MECCANO PLATFORM WEIGHING MACHINE

THE necessity for some means of weighing must have been felt by Man from the time he emerged from a condition of primitive savagery. How the earliest weighing operations were carried out we do not know, but it appears certain that the oldest form of scale is the equal-armed balance. From drawings still in existence it is clear that this form of balance was used by the ancient Egyptians, and no doubt the balance referred to frequently in the Bible was of the same type. In all probability the same means of weighing was used in ancient China long before the Christian era, for civilisation in that country had reached a comparatively high standard at the time it was only beginning to dawn in Europe.

Modern weighing machines present such a variety of forms that it is difficult to recognise in some of them any of the characteristics of the simple, old-fashioned scales. In cases where a high degree of exactitude is unnecessary, and where a small compact machine is required, it is customary to make use of a spring balance, which relies for its action on the fact that the extent to which a coil spring is drawn out varies in accordance with the weight imposed upon it, and it is constant for each definite weight. Spring balances, however, have the disadvantage that the springs gradually lose some of their elasticity and become slightly elongated, and consequently they have to be re-calibrated at intervals in order to ensure their continued accuracy.

The majority of balances and weighing machines, therefore, are constructed without using springs of any kind. The more complicated types incorporate a system of levers, but in almost every case the essential mechanism consists of some variation of the original balanced arm.

