The Meccano Loom

A Wonderful Model that Weaves Real Hatbands, Neckties, etc., etc.

SPECIAL FEATURES

The process of weaving is entirely mechanical. The shedding movement of the Heald Frames, the rocking of the Slay and Reed, the to and fro movement of the Shuttle, and the take-up motion by which the woven material is wound on to a roller, are all brought into operation on rotation of the Crank Handle. The material produced by the model is ot wonderful quality and can be used for practical purposes.

MAN is the only creature that has to make clothes, and certainly a good deal of trouble would be saved if our bodies were covered with feathers or fur, thus making clothes unnecessary!

Animals and birds undoubtedly may be regarded as fortunate because they have not to provide themselves with clothes. Yet, on the other hand, there would be many drawbacks if we were subject to the same conditions. For instance, we should not be able to change our clothes to suit any particular climate when we wish to travel abroad: nor could we wrap ourselves in extra heavy overcoats to brave the stormy days of winter. There would be many other disadvantages, too, for we could not change into flannels for cricket nor into "shorts" for footer. There would be no school colours, and no special caps for those boys in the school XI's! Then again, our mothers and sisters could not have pretty hats nor jumpers, and this in itself would be a terrible calamity indeed, from their point of view, though it would certainly save our fathers a good deal of expense!

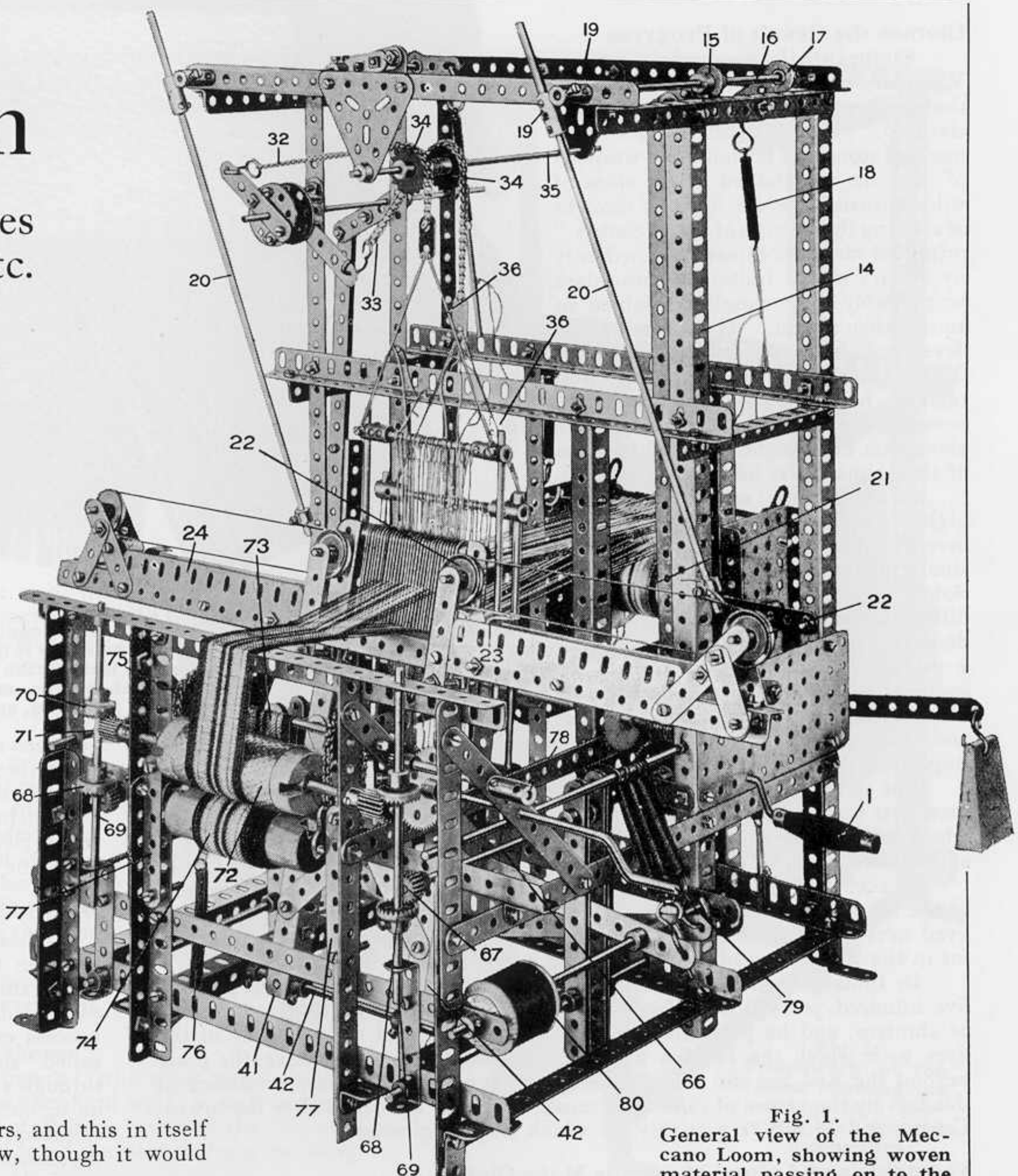

Fig. 1. General view of the Meccano Loom, showing woven material passing on to the take-up Roller.

Clothes the Result of Progress

Clothes are the result of civilisation. We read in our history books that, thousands of years ago, before man was civilised, when his battle axes were made of stone and his tools and weapons of flint, he was clothed in the skins of wild animals. Before he thus thought of robbing the animals of their "clothes," primitive man was himself clothed only by a hairy skin. Indeed in those days he probably more closely resembled an animal than a man. As his intelligence developed, however, and as he pushed further and further into the cold regions, he found the necessity for a covering for his body. Thus it came about that he thought of using the skins of the animals that he hunted for food.

As time went on and man rose higher in intelligence, weaving was invented, and fabrics made of flax and similar materials took the place of skins. Some of these fabrics were dyed different colours, and others were decorated with bright patterns, giving a pleasing effect. In this respect we imitate the ancients even to-day, for we like to wear clothes of different patterns, and to have in our homes curtains and carpets in which colours play an important part.

But spinning and weaving are of great antiquity, and as is the case with most arts and crafts, they were first practised in the East. Even at the time when Britain was covered with forests, and its inhabitants were uncivilised and clothed in skins, the people of Eastern nations were wearing woven cloth.

