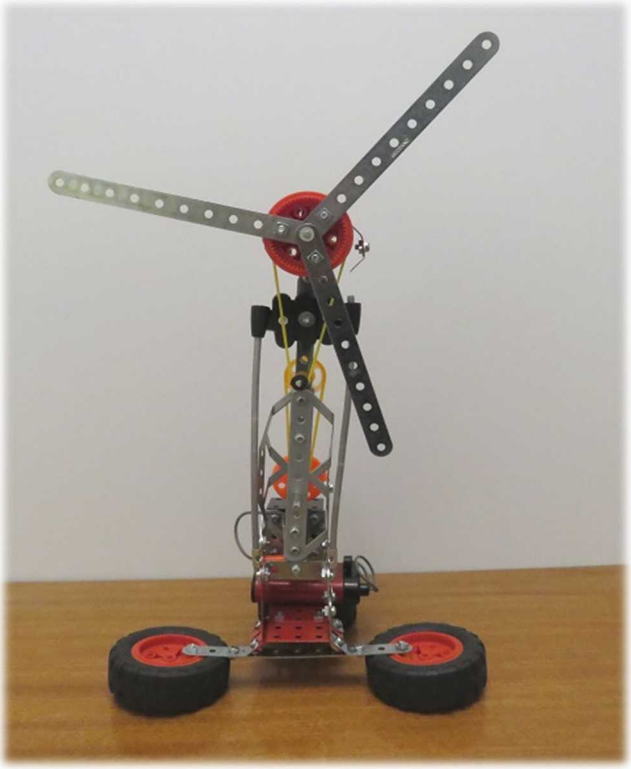
Stan gave Stephen a suggestion to use switches and relays to control the reversing mechanism. We will see what happens for the next meeting.

Max George: Has finally completed the Special Edition Engine from set 0507. Unfortunately the plastic handrail support holding the crank shaft along the top of the engine broke as he was putting the crank shaft in place.

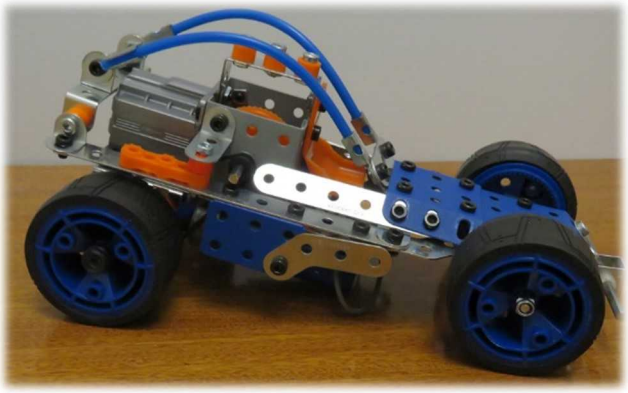
Max has continued twice a month with his very keen U3A Meccano building sessions at his place and this time has quite a few models to show.



A crane built from a photo as one of the models to build from the 2000 set 5042. This was the first time the builder had built a model this way and was happy with the result.



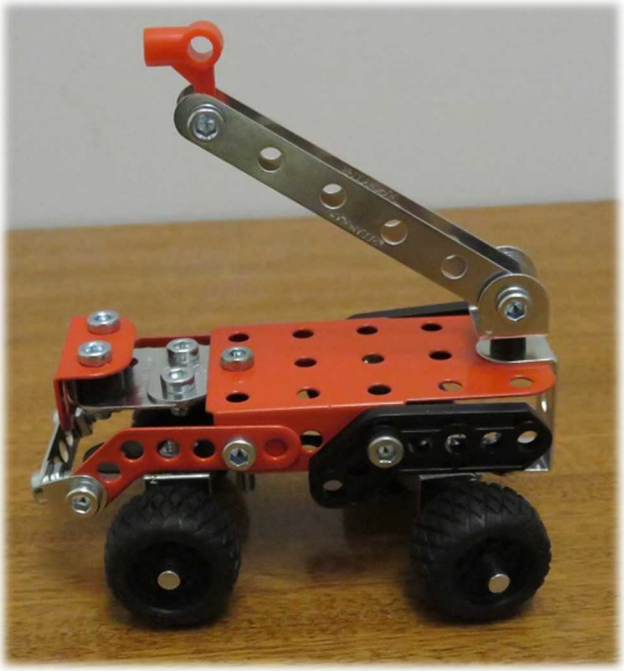
Windmill built from the 25 Multi Model Set 7550.