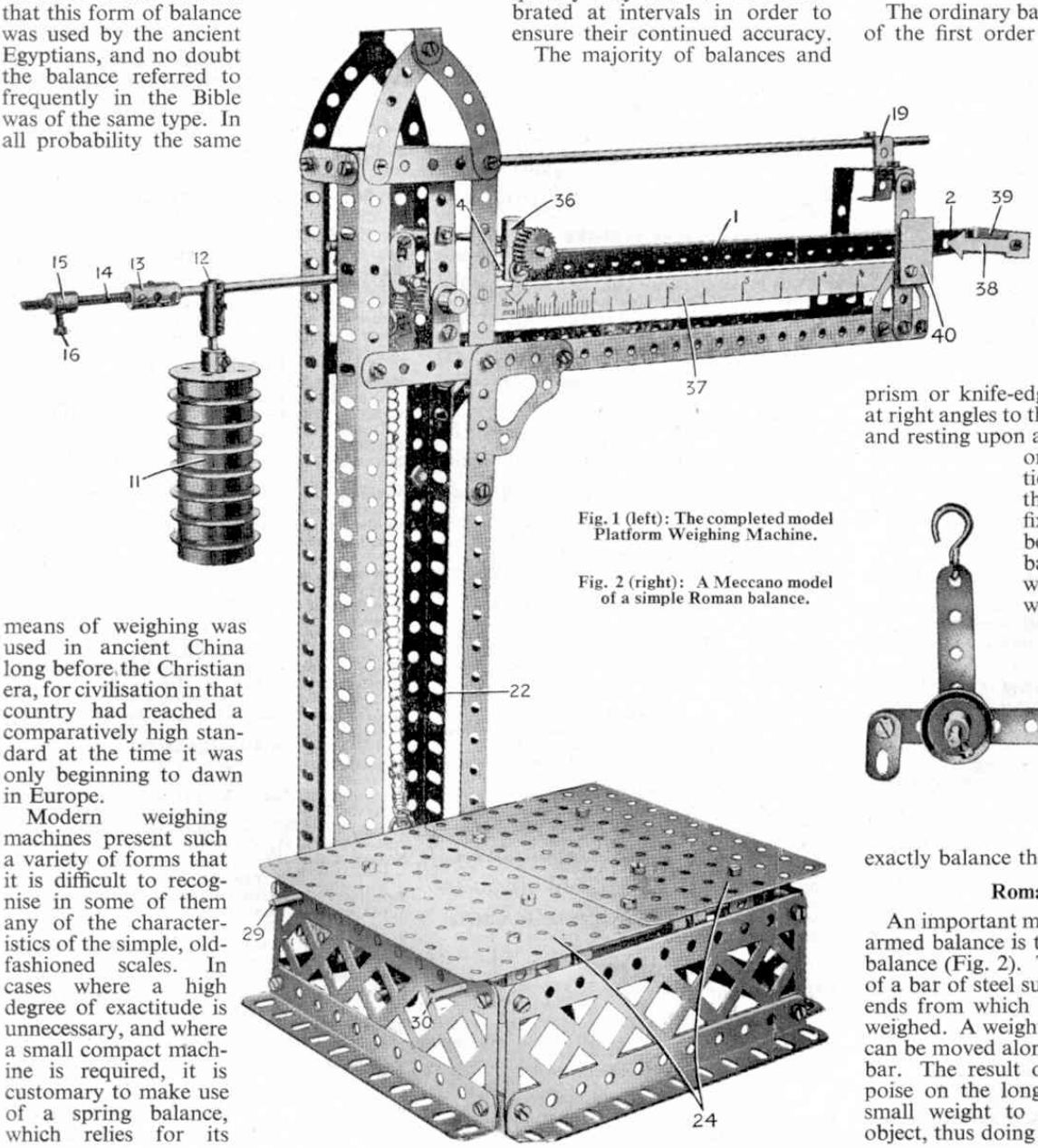


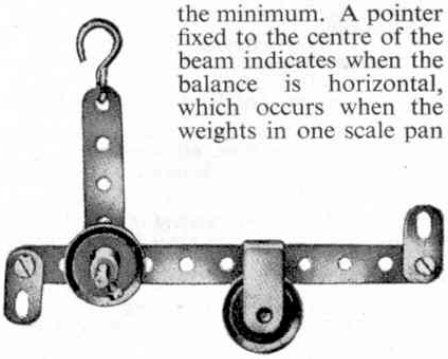
Fig. 1 (left): The completed model Platform Weighing Machine.

Fig. 2 (right): A Meccano model of a simple Roman balance.

The Knife-edge

The ordinary balance consists of a lever of the first order called the beam, supported at its centre on a fulcrum. At each end of the beam is hung a scale pan, one of these pans being for the weights while the other carries the object that is to be weighed.

It is necessary that the beam should be able to swing quite freely on its support, and in order to ensure this, the fulcrum consists of a steel or agate prism or knife-edge, with its sharp edge at right angles to the direction of the beam and resting upon a plane of polished steel or agate. This construction reduces friction to the minimum. A pointer fixed to the centre of the beam indicates when the balance is horizontal, which occurs when the weights in one scale pan exactly balance the object in the other.



Roman Balance

An important modification of the equal-armed balance is the steelyard or Roman balance (Fig. 2). This consists essentially of a bar of steel suspended near one of its ends from which hangs the object to be weighed. A weight used as a counterpoise can be moved along the longer arm of the bar. The result of placing the counterpoise on the longer arm is to enable a small weight to balance a very heavy object, thus doing away with the necessity