In accounts of the late Lord Carnarvon's wonderful discoveries we read of the fabrics found in the tomb of Tut-ankh-amen, the mighty Pharaoh who lived over 4,000 years ago. Linen was known in Egypt in very early times, for in the Bible we read of Joseph being arrayed in fine linen.

In India, cotton cloth was the ordinary wear of the inhabitants at least five hundred years B.C. The histoiian, Strabo, speaks of flowered cottons or chintzes, and he particularly refers to the lustre and vivid quality of the dyes with which the Hindus figured their cloths. In early times, the ports beyond the Red Sea did a large trade in cotton cloth. We are reminded of this fact by the names of calico and muslin, for they are called after the towns, Calicut and Mosul respectively, in which they originated.

Vegetable and Animal Materials Make Clothes.

To-day our clothes are generally made either from cotton or from wool, and it is wonderful to think that these raw materials can be changed so that in their finished form they bear not the slightest resemblance to their original state.

Fig. 2.
The above illustration shows some of the beautiful material that may be made with the Meccano Loom. Unfortunately, it is not possible to reproduce the finished product in colours, so that the illustration gives but a poor idea of the attractive appearance of the finished fabric, the patterns of which are worked in blue, orange, gold, red, etc.

Cotton comes from the pods of the cotton plant, and in this state its appearance resembles cotton wool. It is picked in the fields and packed into great bales, large quantities being pressed into small compass by powerful hydraulic presses. Any readers who have visited Liverpool will have seen heavy loads of these cotton bales passing through the streets from the docks to the warehouse.

Cotton grows in all tropical countries, and is obtained largely from Egypt and other parts of Africa, from certain parts of Central and Southern America, and from India and China. In these countries the climate is particularly suitable for its growth.

Before it is possible to use the raw cotton and wool they must be converted into thread, or "yarn," as it is called. This work is accomplished by spinning machines, of which there are several types. The yarn is then supplied to the weaver who, with the aid of a loom, weaves it into cloth. This must then be bleached and sized, and dyed and finished, before it is ready for delivery to the shops where we buy it by the yard.

Included in these processes are "picking" and "carding," which respectively clean the cotton of impurities, and arrange the fibres so that they all lie in the same direction.

Drawing and Twisting Cotton.

These fibres are only 1/2000th inch in diameter, and under the microscope are seen to resemble a flat ribbon, twisted like a stick of barley sugar. It seems almost impossible that these tiny fibres could by any process be disciplined into a long and continuous thread, yet the feat is accomplished by the process called "drawing." Here the fibres are drawn out into long strands, called "sliver," and in this form they resemble a thick tape. They then pass through a machine called a "slubber," where they are given a twist and wound on to bobbins. From here they pass to the "roving frame" and then to the spinning machine, which further twists the thread and tightens it up until it reaches the requisite quality and strength. It is not until the cotton fibres reach this stage that they are ready for the final process of weaving into cotton cloth.

Making Woollen Yarn.

Wool, of course, is obtained from the fleece of sheep. As in the case of cotton, the raw wool must first be treated by several processes before it is suitable for weaving, one process being that which extracts the grease. The wool is first picked and cleaned, and then carded and twisted into yarn of varying thicknesses. It has also to be dyed before the cloth is made if a pattern is desired in the finished cloth, but if the finished article is to be of a uniform colour, the fabric may be dyed after weaving.

The Hand-Loom

All weaving was done on hand-looms until 1785, when the power-loom was invented. Hand-looms are still in use in many parts of Scotland and Ireland, for instance, and also in France. Nearly every farm-house in Lancashire in the early days was an independent little factory, and hand-looms were to be found in most of the cottages and houses in the towns and villages. The weaver himself generally bought the raw cotton. This was picked by his children, spun into thread by his wife or his elder girls, and then woven at the loom by his sons, whilst he carried it to the merchant for sale.

There were very few hand-looms in England until about the second half of the 16th century, however, when religious persecutions drove the Protestant weavers from Holland, Flanders and France to this country. These refugees established themselves here, and many of the Flemish weavers settled in the neighbourhood of Manchester, now the centre of the cotton industry.

Warp and Weft

The earliest improvements in the ancient hand-loom were those made in connection with that part known as the shuttle. To understand exactly the functions of the shuttle we must remember that a woven fabric is composed of two elements, the "warp" or longitudinal threads, and the "weft," or cross-threads. If you examine your handkerchief or a tablecloth, you will see exactly what is meant by this. Notice how a woven fabric differs from one of another texture, such as a stocking, jumper, or crochet pattern.

The interweaving of the warp by the weft, called the "picking motion," is effected by passing a thread from the shuttle between some of the threads of the warp. The shuttle moves from one side of the loom to the other, and each time it passes between the threads of the warp, it leaves behind a thread of weft.

There are three distinct operations necessary to enable the shuttle to accomplish this movement. The first is the opening of the warp, when some of the threads are raised for the second operation of picking. The third operation, which is called "beating up" the weft, consists of pressing the weft into position by the reed.

These three primary operations must be carried out on every loom, no matter whether it be the hand-loom of a cottage or the largest power-loom used in a modern spinning factory.

