Pulleys, Gears and Levers Study Kit Card 1

Friction Slope

You will need these items:–

Card 26″ (66cm) long, 6″ (15cm) wide.
Coarse sand paper.
Fine sand paper.
Piece of hardboard.
Very smooth material e.g., perspex.
Many materials with different textures of surface e.g., carpet, silk, velvet.
Plasticine.
Kitchen foil.

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FRICTION: Is the name given to a force which tries to stop two or more surfaces moving over each other.

Fasten the card to the slope with Sellotape.

Fasten a string to the slide pan. Pass it over the pulley wheel and tie a hook on the end.

Hang a weight pan on the hook.

Put a 4-ounce (113gms) weight in the slide pan.

How much weight has to be put into the weight pan to make the slide pan just begin to move steadily up the slope?

Fasten a single sheet of coarse sand paper on the slope, using Sellotape, so that the sand paper covers the slope.

Put the slide pan on the sand paper.

What weight is needed now in the weight pan to move the slide pan steadily up the slope?

Repeat your experiment with different materials fastened to the slope.

Record your results.

Does the angle of the slope have any effect on the weight needed to move the slide pan?

Rub two pieces of concrete together for two minutes. Feel the surfaces you have rubbed. You can try this experiment with sections of bicycle tyre, match boxes, pieces of wood, or with a piece of metal and a file.

Can you explain what happens when you slide on ice in winter?

Examine a bicycle. Find out how friction is increased in some parts and decreases in other parts of a bicycle.

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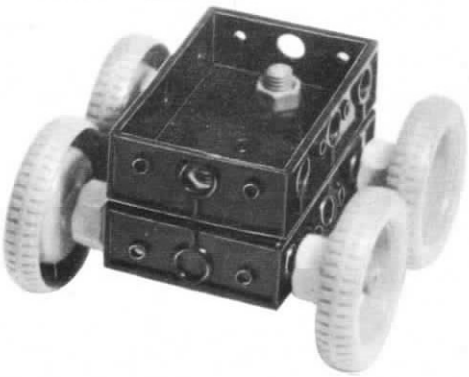
Pulleys, Gears and Levers Study Kit Card 2

Bogie Slope 1

You will need these items:–

2oz. (57gms), 4oz. (113gms), and 8oz. (227gms) weights.
A long tape measure.
A piece of card 26″ (66cm) long by 6″ (15cm) wide.



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Set the slope at any angle.

Sellotape the card to the slope so that the card touches the floor.

Put a 2oz. (57gms) weight in the bogie.

Place the bogie at the top of the slope.

Release the bogie without pushing it and see how far it runs.

Measure the distance it runs.

Do this six times and find the average distance the bogie travels.

Always set your bogie off from the same position.

Copy out this table and record your results:

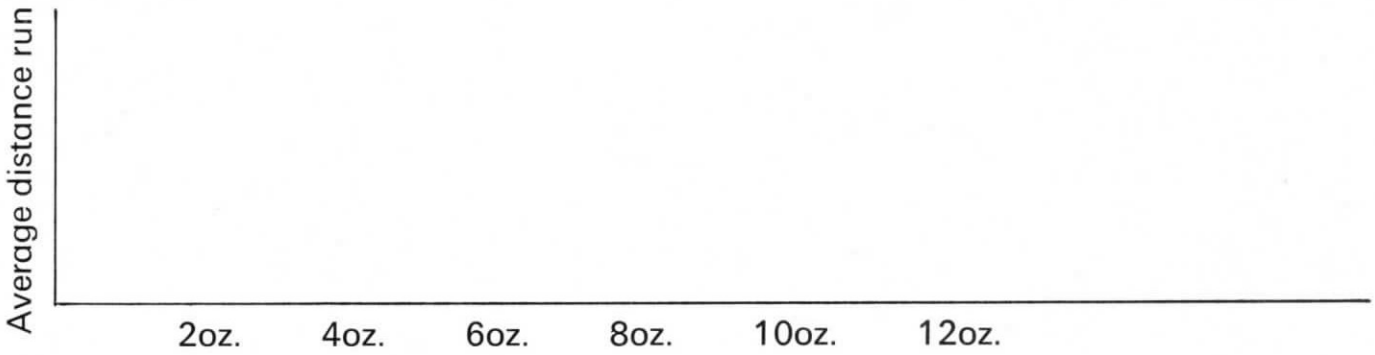
Distance Travelled.