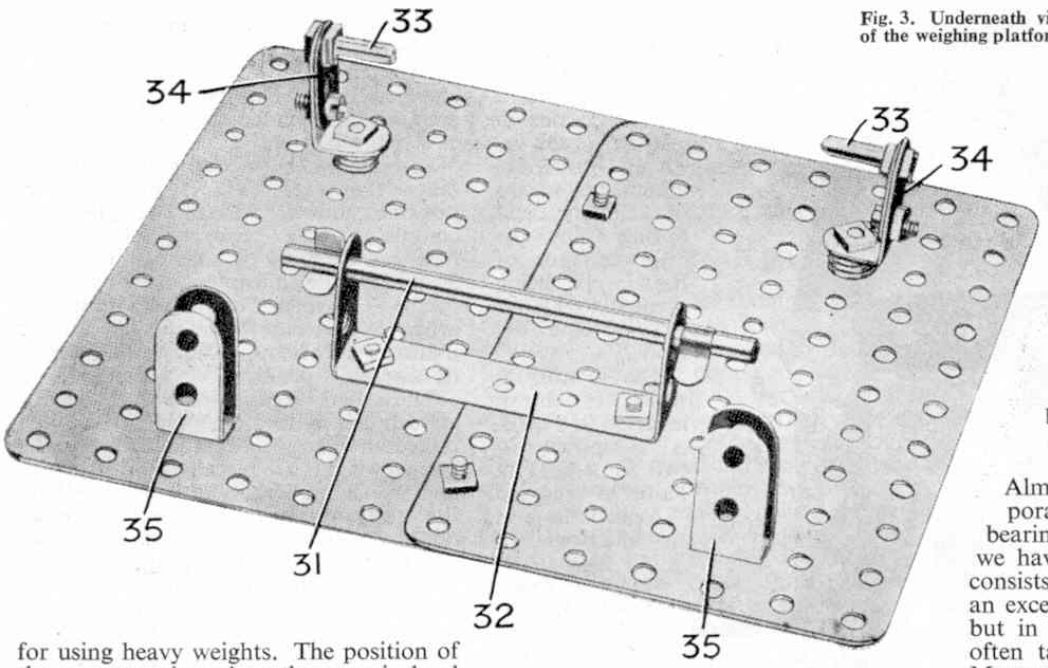


Fig. 3. Underneath view of the weighing platform.

for using heavy weights. The position of the counterpoise when the arm is level indicates the weight of the object balanced on the shorter arm.

From the simple steelyard has been developed the commercial platform weighing machines which are familiar objects in many warehouses and factories.

In this type of machine the object to be weighed is not hung directly from the steelyard, but rests upon a low platform. This arrangement enables heavy and bulky objects, such as sacks full of various materials, to be weighed quickly and with the greatest ease. The whole machine usually is mounted on wheels so that it can be moved about a warehouse as required. Such machines are made in various sizes having capacities of from 3 cwt. to 20 cwt. The same type of machine is used in railway stations, and in other places, without the wheels.

This Month's Model

The Meccano model shown in Fig. 1 closely resembles in principle a machine of this type. If desired the model may be made portable by mounting the base on 1″ Pulleys or Flanged Wheels.

The framework of the model requires no detailed explanation, for it is shown clearly in Figs. 1, 4 and 5. The steelyard 1 (Fig. 1) consists of a 12½″ Strip, and an 11½″ Rod extending along the back of this Strip is attached to it by means of Couplings. The Coupling at the outer end is in a horizontal position, and is secured to the steelyard by means of an ordinary bolt entering one of its transverse threaded bores, the 11½″ Rod being made fast in the longitudinal bore. The 12½″ Strip is similarly attached to the Coupling 5 (Fig. 5), the same bolt serving to attach the Strip and to secure the end of the 11½″ Rod to the lowest transverse hole of the Coupling. The Coupling 5 is carried on the end of a 3″ Rod 6 which is passed through further Couplings 7 and 8 and enters another Coupling in which a 3½″ Axle Rod 10 is mounted. This Rod carries the balance weights 11, which may be secured at any point along its length by means of the Coupling 12 (Fig. 1).

The Rod 10 is extended at its outer end by a Coupling 13 and a 2″ Threaded Rod 14 on which is screwed a Threaded Boss 15. Very accurate balance adjustments can be made by turning this Threaded Boss, and when the steelyard is exactly balanced the Boss is secured in position by the bolt 16.

Knife-edge Bearing

Almost all accurate balances incorporate some form of knife-edge bearing; in the smaller instruments, as we have already remarked, this usually consists of a triangular prism of agate, an exceedingly hard semi-precious stone, but in the case of large machines steel often takes the place of agate. In the Meccano model a very efficient knife-edge bearing is obtained without any deviation from the standard system of parts.

The Coupling 7 (Fig. 5) carries two Centre Forks 17, the points of which rest between the teeth of two ½″ Pinion Wheels. Thus the whole weight of the balance arm, including the load imposed upon it, rests