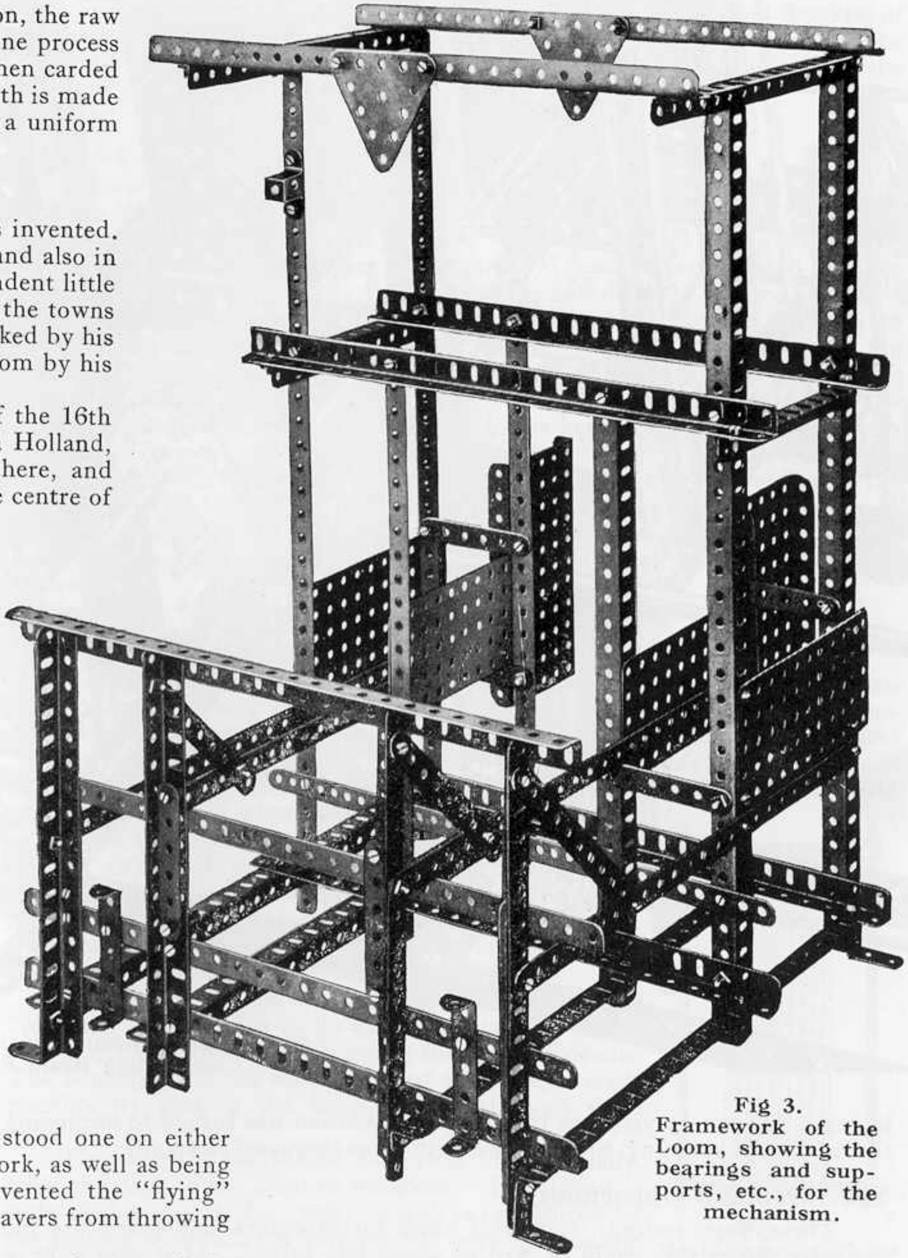

Fig 3.
Framework of the Loom, showing the bearings and supports, etc., for the mechanism.

Up to the early part of the 18th century, the shuttle had to be "thrown" backwards and forwards by hand. This was accomplished by two persons, who stood one on either side of the loom. As the shuttle was heavy, throwing the shuttle was very hard work, as well as being a very laborious and slow process. In 1750, however, John Kay, of Bolton, invented the "flying" shuttle. This consisted of a "picking stick" that drove the shuttle and saved the weavers from throwing it with their hands.

Not only did the invention halve the necessary labour, but it also increased the production of the

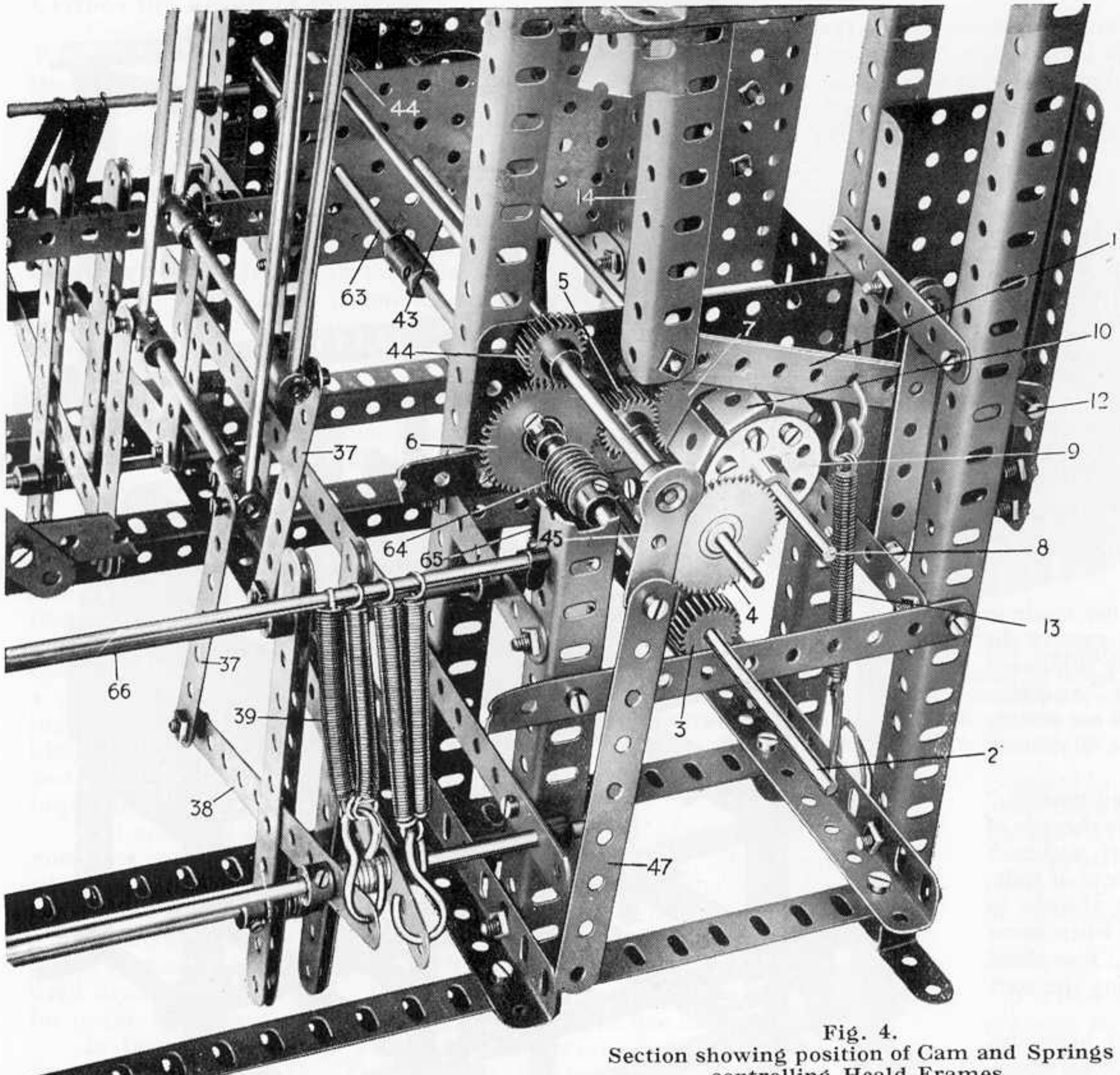

Fig. 4.
Section showing position of Cam and Springs controlling Heald Frames.

looms. Thus more yarn was required and attention was turned to improving the method of spinning, to keep pace with these increased demands.

