

# DRAGLINE SAGA

Steve Coulson Describes How He Created His Ingenious 4mm Scale Working Dragline

**C**HRISTMAS TIME ALWAYS PRESENTS PROBLEMS, having to put on that pleased expression at the receipt of a tie or socks etc., but one particular Christmas, a few years ago, I was given a 4mm Langley dragline kit by my wife, who noted a comment I had made whilst reading a model magazine. Due to other commitments it lay on the shelf for a couple of years and I resolved that when I did finally get round to building it that it would be a working model. Due to the fragile nature of the jib it would have to be protected with a cover to prevent damage and so the idea of a diorama developed. A decision also had to be made as to what form of operating system to use, electric or mechanical.

With the aid of a computer it is now possible to control motors to a high degree, but at some expense and, when you have a box full of gears in the workshop from redundant chart recorders and photocopying machines there is only one answer, mechanical, using cams. The postman (inadvertently) solved the problem – Internet ‘service providers’ who never seem to give up sending you CDs, supplying the basis. I now had three parameters to work from, one – by viewing a video tape of a dragline working I established that a working cycle was on average 55 seconds and two, that the CD determined what size the machinery space would be as this was the largest item to be accommodated with its cam follower/amplifier arms. By drawing out the elevation it was then possible to establish the third which was the height and, as the excavator would slew through 100 degrees, this gave me the width of the base – also the rope travels required, which had to be generated from the cam travel of 1½ inches (the maximum cam throw possible using a CD), the slew would be single, the drag double and the hoist three reeves.

## PROFILES

Cam profiles were generated by drawing a timeline representing one revolution of the camshaft, which is one minute, divided into 60 and the operations for each cam timed from the video. These were then transferred to a drawing of the CD, once again divided into 60. The start time to finish time of a operation and the transition of the cam profile were marked, the two points blended and so on. These were then cut out and pasted on to a CD and cut with a piercing saw. This needed fine tuning when initially run, but there were plenty of CDs arriving!

## ROPES

Ropes were the next item to be tackled, monofilament fishing line seemed to be the answer but would it stand up to being run over a small diameter pulley repeatedly? A test rig was set up, loading the line to its maximum weight and, by running it over a non rotating piece of round bar of similar diameter to that of the pulley, repeatedly for a day, gave promising results. I, of course, would not

be loading it to anything like that test. The jib support ropes are 2½ lb line and the hoist and drag are 1½ lb. The slew rope presented a different problem as a spring is the return force and the monofilament tended to be springy giving a jerky motion. The Porthmadog fishing tackle shop solved the problem by providing a sample of ‘Whiplash’ sea line which is multi stranded, has a breaking strain of 30lbs and no spring.

To ensure the longevity of the ropes and ensure they stayed where they were supposed to be, the ‘underground’ pulleys needed to be in the form of a sheave, correctly aligned to the run of the rope to prevent abrasion.

## RETURN

Next on the agenda, how to get the sand back to the digging point without it being obvious. Initially I had thought of feeding it through a slot in the top of the face, which meant that the conveying system would be horizontal. I tried, variously, a vibrating, drag and a screw type conveyor, none of which performed satisfactorily bearing in mind that I was determined to drive everything with one motor. Then a blinding flash of inspiration came. Having made augers for the top conveyor scheme, what about an ‘underfeed stoker’, as used on coal burning boilers? It worked, made the drive train simpler and silent with the media return being imperceptible.

## SCENERY

The scene is of a sand pit and with just the dragline plus a lorry and a stretch of disused narrow gauge track, the height of the excavator made the case rather tall, leaving a large background void, so something else was needed. If a building was placed at the rear, say a washing plant, with a doorway in that building and a fork truck passing the door (loaded with a pallet in one direction and empty in the other), that would add to the scene.

So, part two, the top base was extended to accommodate the shed, which had to be high enough to house the fork truck mechanism, which uses the same techniques developed for the excavator, but had the desired effect of producing a suitable

The complete diorama, minus the sky backscene. The Dragline is a Langley 4mm scale kit, while the lorry is a much modified 'Schuco' Shell oil tanker, in reality to HO scale. The plastic moulded tank body was a two piece moulding, split horizontally, and the lower half was retained and used as a basis for the scratchbuilt plasticard upper body. The lorry is removable and is held in position by small springs that snap onto the axles. Although not visible, the fork lift truck (see page 142) is scratchbuilt. A solid block of brass forms the core and is carried on four wheels. The body is a 'veneer' of plasticard. Corrugated plasticard on a hardboard backing forms the building at the rear and the skips just behind the RB-22 are from Dundas. Pallets are all scratchbuilt from plasticard with the exception of that used by the fork lift truck. This is a brass pallet with the socks made from DAS modelling clay. Groundwork is builders 'pink' plaster – some 15 years old but safely stored in plastic tubs. Surface decoration is mainly composed of Woodland Scenics materials, with a strip of Silflor grass mat along the pit edge. The loose media used for the dragline is fine sand – bought in the local pet shop.