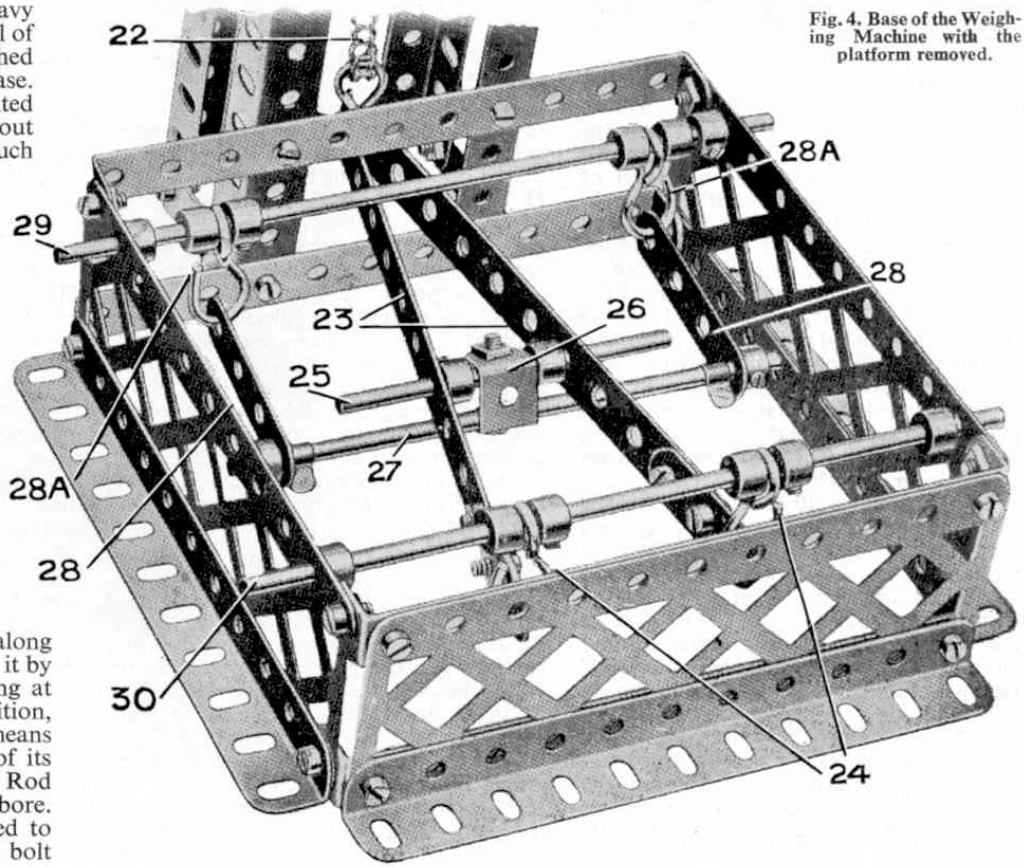


Fig. 4. Base of the Weighing Machine with the platform removed.

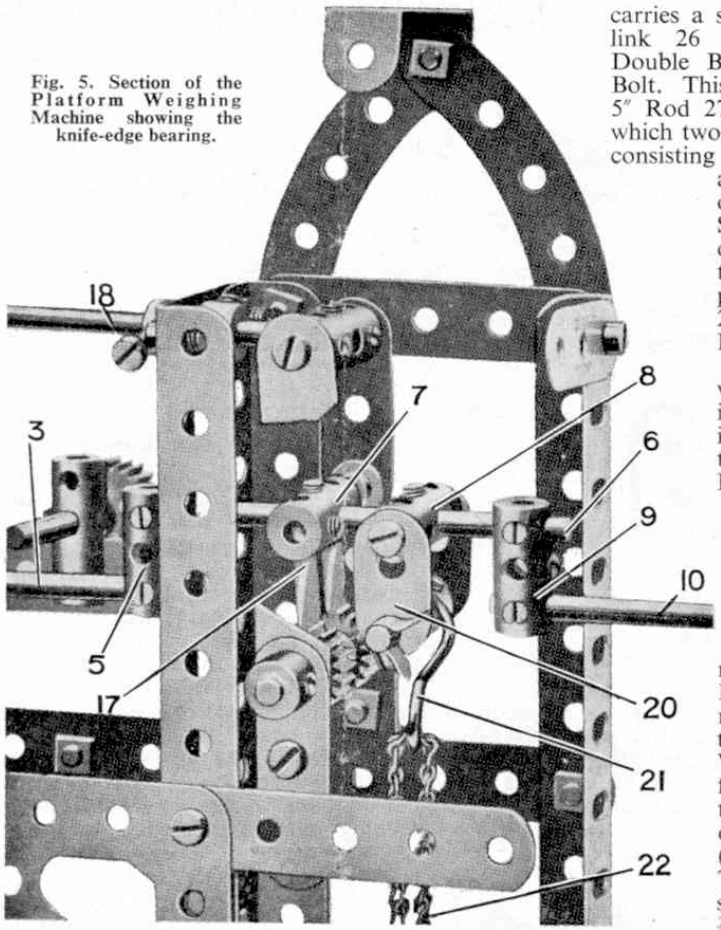


Fig. 5. Section of the Platform Weighing Machine showing the knife-edge bearing.