Racing Car built from the 20 Multi Model Set 6520.

Jet Fighter built from the 10 Multi Models Set 5550.

Fire Engine built from the Multi Models Set 3024805



by the newest member of the group.

Next Meeting:

Will be on 2nd October at **Stephen Westmoreland** place in Paraparaumu.

The theme is anything you are building for the RailX display in Taita in November or the convention next March.

Puzzle Page

Puzzle No 4 - Answers

The best answer came from **Ross Quale,** an altogether stunning effort, totally in keeping with the *gravitas* of the Waikikamoocau Meccano Club philosophy. The bonus questions answers were:

- A single throw eccentric is part No #130, but it is only ¼". (Trick question—well done Ross)
- The name of St Franks second son was Douglas **Egerton** Hornby, born on New Year's Eve, 1890.
- The income for Meccano in 1930 was reported as approximately £142,282.

Hello Richard
I look forward to your competitions and here is my answer to number 4.
From experience, I now look very carefully for trickery in the wording of the question. This time, the question says "How did Dazza know what colour his trunnion was?" - and yes, again this question is just oozing with trickery. Why? Because only Dazza can know how he knew, or guessed, what colour his trunnion was. The rest of us can only speculate how he knew, or guessed; and I offer the following, all reasonably probable ways, that Dazza may have arrived at his answer. The best mind reader wins this competition.

Firstly, Dazza may have relied on his steel-trap mind and cold logic; coupled with his assessment, shared with the editor, that his fellow contenders were pretty sharp characters as well. He can see two green trunnions, so he knows that whatever his colour is, everyone will raise their hand. If his colour is red, then each of the others is looking at one red and one green. This would mean that they could reason that if their own was red, then the other with the green trunnion would be looking at two red, and thus would not raise his hand – but he did raise his hand – and therefore their own must be green. But they did not lower their hands promptly – therefore everyone is looking at two green trunnions and wondering what to do about it. Brilliant work, Dazza!

Or alternatively, Dazza may have relied on his knowledge of his fellow club members' stalwart character, particularly that of the Chairman. If the Chairman had put out two green and one red trunnion, then the logic problems facing each contestant would not be the same. Each of the contestants that were looking at one red and one green, would be able to look at the contestant with the green trunnion and as soon as that person raised their hand then they would know their own trunnion was green. This logic would not be available to the contestant with the red trunnion and therefore the contest would be unfair…. You can only imagine the fuss that would have been created at the WaikikamooKau Meccano Club when that was discovered. Dazza knew his Chairman well and could rely on his inherent fairness – all contestants faced the same problem – therefore all three trunnions were green.

A third alternative, a variation of the above, is that Dazza assessed that while the Chairman was incapable of such detailed logic he did instinctively know, for reasons of self-preservation, that the contest had better be symmetric rather than asymmetric or else there would just as big a fuss as above.

A fourth alternative is that Dazza relied on his quick wits and good eyesight; he caught a glimpse of the three red trunnions still in the Chairman's hand and drew the obvious conclusion.

Lastly, the fifth probable alternative is that Dazza (that true born Meccano man) metaphorically closed his eyes again, and simply did what he was asked to do, and sensed that the trunnion was green!

Given there are five possibilities we need to look for the one that has corroborating evidence. Without any other evidence of abilities in logic, or of the practicalities of peeking into the Chairman's closed fist, or the ability to ask Dazza himself, only one option has corroborating evidence. This evidence is, of course, is the appropriately timed single shaft of sunlight that indicated that the Meccano Gods were appeased. This corroborates the thesis that Dazza is a true-born Meccano man with sensory abilities beyond the normal ones – and now possibly including an astral connection. It is the only explanation that fits with all the evidence …. and of course, Dazza has no need to tell the rest of us how he actually knew.

Now for the Bonus (I am not optimistic about the bonus, and note I have no claims to be a President or a Grand Inquisitor):

A half inch single throw eccentric is not a standard part – part 130 is triple throw, and part 130a is single throw one quarter inch.
Frank Hornby's children have no middle name and the second son (Douglas) was born in 1890.
Total value of Meccano sales in 1930 were "large" – sufficient to say that Frank became a millionaire.

Ross Quayle

PUZZLE No 5

Background:

The monthly meeting of the Waikikamookau Meccano Club was well underway by 7 pm. Newly inaugurated President Dazza was keen to keep things moving along, as he knew that a goodly selection of home baking was lurking in the wings and his blood sugar was dangerously low.