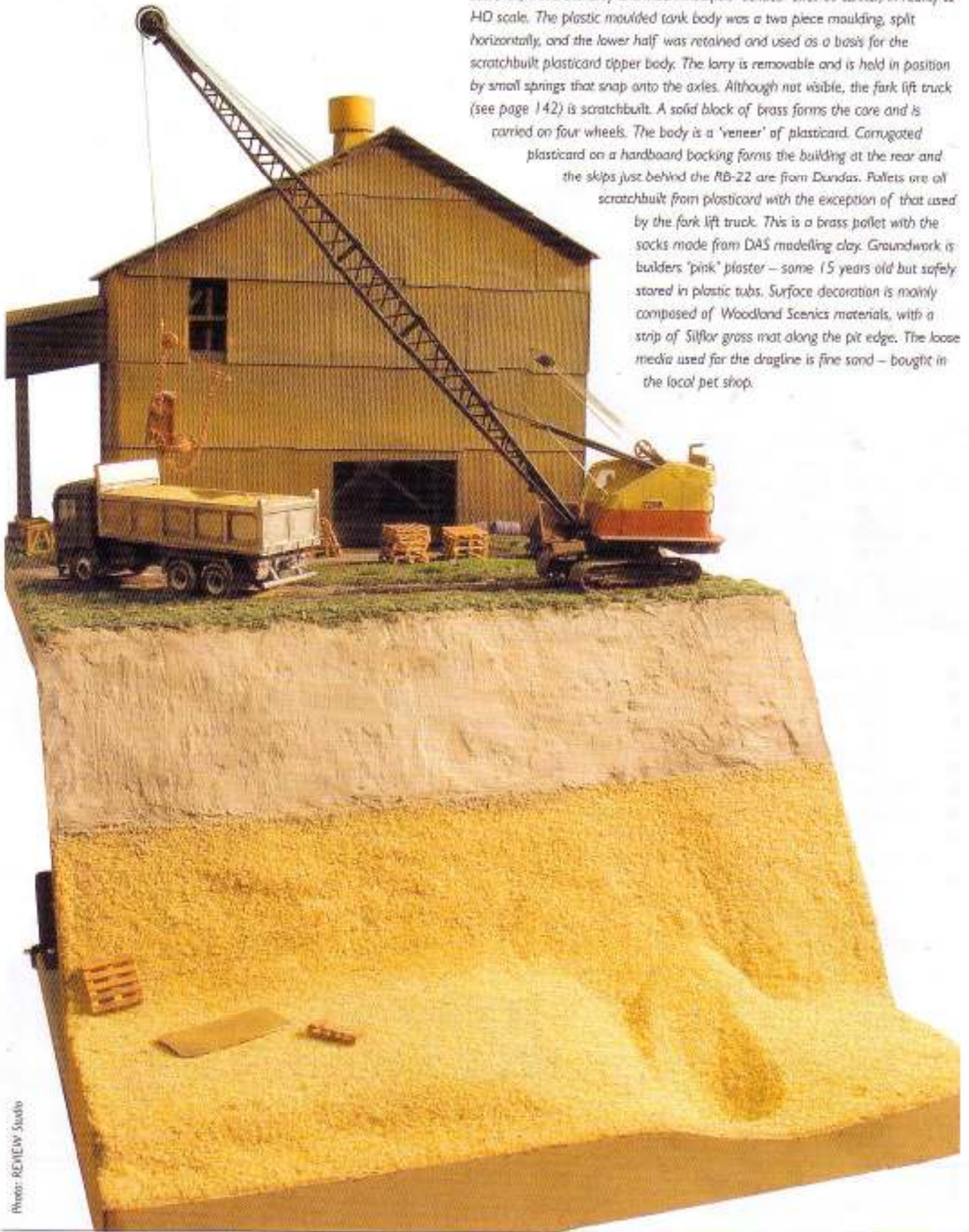


Photo: REVIEW Studio

**R**USTON & PROCTOR OF LINCOLN produced their first excavator in 1875, becoming Ruston & Hornsby in 1892. Later still, in 1930, the excavator part of the business was formed into a separate concern, Ruston-Bucyrus, with the American Bucyrus-Erie excavator company taking a controlling interest. The RB series of excavators commenced immediately, with the 10-RB, the RB-22 being developed in 1950. All were crawler mounted, cable operated machines until 1963, when the first hydraulic operated excavator (3-RB) was put into production.

The 22-RB, like most of the cable operated designs, could be equipped as a skimmer, back-shovel, bucket excavator, dragline, pile driver or crane. Often, contractors had one or more of these 'attachments' which were swapped around depending on the requirements of the work in progress.

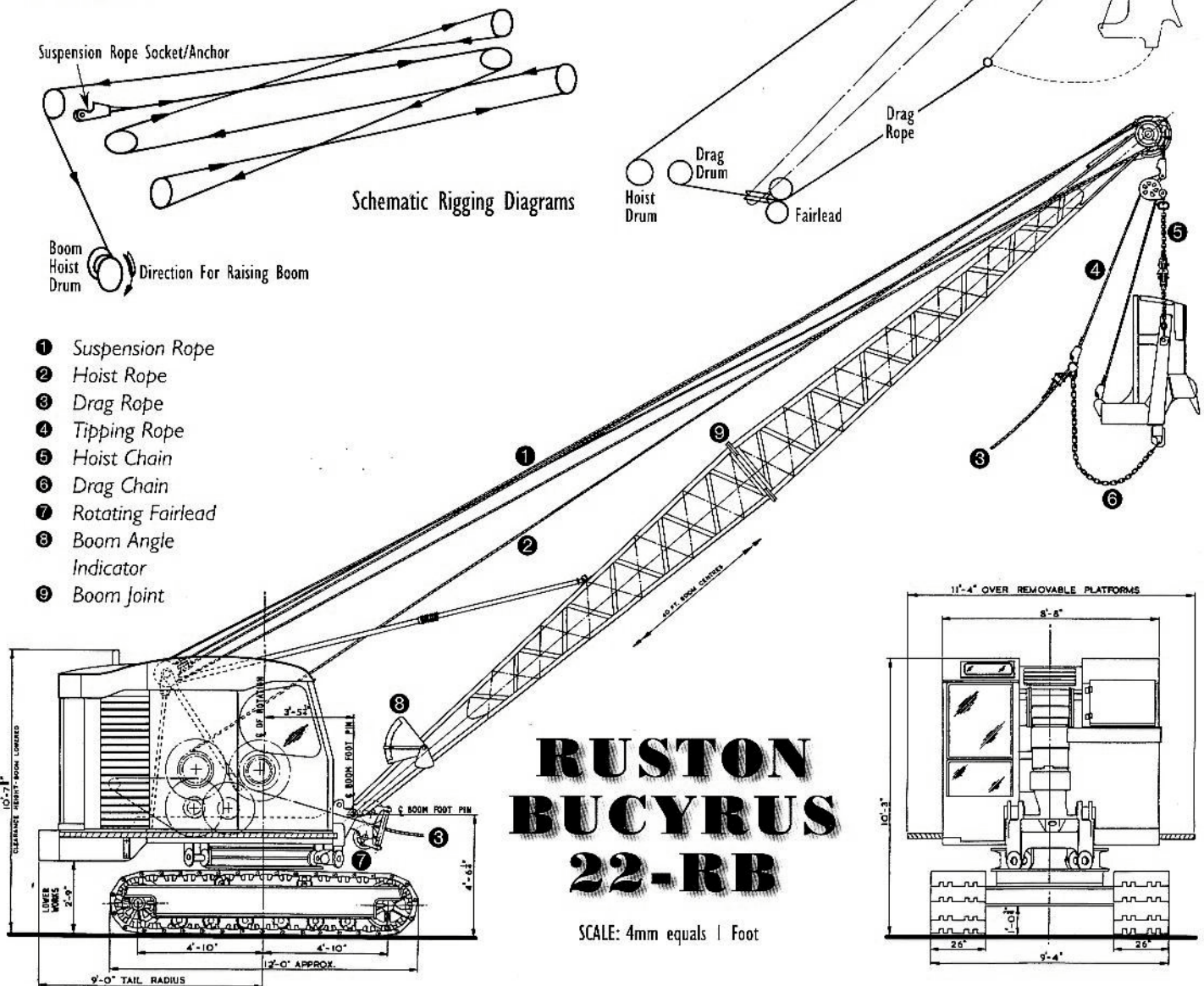
Shown here, set up as a dragline, the boom could be either 40 feet between centres, or 50 feet, with the addition of an extra 10 foot parallel boom section at the centre, where the two symmetrical taper sections bolted together.