The Inventors' Opportunity

These were, indeed, wonderful times for inventors, and many are the romantic stories that could be written about this period. Men who were in lowly walks of life were able to amass great fortunes from their inventions and discoveries in such days of golden opportunity, and many British families to-day owe their prosperity to the inventions of this period.

James Hargreaves, of Blackburn, and Richard Arkwright, a Preston barber, both produced inventions that improved the output of yarn. Crompton in 1787 invented his spinning "mule," which combined the features of Hargreaves' and Arkwright's inventions. The steam engine, then lately perfected by Watt, was harnessed to drive the spinning mule, and a great increase in cotton production followed.

In 1785 Edmund Cartwright, an English clergyman, invented the power-loom, which enabled cloth of more uniform texture to be produced at a lower cost and in greater quantities.

Strange though it may seem, yet it is a fact that the power-loom was only slowly taken up. It was first used in Glasgow about the end of the 18th century, but about a century ago it was rapidly adopted, especially after it was made so that the cloth was taken up mechanically, instead of it having to be continually pulled forward by the weaver.

In those early days the power that was available was limited, and often advantage had to be taken of a waterfall to drive the mill by means of a water-wheel. The alternative method was to drive the mill by a horse attached to a rotating capstan in the centre of a circle, around which the horse continuously walked.

It is a far cry from the hand-looms of the Ancient Egyptians to the giant power-looms of our modern factories, in some of which there are over 8,000 looms installed and the weekly output is 600 miles of cloth! Nevertheless, the story of the intervening centuries is one of the greatest interest, and not the least extraordinary is the fact that all the changes and improvements have taken place in the last two hundred years.

The Meccano Loom is designed exactly on the lines of the large power looms used in the cotton industry in Lancashire, and is capable of weaving excellent cloth, samples of which are illustrated in Fig. 2. While the three pieces of cloth shown at the top of the illustration were produced on the model Loom as described in the booklet, the other patterns, which are more intricate, require three or more heald frames operating at different times. So far as the texture of the cloth is concerned looms having only two heald frames will produce excellent work. The additional heald frames are only for the purpose of introducing variety of pattern into the finished material.

Building the Meccano Loom

The main framework of the loom should be built up carefully as shown in Fig. 3, both sides being exactly similar in construction. When the frame is completed the driving mechanism illustrated in Figs. 1 and 4 may be inserted. In Fig. 4 portions of the framework have been removed in order to reveal the mechanism.

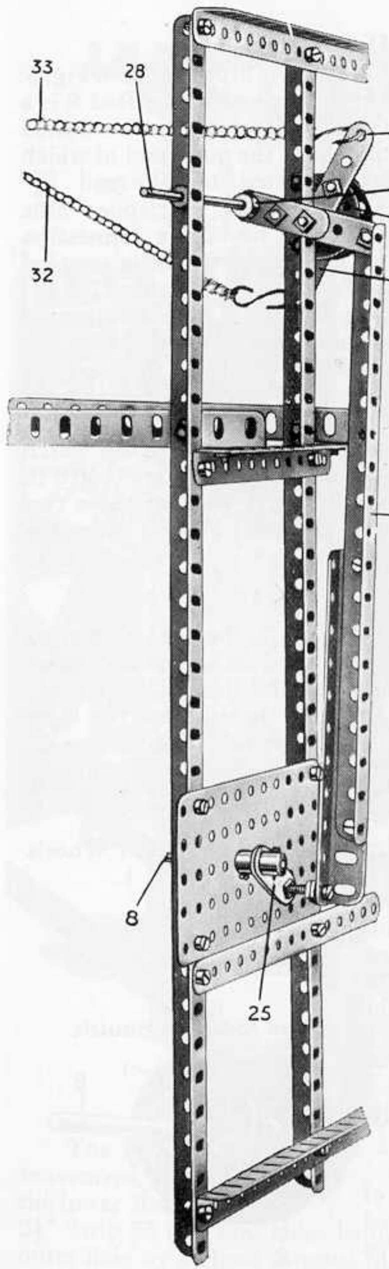

Fig. 5.
Cranks and connecting Strip operating Heald Frames.

The shaft 2 of the main operating Crank Handle 1, which, if desired, may be fitted with a wooden handle as shown in Fig. 1, carries a $\frac{3}{4}''$ Pinion Wheel 3 meshing with a 50-teeth Gear Wheel 4. A $\frac{3}{4}''$ Pinion 5 on the same Rod as the Wheel 4 engages two 50-teeth Gear Wheels 6 and 7 secured to $11\frac{1}{2}''$ Axle Rods that extend through the entire width of the framework.

Picking Motion

The Rod 8 on which the Gear Wheel 7 is mounted also carries at opposite sides of the model two cams 9 of the type shown in Fig. 9. It will be noticed that Bush Wheels are shown in Fig. 4 and $1\frac{1}{2}''$ Pulleys in Fig. 9. Either of these are suitable for the construction of the cams and may be used as preferred.

Each of the cams embodies three Double Brackets 2 (Fig. 9) bolted between the Pulleys or Bush Wheels 1, and the latter are secured to the $11\frac{1}{2}''$ Axle Rods 8 (Fig. 4). The $5\frac{1}{2}''$ Strips 11, which ride on the tops of the cams 9, are pivoted at 12 to Double Bent Strips bolted to the $5\frac{1}{2}''$ by $2\frac{1}{2}''$ Flanged Plates at the rear of the loom. The Strips 11 slide between vertical $3\frac{1}{2}''$ Strips spaced apart by the thickness of two Washers, and are held down by Springs that cause them to follow the cams 9 and impart an up and down movement to vertical $12\frac{1}{2}''$ Angle Girders pivoted to the composite Cranks 15, each of which consists of two Cranks butted together with a 2″ Strip between them. The Rods 16, to which these Cranks are secured, are assisted in responding to the movements of the cams 9 by Springs 18, which are attached to ordinary Cranks 17 by means of Hooks. To the outer end of the Rod 16, by means of a Threaded Pin and $\frac{1}{2}''$ Bolt, is attached the picking stick 20 formed by an $11\frac{1}{2}''$ Rod, the lower end of which is connected to a cord 21 passing roun two 1″ Pulleys 22. This cord is connected to a Double Bent Strip 23, which engages the Shuttle and flicks it across the slay 24.