Weight	1st run	2nd run	3rd run	4th run	5th run	6th run	Average distance

Keep the slope at the same angle.

Repeat the experiment with 4oz., (113gms) 6oz., (170gms) 8 oz., (227gms) 10oz., (284gms) and 12oz., (340gms) in the bogie.

Make a graph of your results:



What can you discover from your graph ?

Is there anything other than the weight which will affect the distance the bogie will run ?

If the floor was covered with rough sandpaper, how would this affect the distance travelled by the bogie ?

In winter some motorists put chains on their wheels and others use tyres which have studs. Can you explain why ?

Pulleys, Gears and Levers Study Kit Card 3

Bogie Slope 2

You will need these items:–

Protractor.
Long tape measure.
Card 26″ (66cm) long, 6″ (15cm) wide.

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Set the slope at its smallest angle.

Sellotape the card to the slope so that the card touches the floor.

Measure this angle.

Place the bogie at the top of the slope.

Let it run down without pushing it.

Measure how far it travels.

Do this for 6 runs and find the average distance travelled.

Distance Travelled.

Angle	1st run	2nd run	3rd run	4th run	5th run	6th run	Average distance

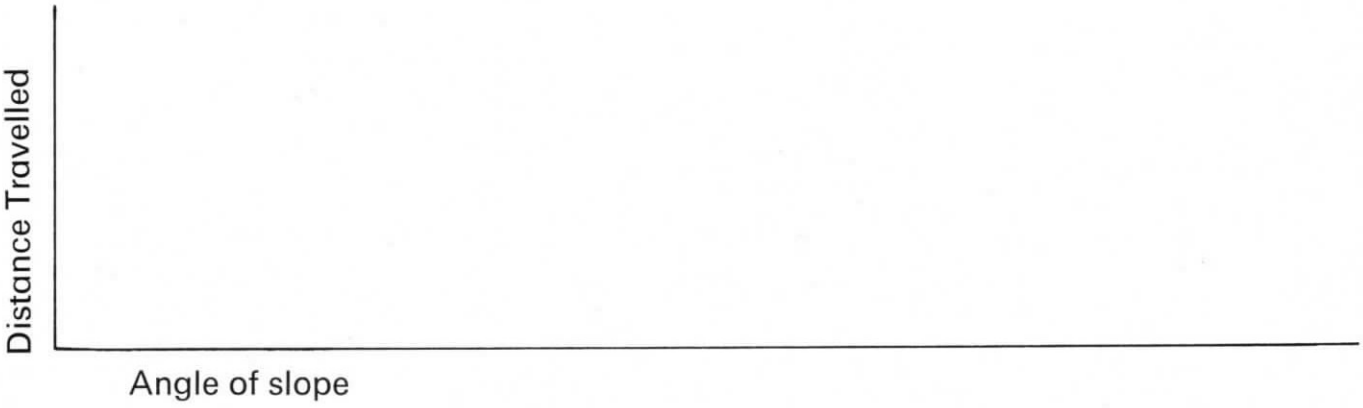
Repeat the experiment with the slope set at as many different angles as possible.

Every time you alter the angle, move the card so that it touches the floor.

Record all the things which happen in your experiments.

Try to give reasons why they happen.

Make a graph of your results.



What can you discover?