Operation was one-man who was seated in the cab behind a complex array of levers and foot pedals. All of these engaged directly with the cable drums, brakes etc., by mechanical linkage. In the hands of a skilled operator, the machines could perform a veritable 'ballet' with the bucket, making it all look deceptively easy.

GENERAL REFERENCES (Useful but not 22-RB specific)  
 VINTAGE EXCAVATORS by Michael Irwin, Farming Press 1996.  
 ISBN 0 85236 333 8

EXCAVATORS by Peter Grimshaw, Blandford Press 1985.  
 ISBN 0 7137 1335 6

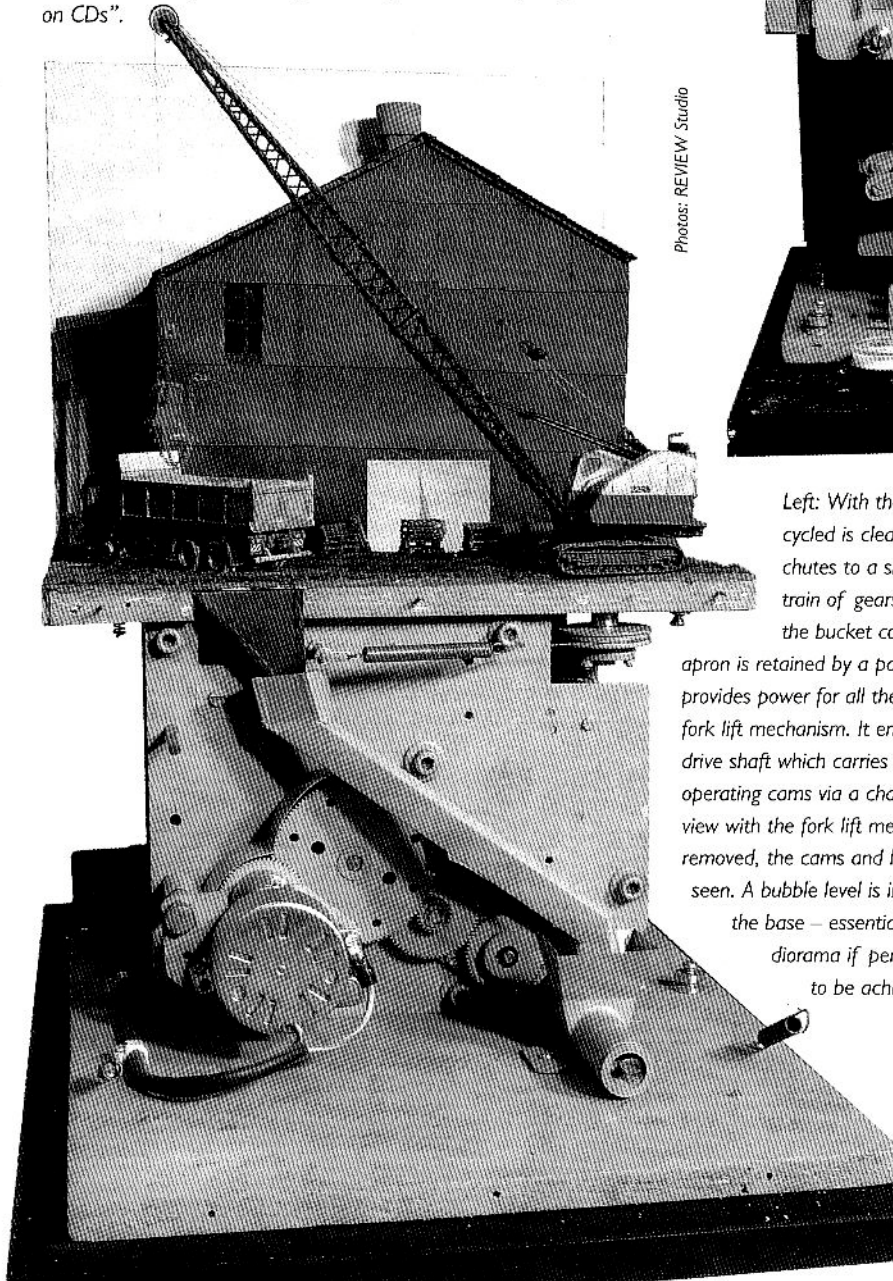
AN ILLUSTRATED HISTORY OF  
 EXCAVATORS by Hinton J Sheryn,  
 Ian Allan Publishing 1995.  
 ISBN 0 7110 23553 0