The cams 9 are oppositely disposed, that is, the three Double Brackets of one cam are on top while those of the other cam are underneath, so that the picking sticks work alternately, throwing the Shuttle first to one side of the slay and then to the other.

Take Up Motion

This is shown in Fig. 4. On the Rod 63 of the Gear Wheel 6 are mounted also two Worms 64, which engage and drive 57-teeth Gear Wheels 65 on Rods 66. The $\frac{1}{2}''$ Pinions 67 (Fig. 1) drive $\frac{3}{4}''$ Contrate Wheels 68 on the vertical Rods 69. It will be noted that the Contrate Wheels 68 are reversed. Other $\frac{3}{4}''$ Contrate Wheels 70 on the Rods 69 engage and drive $\frac{1}{2}''$ Pinions 71 on the Sand Roller 72. Owing to the gearing of the Worm 64 and Gear Wheels 65 the necessary slow "take up" motion is imparted to the Sand Roller, and the woven material, after passing beneath the Sand Roller, passes over the Rod 73 to the lower Roller 74, on which the fabric is wound. The lower Roller 74 is driven frictionally from the Sand Roller and is kept in frictional contact with that Roller by means of the Sprocket Chains 75 at either side, which are hooked on the Rod of the Roller 74 and are kept taut by Springs 76. The Rod of the lower Roller 74 is enabled to move away from the Sand Roller 72 (so as to allow for the increasing diameter of the roll of woven fabric) by causing the ends of its Rod to engage between $2\frac{1}{2}''$ Strips 77 and the frame of the machine at each side.

The Heald Frames

The construction of the heald frames will be clear from the detail given in Fig. 6. The lower ends of the heald frames, as shown in Fig. 4, are connected to $3\frac{1}{2}''$ Strips 37 coupled to $5\frac{1}{2}''$ Strips 38. The latter are controlled by the Springs 39, which tend always to draw the heald frames down.

To adjust the healds correctly set them so that the eyes of both heald frame sets are level when the Cranks 45 are vertical and the Strips 47 (Fig. 4) are horizontal.

As in actual practice, the healds are assembled vertically. In the Meccano Loom there are two frames, but there may be many more frames in actual looms. The healds serve to lift and depress the warp, so that the shuttle may be passed between the threads.

The healds consist of a number of wires, called "leaches," each having in its centre an eye, or "mail," which to a certain extent resembles the eye of a needle. The depression of the warp, referred to above, is made possible by passing the warp threads through these mails.

The warp is the thread that runs longitudinally, from the back to the front of the loom. The thread at right-angles to it is the "weft," which is introduced by the passing of the shuttle between the warp threads and pressed into position by the reed.

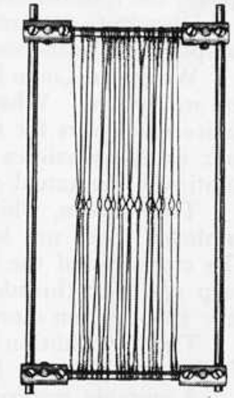

Fig. 6.
Heald Frame, with set of Healds in position.

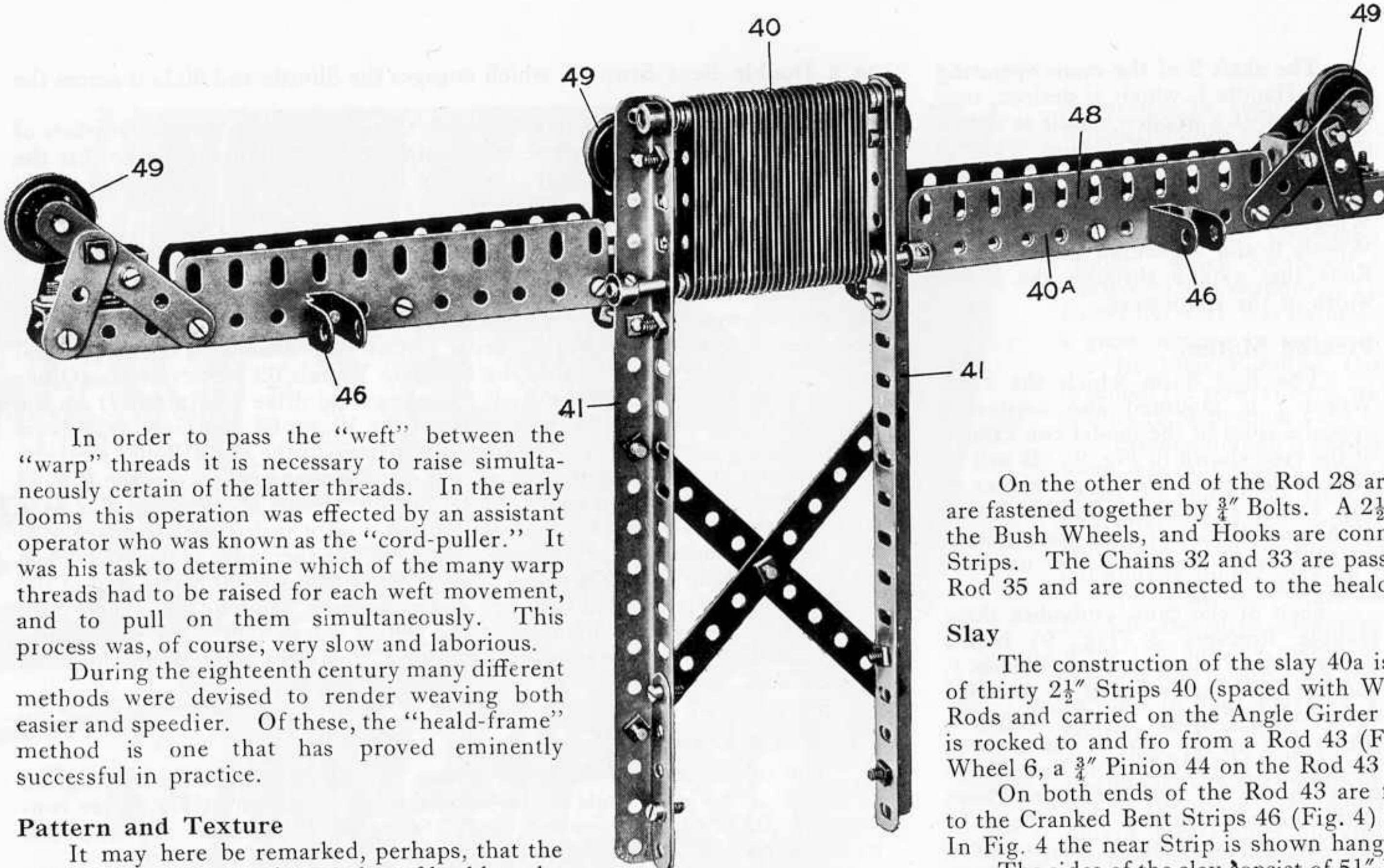

Fig. 7.
The Slay and Reed Frame.