The last thing on the agenda was judging the monthly challenge, which this time had been to build a functional weighing machine that could handle weights of up to and including 40 grams with a precision of not less than 1 gram. He gestured at the array of models clustered around the room.

"Right-oh, chaps. Who's up first?"

One by one the members stepped forward to demonstrate their creations. And one by one they failed to meet the minimum standards, several times in quite spectacular ways as broken springs and bend angle girders launched themselves across the room. Dazza shook his head sadly, as he mused that quality control was not what it had been.

Last up was the newest member, a young girl who had inherited her grandfather's Meccano. Her entry was a simple balance arm, robustly constructed out of Dazza's preferred palette of pea green and dark red parts.

"OK, Bella, show us what you've got."

She stepped shyly forward and pointed out the salient features of her entry.

"This lever raises the arm so it can pivot on the part 76. You then just add weights until it balances."

"What weights," asked Dazza.

"These," said Bella, holding out four sealed packets, each containing an assortment of gears and other brass parts. Dazza looked confused.

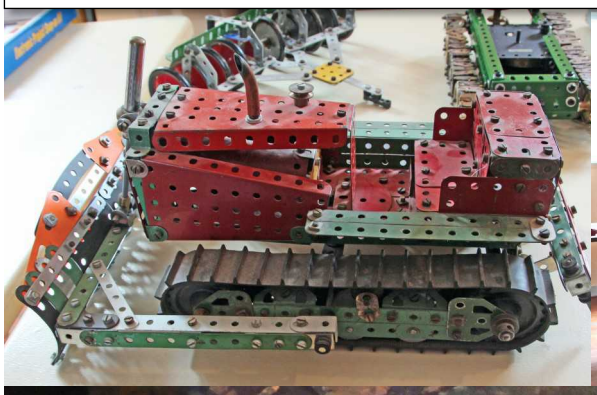
"But you have to weigh 40 different weights," he protested.

"And you can. Using various combinations of these four weights you can weigh any integer quantity between 1 and 40 grams."

Question:

What were the weights of Bella's four packets?

Below: Charlie Cross bulldozer; MWT gathering. *Bottom*: Te Manawa display by MWT members.



New Zealand Club Diary 2021

Auckland Meccano Guild

President: David Wall, Tel. (09) 426 1965
Secretary: Gary Higgins, Tel. (09) 832 4292
Meetings: Next meeting not yet confirmed

MWT Meccano Club

Chairman: Chris Morton, Tel. (06) 323 8001
Secretary: Robin Rye, Tel. (06) 764 8670
Meetings: Second Saturday of every second month, at 2pm. Next meeting: 8th August**,** at St. Luke's Church Hall, Corner Cornfoot and Manuka Streets, Castlecliff, Wanganui.

Wellington Meccano Club

President: Reg Barlow, Mob. 021 955 488
Secretary: Max George, Tel. (04) 232 4200
Contact: Stan Baker, Tel. (04) 566 7150
Meetings: Begin 7:30pm on first Friday every second month.

Christchurch Meccano Club

President: Neil Pluck, Tel. (03) 382 0411
Secretary: Roland Jaspers, Tel. (03) 351 4389
Meetings: Start at 7:30pm on first Friday every month (except January) at Papanui RSA Club, 55 Bellevue Ave or No. 1 Harewood Road, Christchurch.

Greater Waikato Meccano Club

Contact: Graeme Wrightson, (Mob) 027 671 6004
Meetings: These are held on the first Saturday of every second month, except January. Most meetings are held in the Central Waikato area starting at 2 pm. Contact Graeme Wrightson on 027 671 6004, Matamata.

Other Meccano Contacts

Hamilton: Don McClelland, Tel. (07) 843 4198
Tauranga: Barry McKey, Tel. (07) 576-1623
Hawera: Daryl Anderson, Tel. (06) 278 7666
Napier: Trevor Adam, Tel. (06) 843 4837
Palmerston North: Bruce Geange, Tel. (06) 357 0566
Nelson: John Stark, Tel. (03) 545 1025

Articles, etc. for the February 2021 issue of NZFMM Magazine should be sent to Richard Feltham before the 20th January 2021. at: richard.feltham174@gmail.com

Back Numbers: NZFMM Magazines from April 2001 are available. Please contact Bruce Geange.

WANTED

LOOKING FOR Average to Good condition Super Highway and Crane multi-kits for building. Prefer posted or pickup from Waikato or Auckland Area.