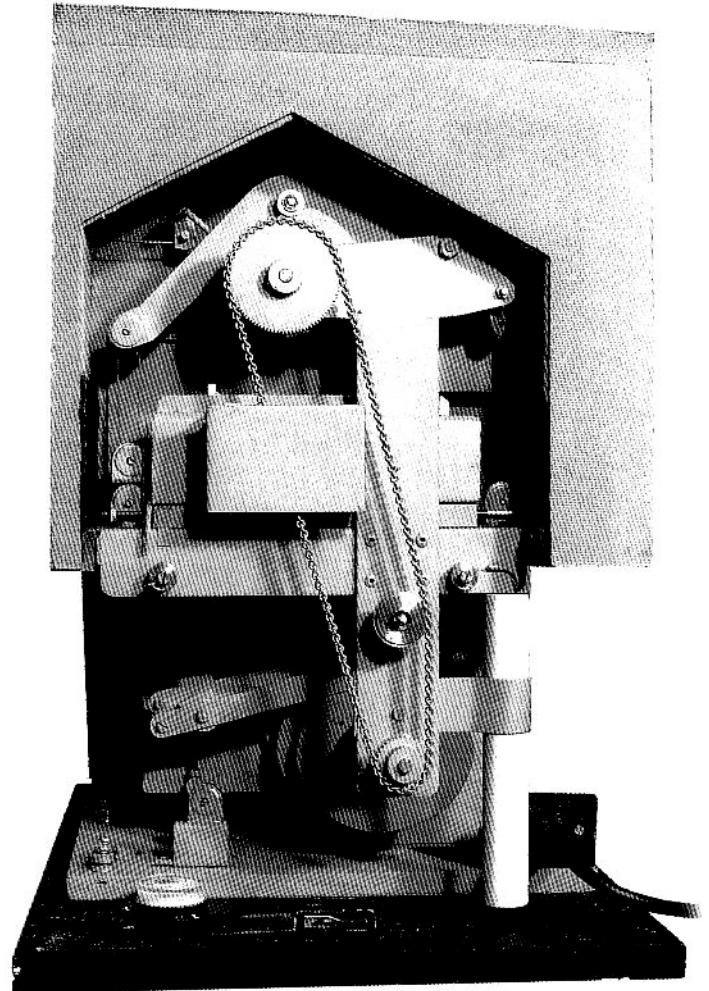
backdrop. This mechanism is a separate unit giving access to the excavator cams and access to the unit itself and the shed is part of the main base, for the sake of simplicity. Nothing looks worse than a building which seems as though it is not fastened to the rest of the world. The scenic materials are building plaster, hardboard, various foliage products, the ubiquitous styrene sheet, oil and water paints.

**COIN OPERATION**

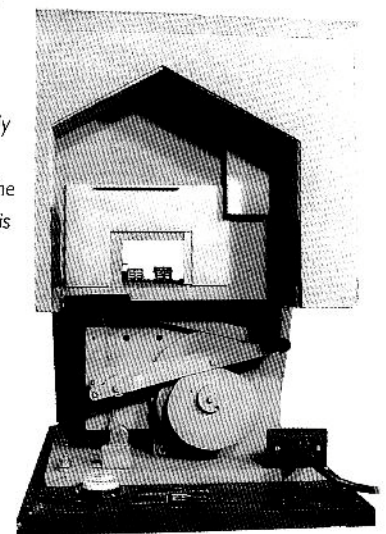
The illustrations should explain how this 'added' attraction works. The whole assembly lives in an acrylic case giving protection from fingers and dust. It can also be mounted on a base unit which houses a coin mechanism, from a scrap cigarette vending machine, you get 3 minutes of pure enjoyment for 10 pence – what a bargain. I hope that this article will help in inspiring others and solve some problems that may have deterred them from having a bash, and when someone asks you "Is it high tech?" you can always say, "Yes it runs on CDs".