In order to pass the "weft" between the "warp" threads it is necessary to raise simultaneously certain of the latter threads. In the early looms this operation was effected by an assistant operator who was known as the "cord-puller." It was his task to determine which of the many warp threads had to be raised for each weft movement, and to pull on them simultaneously. This process was, of course, very slow and laborious.

During the eighteenth century many different methods were devised to render weaving both easier and speedier. Of these, the "heald-frame" method is one that has proved eminently successful in practice.

Pattern and Texture

It may here be remarked, perhaps, that the pattern depends upon the number of healds: the greater the number employed, the more complex is the resulting pattern. For the weaving of very complex figures the warp must be divided among a large number of healds.

When the Loom has been built, it is necessary to determine what pattern you will weave. Whether it be a tie or a hat-band that is your first effort, the choice of colours for the warp, and the colour of the weft will call into play your artistic qualities to no little extent, in addition to your manipulative abilities in the actual process of weaving.

The pattern, which as we have seen depends on the number of healds employed, does not have any bearing on the texture of the woven fabrics. The closeness of the texture of any material depends upon the number of warp and weft threads to the inch. In actual manufacturing, fine cloth may have 125, or even more, threads to the inch both in warp and in weft.

Thus in addition to the colour and the pattern, you will have to decide of what texture your fabric is to be.

A suitable material for use in this model is No. 8 Star Sylko for warp and No. 40 Sylko thread for weft. No thicker material should be used. Any drapery establishment will supply you.

Heald Motion

This is brought out in Fig. 5. On the far end of the Rod 8 is a Crank 25 (two Cranks butted together), the outer end of which is connected to 9½″ and 5½″ Angle Girders, overlapped nine holes and forming a connection 26, the top of which is coupled to an extended Crank 27 fixed to a Rod 28. The element 27 is made up of a 2½″ Strip, the end hole being on the Rod 28, and with two Cranks reversed and bolted through the Strip.

On the other end of the Rod 28 are secured two Bush Wheels 29, which are fastened together by ¾″ Bolts. A 2½″ Strip 30 and 3″ Strip 31 are bolted to the Bush Wheels, and Hooks are connected to the outer ends of these two Strips. The Chains 32 and 33 are passed over 1″ Sprocket Wheels 34 on the Rod 35 and are connected to the heald frames 36.

Slay

The construction of the slay 40a is shown in Fig. 7, the reed consisting of thirty 2½″ Strips 40 (spaced with Washers), mounted on upper and lower Rods and carried on the Angle Girder 41 pivoted on the Rod 42. The slay is rocked to and fro from a Rod 43 (Fig. 4), which is driven from the Gear Wheel 6, a ¾″ Pinion 44 on the Rod 43 meshing with the Gear Wheel 6.

On both ends of the Rod 43 are fixed Cranks 45, which are connected to the Cranked Bent Strips 46 (Fig. 4) on the slay by means of 4½″ Strips 47. In Fig. 4 the near Strip is shown hanging down disconnected.

The sides of the slay consist of 5½″ Flat Girders 48, and the Pulley Wheels 49, round which the picking cords run, are carried as shown in Fig. 1.

The Shuttle moves along the "slay" which supports and guides it as it is jerked from one side of the loom to the other by means of the "picking sticks," suspended from above. Attached to the slay is the "reed" which moves forward with the slay after every crossing of the warp by the weft.

The bed of the slay may be improved by covering its upper surface with a strip of sheet tin, upon which the shuttle can slide more freely.

Fig. 8.
The Meccano Shuttle.

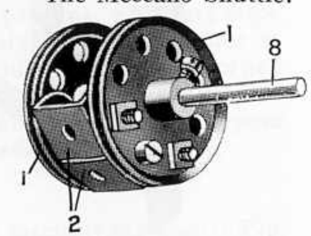

Fig. 9.
Cam for operation of Picking Sticks.

Warp Thread Tension Mechanism

In order to compensate for the slacking of the warp threads which develops when the shed is formed by the motion of the healds, the warps are passed from the beam 50 (Fig. 10) under the Rod 51 and over another Rod 52 and thence through the eyes of the healds to the reed.