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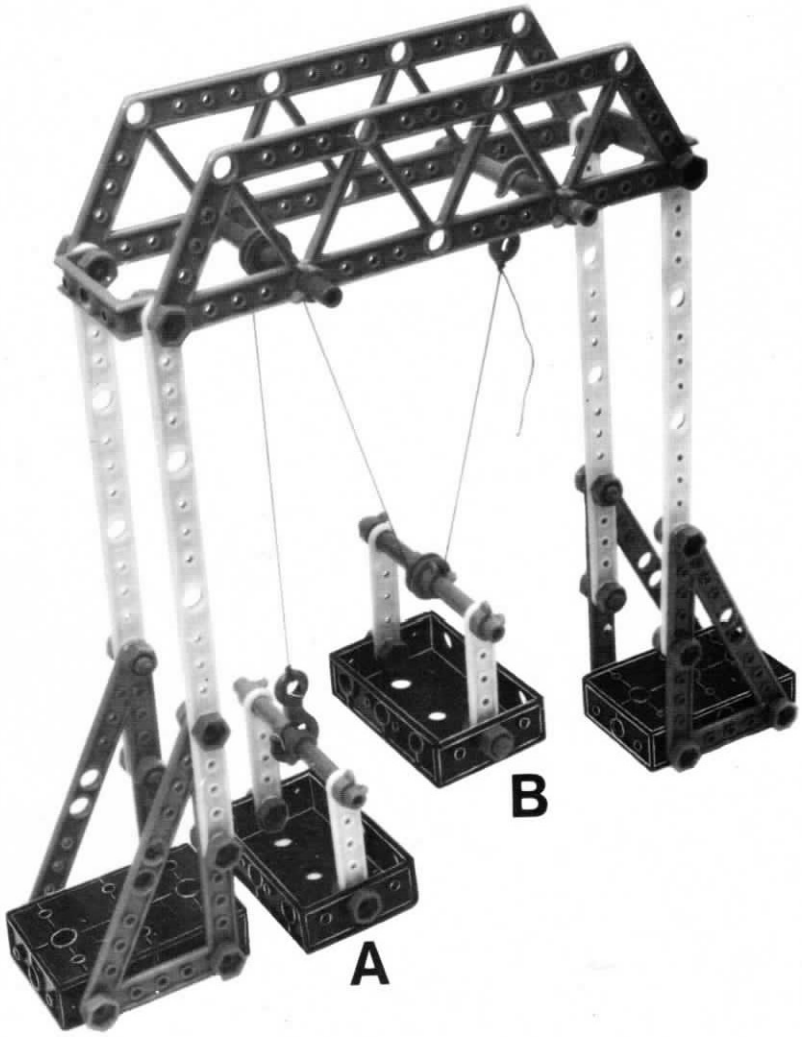
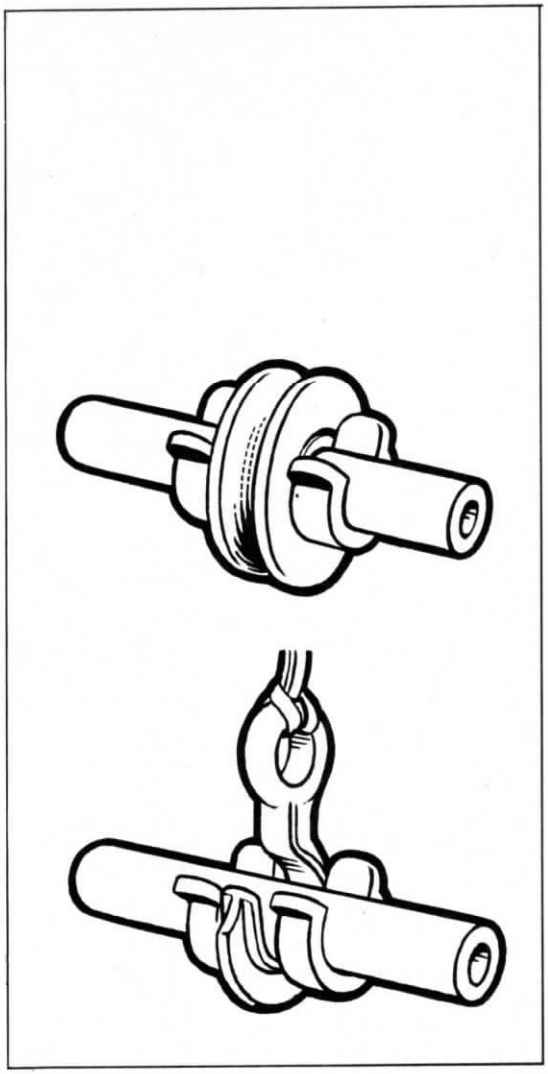
Pulleys, Gears and Levers Study Kit Card 4

Pulleys





You will need these items:–

Weights.
A few drops of light oil.

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Put a 4oz. (113gms) weight in pan A.

Put weights in pan B until pan A just begins to move.

Record your result.

Put a little oil on the pulley rods.

Put different weights in pan A and find what weight is needed in pan B just to move pan A.

PAN A	PAN B

What can you discover from your recordings?

If pan B moves 2″ (5cm) how far does pan A move?

Move pan B a different distance and find out how far pan A moves.