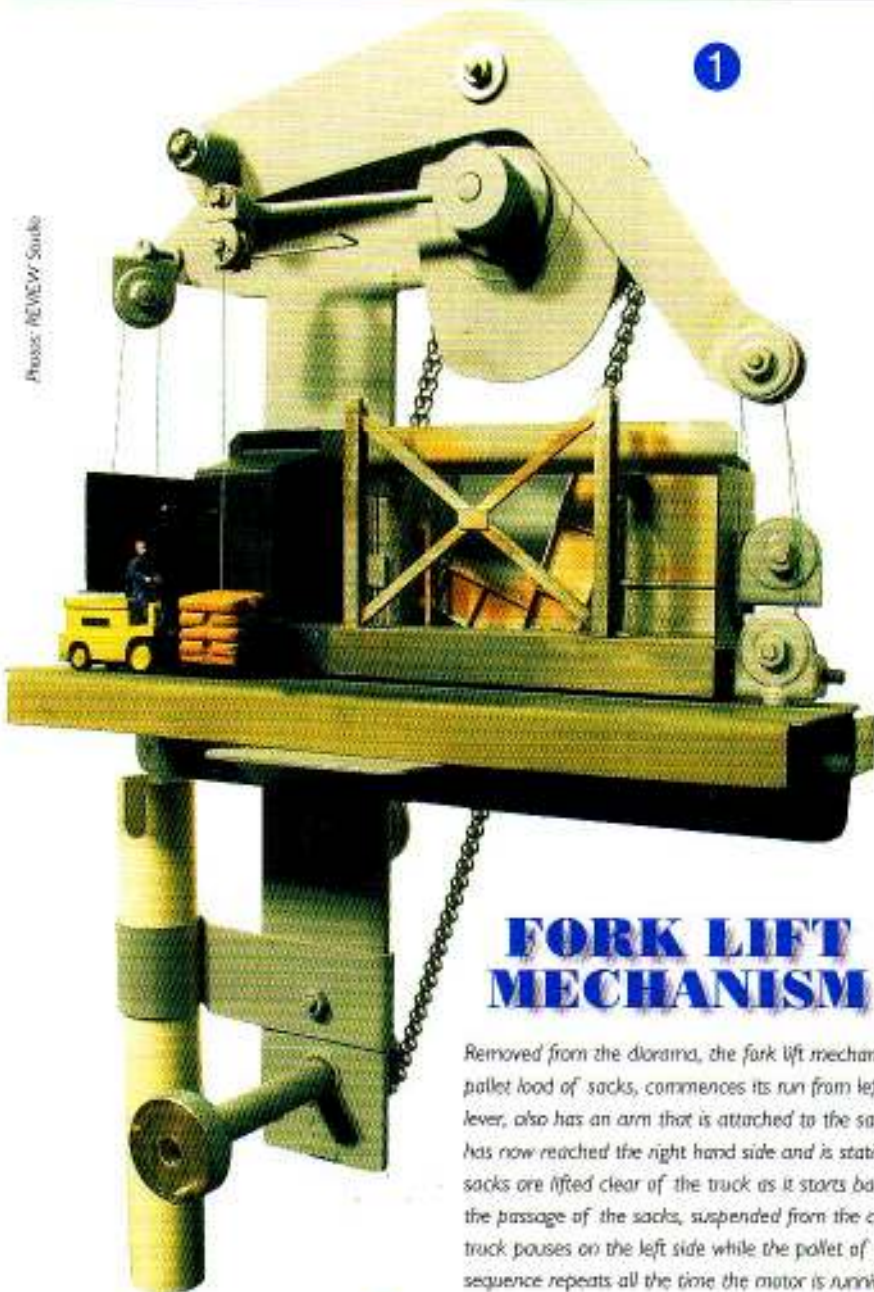
Photos: REVIEW Studio



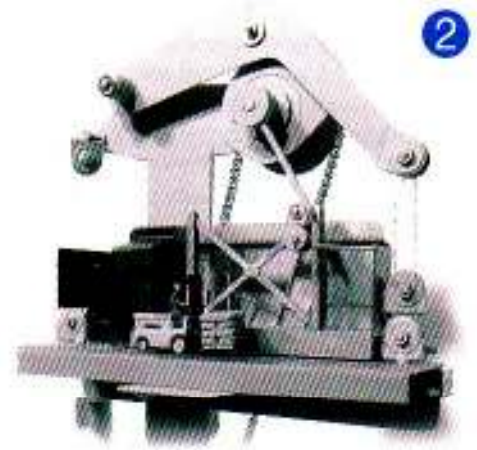
Left: With the front 'apron' removed the way that the media is recycled is clearly visible. Sand moves from the lorry down a system of chutes to a small hopper over an archimedian screw (driven via the train of gears from the motor) which feeds the sand back directly to the bucket collection point on the scenic 'apron'. For easy access the apron is retained by a pair of springs. The mains motor drives a single shaft that provides power for all the functions. Above: The rear of the diorama showing the fork lift mechanism. It engages with the drive shaft which carries the main operating cams via a chain. Below, a view with the fork lift mechanism removed, the cams and levers are clearly seen. A bubble level is incorporated in the base – essential for levelling the diorama if perfect operation is to be achieved.



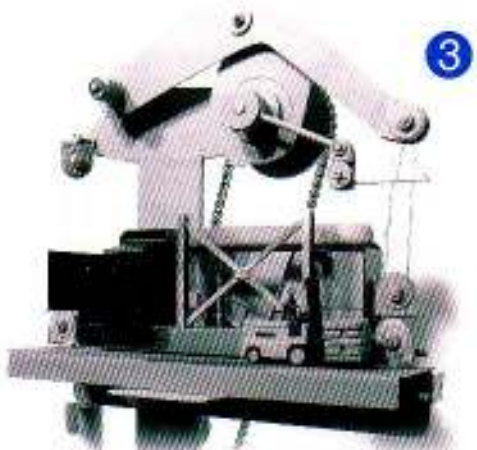
Photos: REWEVEY Studio



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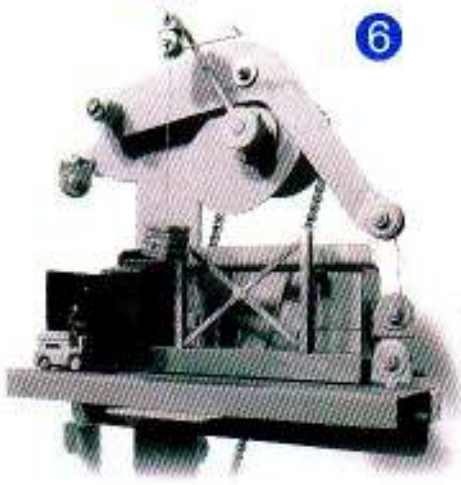
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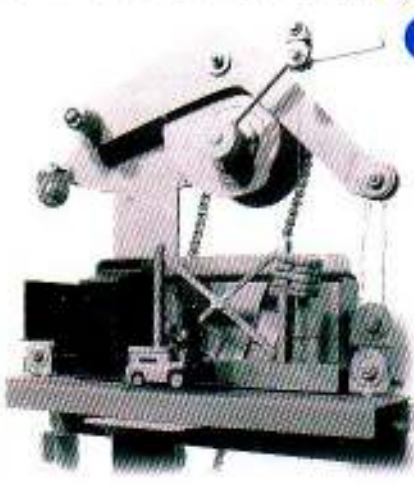
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# FORK LIFT MECHANISM

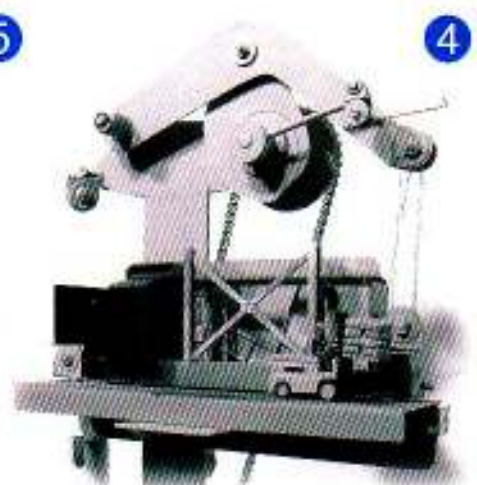
Removed from the diorama, the fork lift mechanism 1 is shown in operation... 2 - The truck, with its pallet load of sacks, commences its run from left to right. The rotating cam, which operates the overhead lever, also has an arm that is attached to the sacks with a very fine monofilament thread. 3 - The truck has now reached the right hand side and is stationary. Note that the cam arm is now rising. 4 - The sacks are lifted clear of the truck as it starts back towards the left. 5 - When mounted in the diorama the passage of the sacks, suspended from the cam arm, is hidden from sight by the building. 6 - The truck pauses on the left side while the pallet of sacks is lowered back into position on the forks. The sequence repeats all the time the motor is running.