on the six hard steel points of the Centre Forks, with the result that a delicate balance is obtainable. The two ½″ Pinions are secured to a 2″ Rod rigidly held in two Cranks, which are attached to a pair of 3½″ Strips pivoted to the ends of a Coupling. The central transverse hole of this Coupling carries an 11½″ Rod 18, which passes through the middle hole of a horizontal 1½″ Strip that forms part of the framework. Collars are secured to the Rod 18 on both sides of this 1½″ Strip, but are spaced sufficiently far apart to allow the Rod a certain amount of freedom to pivot. A stop 19 for the Rod 18 is provided at the outer end of the framework (Fig. 1), and consists of a Reversed Angle Bracket to which a nut and bolt are attached.

Two Fishplates 20 (Fig. 5) suspended from the ends of the Coupling 8 carry in their lower holes a 1″ Rod, which is retained in position by Clips. A Hook 21 suspended from this Rod is connected with the levers 23 (Fig. 4) in the base of the model by a sprocket Chain 22 and another Hook, which passes under a 1″ Rod held in the end holes of the levers 23.

Platform Mechanism

The levers 23 are pivoted on Hooks 24 (Fig. 4)which are held in position on the 6½″ Rod 30 by means of Collars. A central 3″ Rod 25 journalled in the Strips 23 is also retained in place by Collars, and carries a special suspension link 26 consisting of a Double Bracket and a ¾″ Bolt. This link supports a 5″ Rod 27, to the ends of which two further levers 28, consisting of 2½″ Strips, are attached by means of Collars and Spring Clips, the opposite ends of the levers being pivoted to Hooks 28a on the 6½″ Rod 29.

The Platform, which is shown inverted in Fig. 3, is composed of two 5½″×3½″ Flat Plates overlapped one hole and bolted together. A 2½″ × 1″ Double Angle Strip 32 attached to the underside carries a 3½″ Axle Rod 31, which is retained in position by Clips. When the platform is in position, this Rod 31 rests on the levers 23 (Fig. 4), while two Threaded Pins 33, secured to the 1″×½″ Angle Brackets 34, rest on the levers 28.

Four Washers are placed between each of the Angle Brackets 34 and the underside of the platform, and two washers are placed on each of the bolts that secure the Double Angle Strip 32. Single Bent Strips 35 bolted to the 5½″×3½″ Flat Plates fit over the Rod 30 in the base (Fig. 4) and form vertical guides for the platform.

The arrangement of the levers underneath the platform is specially designed to make the machine respond to the slightest pressure, and to ensure that the same weight placed on any part of the platform (except at the extreme edges) will produce an equal pull on the Chain 22, whether the load is transmitted through the Chain by way of the Rod 31 and the levers 23 or by the Threaded Pins 33 and the levers 28.

Indicator Details

A weight 36 (Fig. 1), consisting of a Strip Coupling, a short Rod, and a ¾″ Pinion, slides along the steelyard 1 and carries a small pointer cut from cardboard, which indicates the load being weighed by means of the graduated scale 37. A piece of cardboard 38 should be cut in the form of an arrow and bolted to a Reversed Angle Bracket 39 in such a position that it comes to rest opposite a line marked on the cardboard indicator 40 when the steelyard is exactly horizontal. An upper and lower stop should be provided for the steelyard, consisting of a Reversed Angle Bracket and a 1″×½″ Angle Bracket respectively. The upper stop is clearly seen in Fig. 1 immediately below the stop 19.

In building the model, care should be taken that each part is in the exact position shown. When the model is completed, the steelyard should be balanced carefully by moving the weight 36, and minute adjustment made by means of the Threaded Coupling 15 until the arrow 38 lies exactly on the line on the indicator 40 when the sliding weight is in its innermost position.

The scale 37 is provided with extensions at each end by means of which it may be bolted in place. To graduate the scale, known weights are placed on the platform and the sliding weight 36 is moved along the steelyard until the arrow 38 points once more to the line on the indicator 40. The exact position of the pointer attached to the weight should be noted on the scale in each case, and the magnitude of the weight marked against it. The need for exactitude, both in calibrating (i.e. graduating the scale) and in the actual process of weighing, cannot be stressed too greatly, for a slight variation on the scale represents a considerable difference in the weight on the platform.