PAN A	PAN B

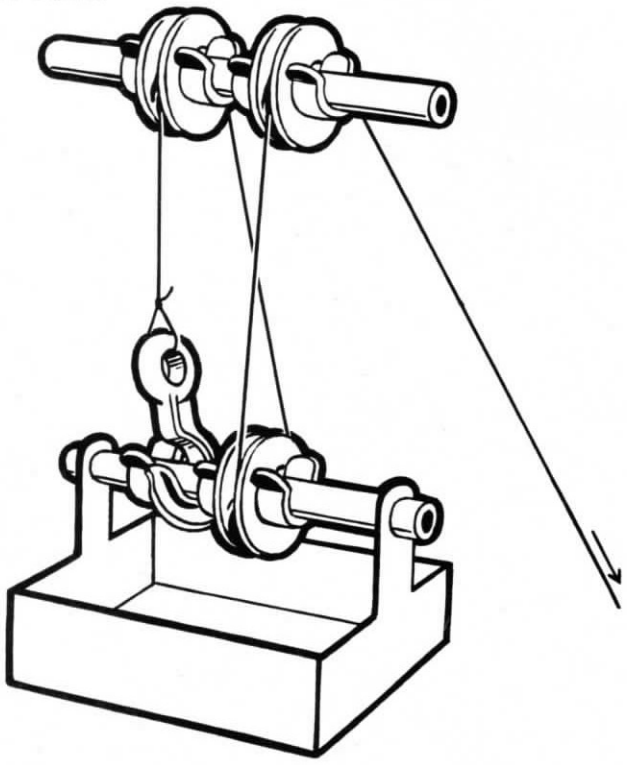
What can you discover from your results?

Is there any relation between the number of strings and your last discoveries?

What have you discovered about this pulley system?

Now try pulley systems of your own.

Here is one suggestion:



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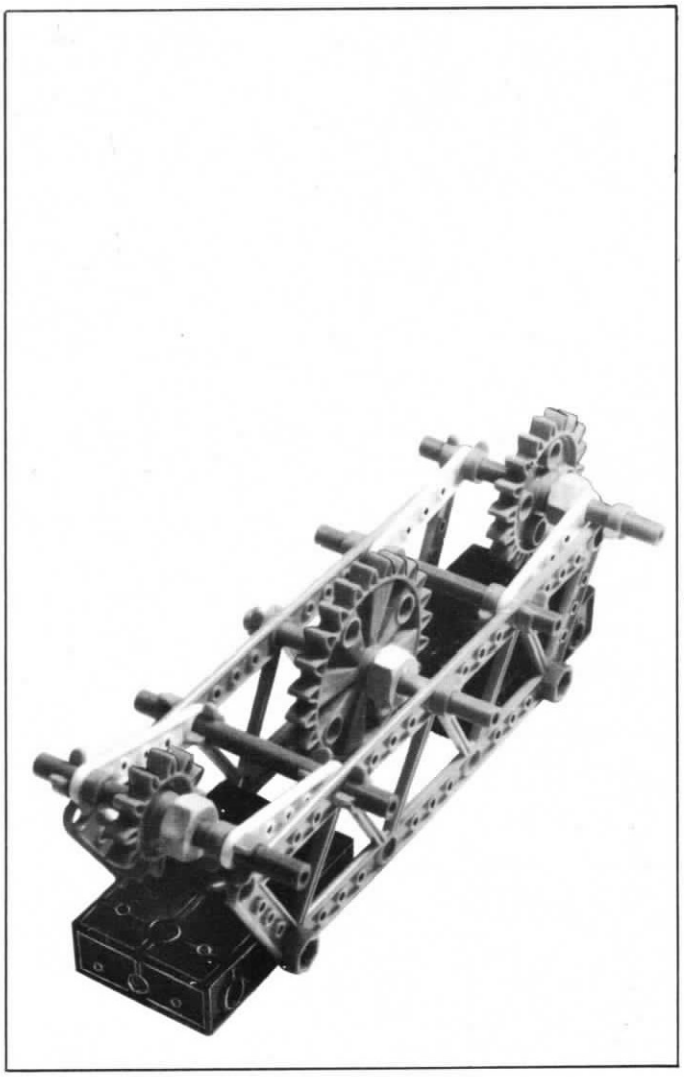
Pulleys, Gears and Levers Study Kit Card 5

Gears 1



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Count the number of teeth on each gear wheel.

How many teeth has the large cog ?

How many teeth has the medium cog ?

How many teeth has the small cog ?