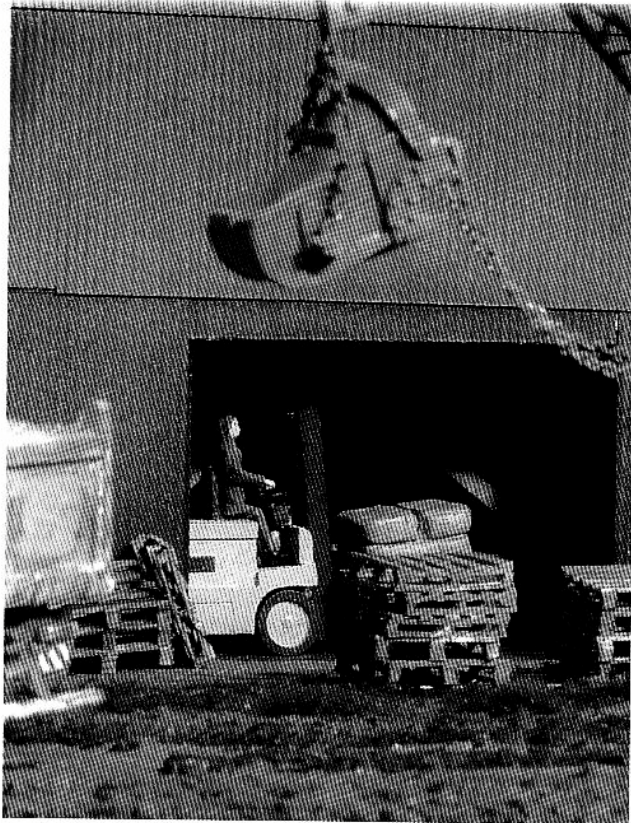
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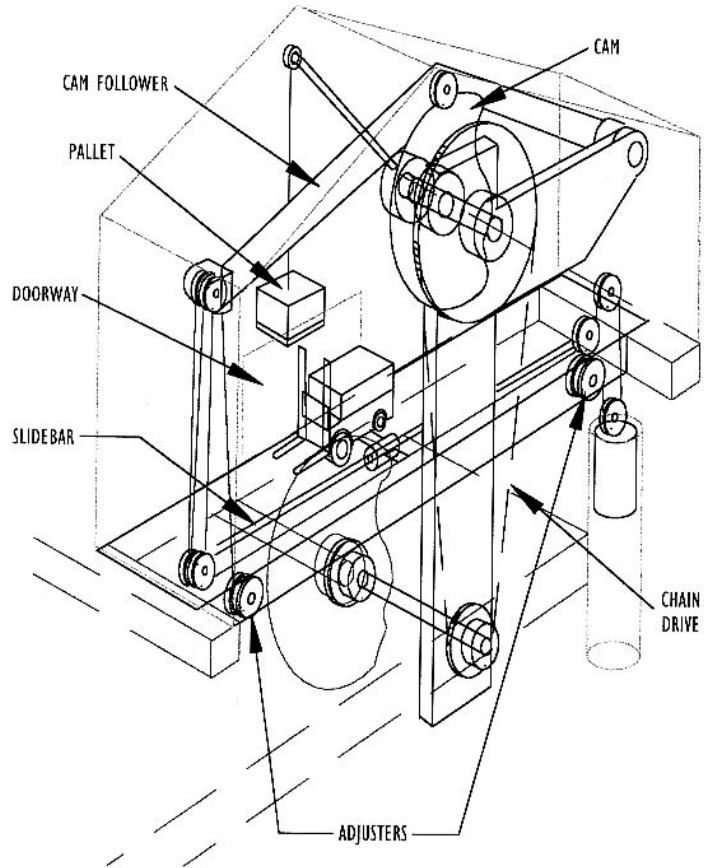
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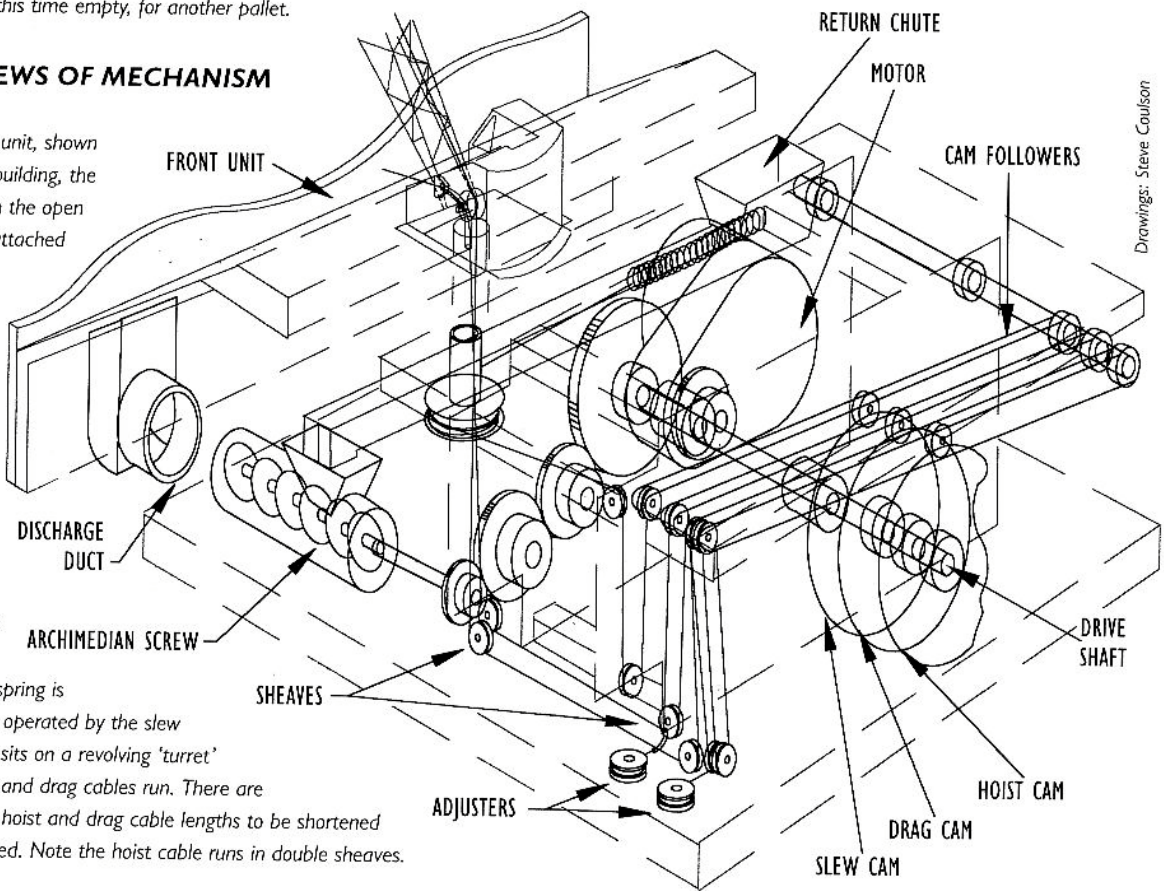
The forklift truck passing by the doorway with a pallet of sacks. In a moment it will return, this time empty, for another pallet.