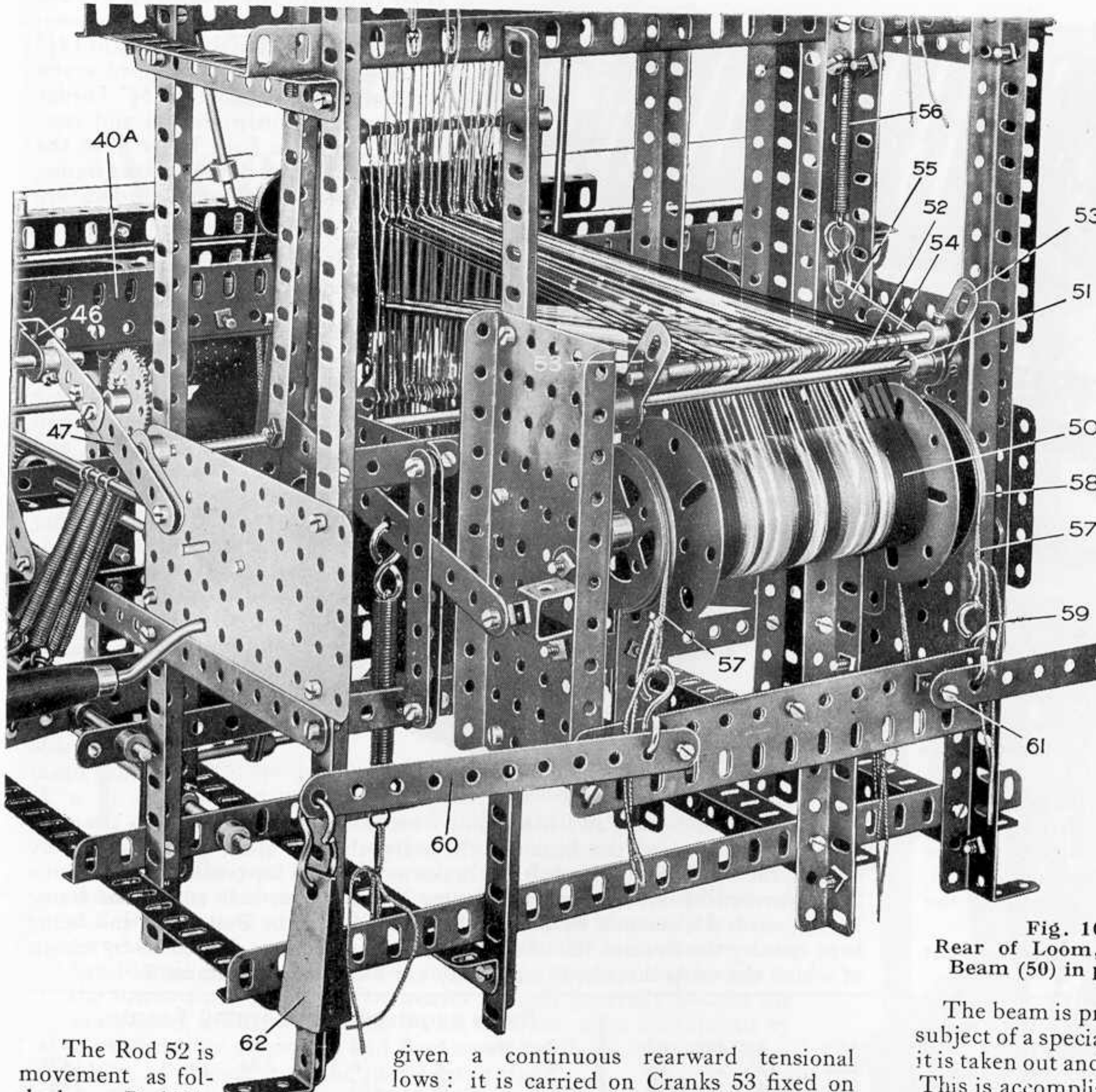

Fig. 10.
Rear of Loom, showing Beam (50) in position.

The Rod 52 is given a continuous rearward tensional movement as follows: it is carried on Cranks 53 fixed on the lower Rod 51: another Crank 54, to which is connected a 2½" Strip 55 (the end holes being threaded on the Rod 51) is connected on its outer hole by a Hook coupled to a Spring 56. The Spring 56 therefore rocks the upper Rod rearwardly, and takes up the slacking formed by the shedding action of the healds.

The beam 50 is braked by means of cords 57 passing over 2" Pulleys 58 and secured to the frame of the loom, the other ends being connected to Hooks 59, engaging a hole in the Strip 60 pivoted at 61, weights 62 on the outer ends of the Strip 60 putting the required frictional resistance on the beam 50.

Preparing to Weave

In preparing to weave, the first thing to be done is to pass the ends of the warp from the beam (situated at the back of the loom) through the mails of the healds and then through the reed. One or more threads are passed through each division of the reed, and attached to the taking-off roller.

By turning the Crank Handle, the Shuttle is jerked across the slay and passes over the threads held down by the lower heald frame and beneath those raised by the upper heald frame, at the same time leaving in its wake a loose thread of weft. The slay then moves forward and brings up the reed, which drives before it this thread or "first pick" of the weft. By continuing to turn the handle the same process is repeated, the shuttle being again jerked back and across the loom, this time from the other side. The reed again moves forward and presses up the second pick against the first. The taking-off Roller in the meantime slowly rotates, and as the weaving proceeds it rolls around itself the woven fabric.

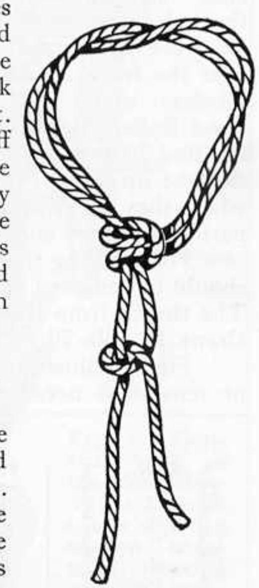

Fig. 11.
Weaver's Knot.

Preparing the Beam.

The beam is prepared by a Beaming Frame, which is the subject of a special Meccano model. After being prepared it is taken out and placed in position at the rear of the loom. This is accomplished by slipping the 2" Wheels 58 on the beam spindle, before inserting the latter in the holes of the side Flanged Plates. After doing this the Pulley Wheels are secured to the spindle at each end to hold the beam in position.

All the ends of the threads are drawn under Rod 51 and over 52, and each thread is passed through the healds in the following manner: the first warp thread is passed through the eye of the first heald in the near frame, and thence through the first aperture of the reed : the next thread is passed between the first two healds in the near frame and through the eye of the far frame and thence through the next aperture of the reed. The warp threads may be threaded through the reed spaces in pairs. This process is continued until all the ends are threaded through the reed. They are then carried over the front Angle Girder, under the Sand Roller 72, over the Rod 73 and on to the take-up Roller 74, where they are gripped under a Rod in the slot of the Roller. This operation is performed more conveniently by two persons with the aid of a Reed Hook.

For winding the weft thread on the spindle forming the cop the spindle should be removed from the Shuttle, and one end inserted in the Coupling 78. The thread from the bobbin 80 may then be wound round it by turning the Crank Handle 79.

Fig. 11 illustrates a weaver's slip-knot, which is used when adjustment or tension is necessary.