The steelyard is lifted into weighing position by placing the 11½″ Rod 18 under the stop 19 (see Fig. 1). The object to be weighed is then placed on the platform, and the weight 36 adjusted as explained until the pointer 38 is opposite the line on the indicator 40. The pointer attached to the sliding weight will then be found to indicate on the scale 37 the exact weight of the object. When not in use the scales should always be put out of action by releasing the Rod 18 from under the stop 19.

Miscellaneous Points

The model should be oiled at frequent intervals, and all the working parts must be kept clean and perfectly free to move. The Coupling 7 of the fulcrum in particular should not be allowed to touch the suspended 3½″ Strips on either side of it.

The appearance of the model may be improved considerably by filling in the sides of the base and the upright member with a Braced Girder, Strips or Plates, etc. The framework enclosing the steelyard may also be covered with either Strips or Flat Girders. This will not only give the model a more solid and workmanlike appearance, but will also protect the knife edge and the other working parts from possible disarrangement.

In addition to affording a very interesting model to build, the Meccano Platform Scales illustrates clearly and simply the general principles of the lever when used as a mechanical power and as a means of changing the direction of a force. Although the internal arrangements are perhaps a little complicated, it is a model that any Meccano boy can build. It will amply repay the little extra time and concen-

(*Continued in col. 3, next page*)

WITH THE SECRETARY

Club and Branch News

CLUB NOTES

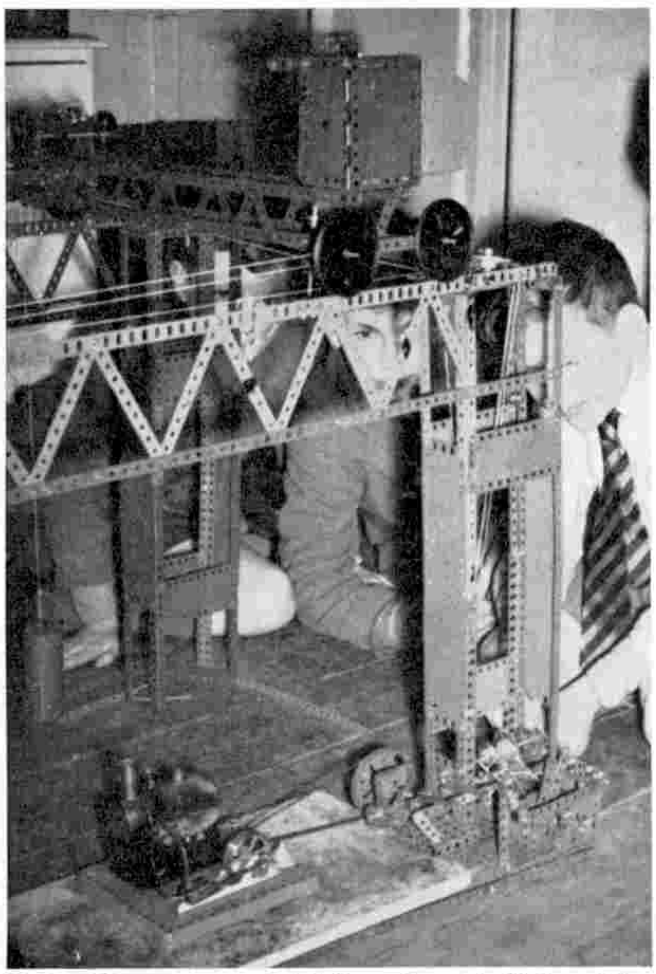
COPDOCK AND WASHBROOK M.C.—The members have been grouped into two teams named *Nuts* and *Screws* respectively. Interesting model-building, quiz and games competitions between the teams are held and are much enjoyed. *Secretary:* R. Soilleux, The Street, Washbrook, Ipswich, Suffolk.

SHEBBEAR COLLEGE (BEAWORTHY) M.C.—The chief feature of recent model-building has been the construction of a large gantry crane driven by a steam engine. It was equipped with a gear-box to operate three different mechanisms to move the crane along the gantry rails, traverse the crane bogie and raise and lower the pulley block respectively. A reversing mechanism by which these actions could be reversed was included, and when required all movement could be stopped by the application of two brakes. On the crane there was a cabin with a sliding door. Another model-building event was a Lorry competition, which was won by Albert Sloman and Brian Petherick. *Secretary:* M. R. J. Kent, Shebbear College, Beaworthy, N. Devon.