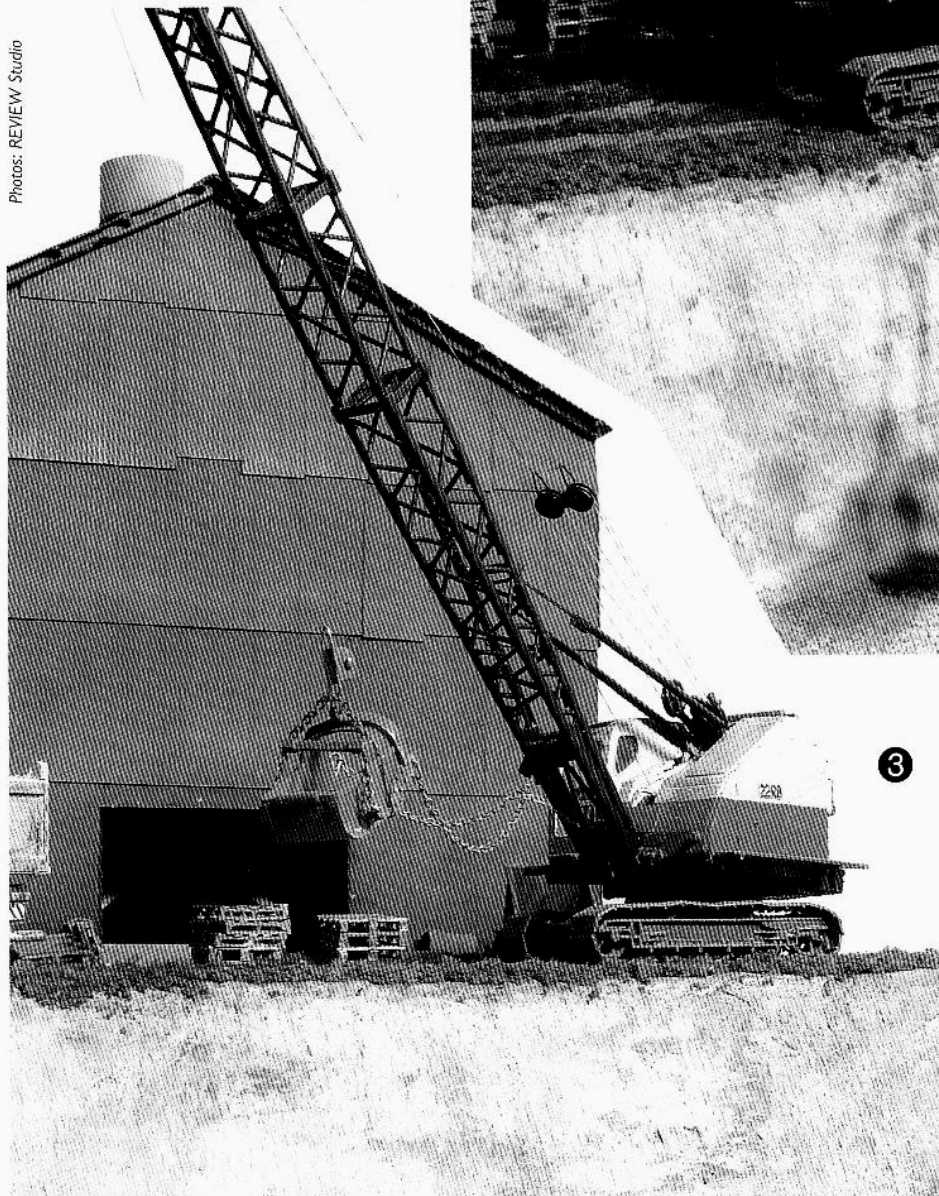
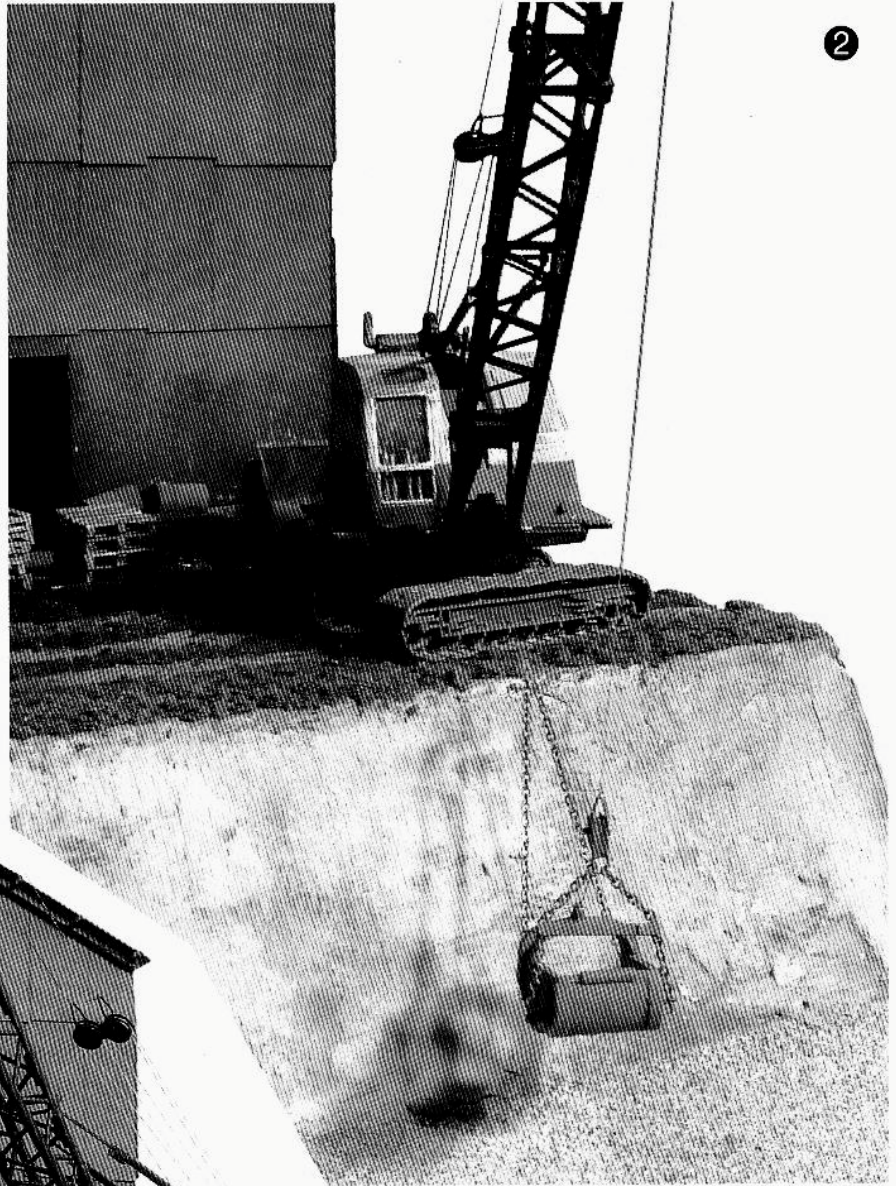
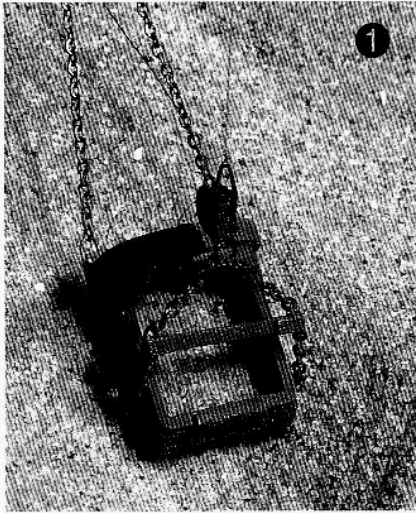