Swing the small cog on to the large cog.

What happens when the large cog is turned ?

Complete this table:

Turns of the large cog	Turns of the small cog
1.	
2.	
3.	

Swing the small cog away.

Swing the medium cog on to the large cog.

Find out and record all you can about your new gear system.

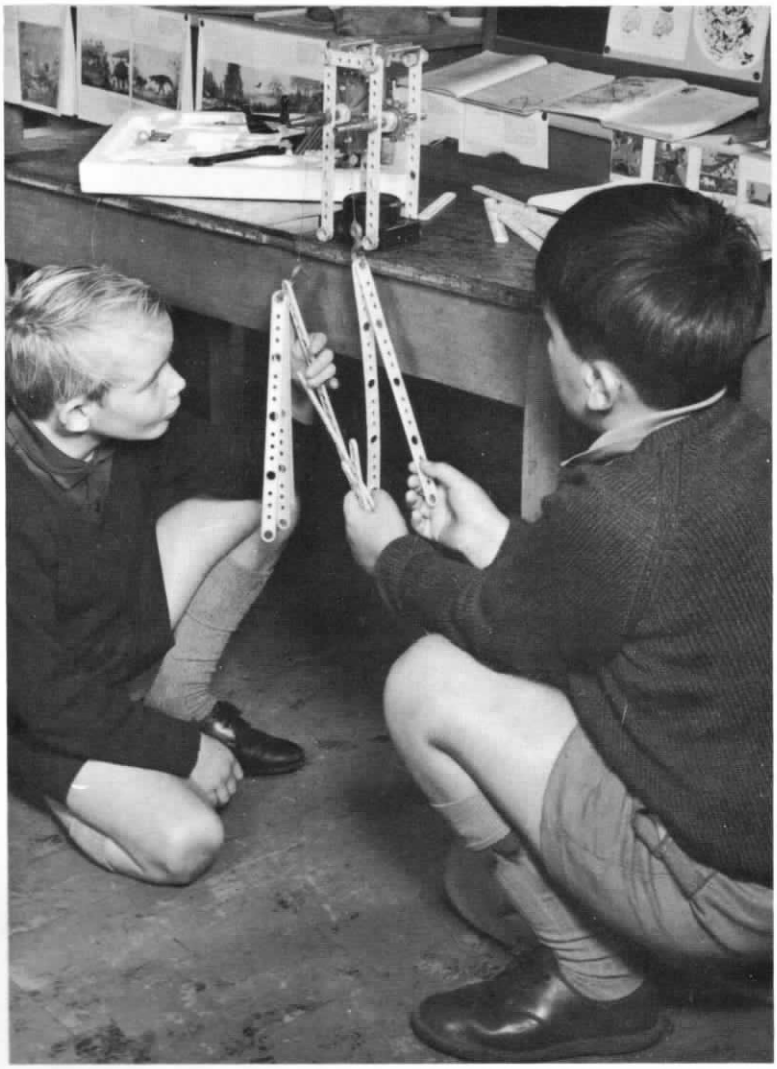
Swing both the small and medium cogs on to the large cog.

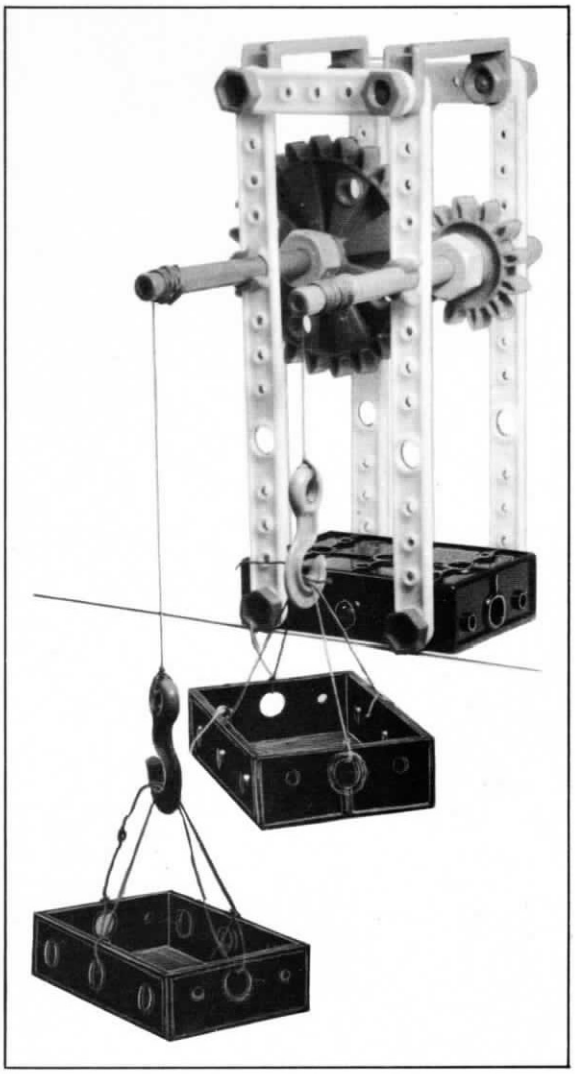
First turn the small cog. Record what happens to the other cogs. See what happens when you turn the medium cog and then the large cog.