WOODLEY C.E. SCH. (READING) M.C.—The Club affiliation certificate is to be framed and hung in the Club room. Points are awarded in the Club model-building competitions, and at the end of term a "Best Model-Building" Cup is presented to the boy who has gained the highest number of points. The subject of a recent model-building meeting was *Model Aeroplanes*, and the results were very creditable to the builders. A party of members went to London and visited the Model Railway Exhibition at Central Hall, Westminster. *Leader:* Mr. H. W. Mason, Woodley C.E. (Controlled) School, Church Road, Reading, Berks.

BRANCH NEWS

NORTH END (PORTSMOUTH)—Model railway activities have been centred on preparations for the Summer Fair. New scenic effects have been constructed for Mr. Enfield's re-built old layout, with the aid of several sheets of green crêpe paper, blackboard paper pasted on cardboard (for roads), and mountain scenery painted on a backcloth. Further features are a goods yard and a model airport. The big new layout which Mr. Enfield is constructing for use when the Branch gives displays in halls other than its own premises, is being made in sections each measuring 4 ft. 6 in. × 2 ft. *Secretary:* Mr. A. J. Nicholson, 213 Sultan Road, Buckland, Portsmouth.



The large Meccano gantry crane built by members of the Shebbear College M.C., Beaworthy, and described on this page. The members in the background are (left to right) Brian Petherick, Martin Kingdom and M. R. J. Kent (Secretary of the Club).

Meccano Platform Weighing Machine

(*Continued from previous page*)

tration that may be required to make it efficient and accurate.

List of Parts required to build the Meccano Platform Scales: 3 of No. 1; 2 of No. 2; 2 of No. 3; 2 of No. 4; 3 of No. 5; 2 of No. 6; 6 of No. 6A; 4 of No. 8; 2 of No.9; 4 of No. 10; 1 of No. 11; 2 of No. 12; 1 of No. 12A; 3 of No. 12B; 2 of No. 13; 2 of No. 14; 1 of No. 15; 3 of No. 16; 2 of No. 16B; 1 of No. 17; 2 of No. 18A; 1 of No. 18B; 8 of No. 20; 1 of No. 25; 2 of No. 26; 8 of No. 35; 78 of No. 37; 14 of No. 38; 1 of No. 46; 3 of No. 48; 4 of No. 48D; 2 of No. 52A; 6 of No. 57; 20 of No. 59; 2 of No. 62; 8 of No. 63; 1 of No. 63B; 1 of No. 64; 2 of No. 65; 1 of No. 81; 4 of No. 90; 3 of No. 100; 2 of No. 102; 2 of No. 108; 1 of No. 111; 1 of No. 111A; 2 of No. 115; 2 of No. 126A.

BOOK REVIEWS

The Welsh Highland Railway by Charles E. Lee, F.R.S.A. (David and Charles, price 9/6d.) is based on relevant portions of an earlier work by the same author, *Narrow Gauge Railways in North Wales*, that was published in 1945. The text has been revised and amplified. Not only so, but illustrations additional to those in the original book have been provided, so that considering the nature of the present book, which runs to 48 pages, the proportion of pages devoted to pictures of one kind and another is high indeed. In addition to half-tone reproductions, there are diagrams and sketches, and a map showing the district served by the line, which is made up of several older railways laid to the narrow gauge of 1 ft. 11½ in.

A folding drawing allows the basic details of one of the characteristic locomotives to be followed. As well as the factual account of the line, details of locomotives and rolling stock, time-tables and tickets are included in this fascinating publication.

* * * *

Beginner's Guide to Photography by Edward C. Partridge (Newnes, 10/6) is one of a series of handbooks each dealing with a particular aspect of the photographic hobby and, as the title indicates, is directed primarily to the newcomer. It is written by a professional photographer who knows all the problems and, what is more, the correct answers to them. So his practical advice on choosing the right equipment—from the purchase of a camera to the installation and use of the darkroom—is well worth having. How to use your camera correctly when you have got it, the important matters of exposure, artificial lighting and, subsequently, development are dealt with clearly and adequately. Naturally, colour photography too is dealt with, and the making of enlargements. The book is beautifully illustrated with full-page colour plates, more than 60 half-tone pictures and many line illustrations.