Contact:
Kegan Wrightson
0220481447
s4ndv1p3r@icloud.com

Buy, Sell, Auction & Exchange

FOR SALE:

No.9 Set - plus many additional parts - fair condition, stored in drawers in a home-made cabinet. Also a large box of post-war Meccano Magazines.

Price: $100.00 Buyer to collect.
Contact: Mr Gordon Binnie
Mildale
AUCKLAND
(H) 09 426 6196
(M) 027 361 8110

FOR SALE:

- 15305 Race car
- 16301 Excavator
- 17207 Chev Silverado
- 6023640 Evolution excavator
- Have checked and all parts are complete, did not count nuts and bolts

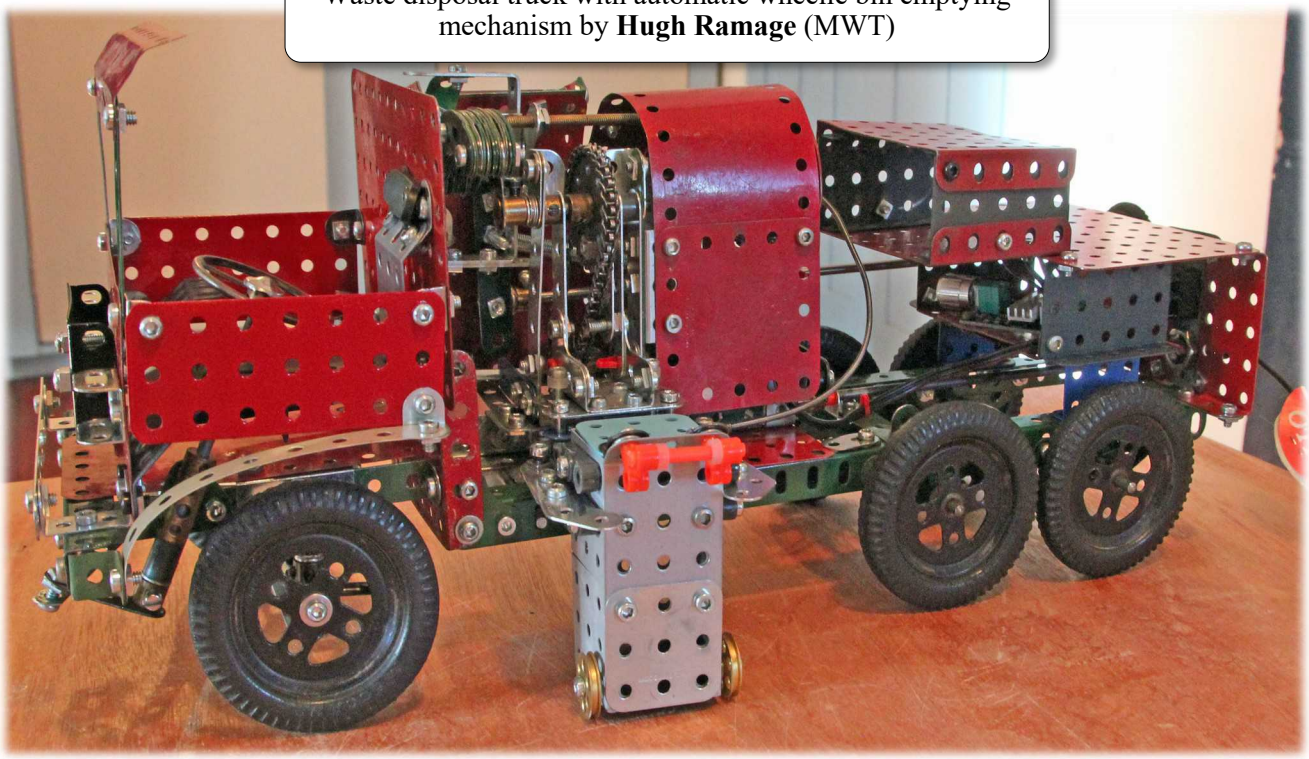
Please contact Don Flowers at
bflowers@gmail.com

Small Meccano Models Collection

Bruce Geange's delightful miniature tractor models have featured prominently in the NZFMM magazine over the years. A bound collection of these articles can be obtained from the author for $20+p&p. Please contact Bruce directly at *a.b.geange@slingshot.co.nz* or write to 4 Winchester Street, Palmerston North, 4412.

2021 Convention
Waikanae Memorial Hall
19th, 20th, 21st March

Waste disposal truck with automatic wheelie bin emptying mechanism by **Hugh Ramage** (MWT)



If 2020 was a Meccano project….