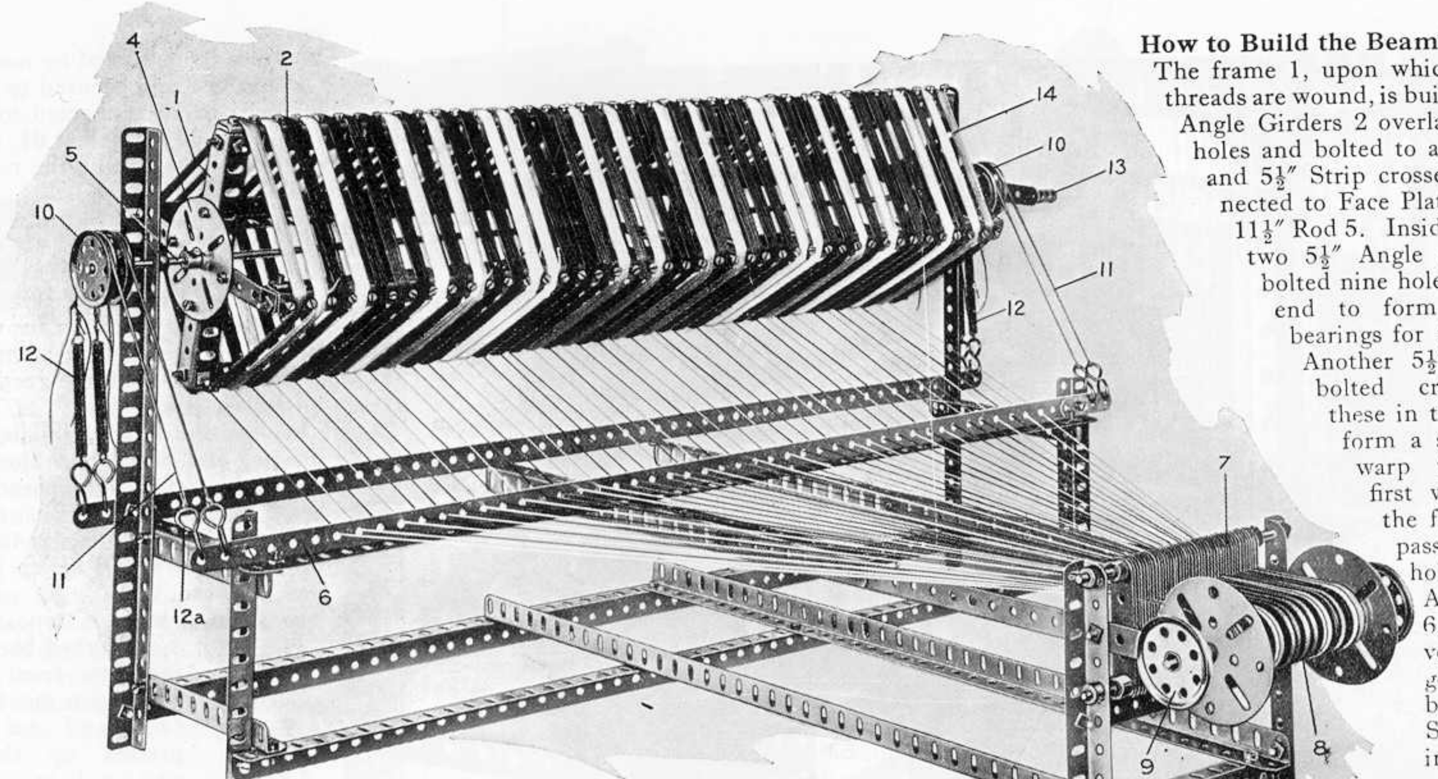

Fig. 12.
Beaming Frame, on which the Beam must be prepared before insertion in Loom.

How to Build the Beaming Frame

The frame 1, upon which the warp threads are wound, is built up of $12\frac{1}{2}''$ Angle Girders 2 overlapped seven holes and bolted to a $5\frac{1}{2}''$ Girder and $5\frac{1}{2}''$ Strip crossed and connected to Face Plates 4 on the $11\frac{1}{2}''$ Rod 5. Inside the frame, two $5\frac{1}{2}''$ Angle Girders are bolted nine holes from each end to form the inner bearings for the Rods 5. Another $5\frac{1}{2}''$ Girder is bolted crosswise to these in the centre to form a stay. The warp threads are first wound upon the frame 1, and pass through the holes in a $24\frac{1}{2}''$ Angle Girder 6, and, converging together, pass between $2\frac{1}{2}''$ Strips 7 forming the reed, and so on to the beam 8. On the far side of the beam Rod is a $\frac{1}{2}''$ Pinion engaged by a Pawl (not shown on the photograph) which prevents backward rotation of the beam as the warp threads are wound thereon by turning the $1\frac{1}{2}''$ Pulley Wheels 9. A brake mechanism for tensioning the frame 2 is provided by securing two $1''$ Pulley Wheels 10 at each end of the frame Rod 5, cords 11, secured by Hooks 12, passing over the Pulleys 10 and being kept taut by the Springs 12. A handle 13 is provided on the Rod 5 by means of which the warp threads 14 originally are wound on the frame 2.

Parts required for Loom

6 of No.	1	15 of No.	9	6 of No.	16	5 of No.	27	5 of No.	45	4 of No.	82
22 ,,	2	2 ,,	10	8 ,,	18a	3 ,,	27a	2 ,,	48a	12″ ,,	94
8 ,,	3	8 ,,	11	2 ,,	19	4 ,,	29	2 ,,	52	4 ,,	96
9 ,,	4	4 ,,	12	2 ,,	20a	2 ,,	32	17 ,,	57	42 ,,	101
39 ,,	5	4 ,,	12a	4 ,,	21	6 ,,	35	55 ,,	59	6 ,,	103
4 ,,	6	4 ,,	13	4 ,,	22	195 ,,	37	15 ,,	62	1 ,,	104
4 ,,	6a	13 ,,	13a	2 ,,	24	33 ,,	37a	13 ,,	63	1 ,,	106
6 ,,	7a	10 ,,	14	5 ,,	25	198 ,,	38	4 ,,	67	1 ,,	106a
17 ,,	8	1 ,,	15	2 ,,	25a	15 ,,	43	4 ,,	70	2 ,,	109
3 ,,	8a	1 ,,	15a	5 ,,	26	2 ,,	44	2 ,,	76	7 ,,	111

Parts required for Beaming Frame

2 of No.	1	3 of No.	14	1 of No.	147a
4 ,,	2	6 ,,	21	1 ,,	147b
44 ,,	5	253 ,,	37	1 ,,	148
4 ,,	6	88 ,,	38		
4 ,,	7	4 ,,	43		
2 ,,	7a	8 ,,	57		
12 ,,	8	10 ,,	59		
10 ,,	9	1 ,,	63		
8 ,,	12	1 ,,	103		
2 ,,	13	4 ,,	109		

Ask your dealer for a complete illustrated list of Meccano parts.