**SCHEMATIC VIEWS OF MECHANISM**

Top Right: The fork lift unit, shown in the confines of the building, the only view being through the open doorway. The truck is attached to a runner which runs back and forth on a slide bar. A weight keeps it all in tension.

Below Right: The dragline unit. Three cams provide all the operations required and the motor also drives the archimedian screw which returns the sand to the collection point. The large return spring is at the end of the cable operated by the slew cam. The RB-22 model sits on a revolving 'turret' through which the hoist and drag cables run. There are adjusters that allow the hoist and drag cable lengths to be shortened or lengthened, as required. Note the hoist cable runs in double sheaves.

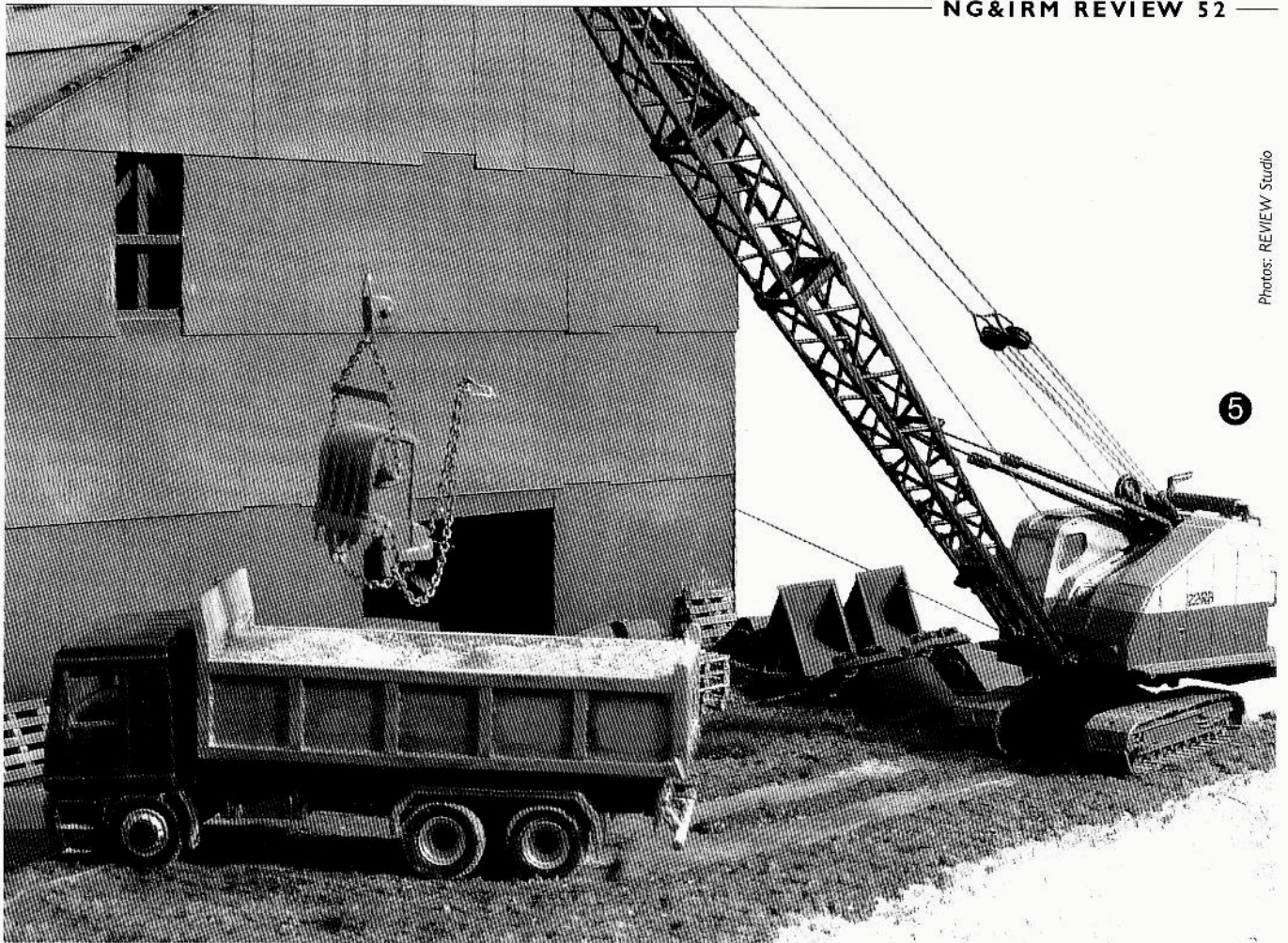




## DRAGLINE SEQUENCE

The dragline sequence commences as the bucket is filled with sand ❶. The bucket then rises and is simultaneously angled upwards, trapping the excavated sand ❷. As the rim of the 'excavation' is reached the jib swings ponderously toward the waiting lorry as the bucket rises further still to clear the rim ❸. As the bucket reaches the lorry it is inverted when the jib rotation ceases ❹ releasing its load ❺. The empty bucket is smartly returned to the collection point for more sand ❻.

Photos: REVIEW Studio



Above: Just visible behind the RB-22 are some old skips, awaiting the scrap man. These, along with the track on which the lorry stands, represents all that is left of a once busy narrow gauge line that served the works. Below: The works building provides an ideal backscene and is itself worthy of study, particularly the missing panel of corrugated iron, revealing the inner structure. Not visible is the forklift truck – maybe the driver has gone for a cuppa!