If you alter the position of the cogs, does this alter what happens when one is turned ?

Pulleys, Gears and Levers Study Kit Card 6

Gears 2





You will need these items:–

A heavy object sufficient to keep the gear system steady.
A few drops of light oil.

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Make sure the gears rotate freely.

Put your gear system at the edge of a table.

Weight it with the heavy object.

How many teeth are on each cog ?

Put a 4oz. (113gms) weight into pan A.

Add weights to pan B until pan A is balanced.

Record your results.

Place a little oil where you think friction will occur.

Now repeat the experiment.

What effect does the oil have ?

Put different weights in pan A and balance them with weights in pan B.

Record your results.

Weight in pan A	Weight in pan B

What can you find out from your results ?

If pan A moves 2″ (5cm) how far does pan B move ?

Discover all you can about the distances each pan moves.

Can you see any relationship between what you have just discovered and the number of teeth on each cog ?

If the framework is not square, does this alter the working of the pulleys ?

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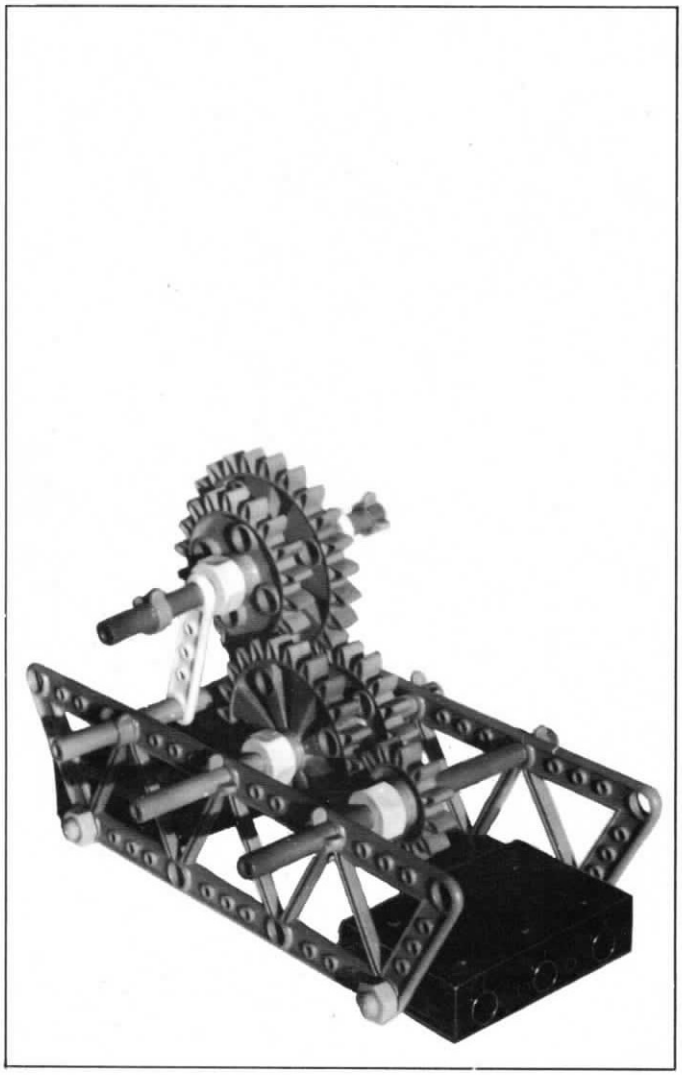
Pulleys, Gears and Levers Study Kit Card 7

Gears 3



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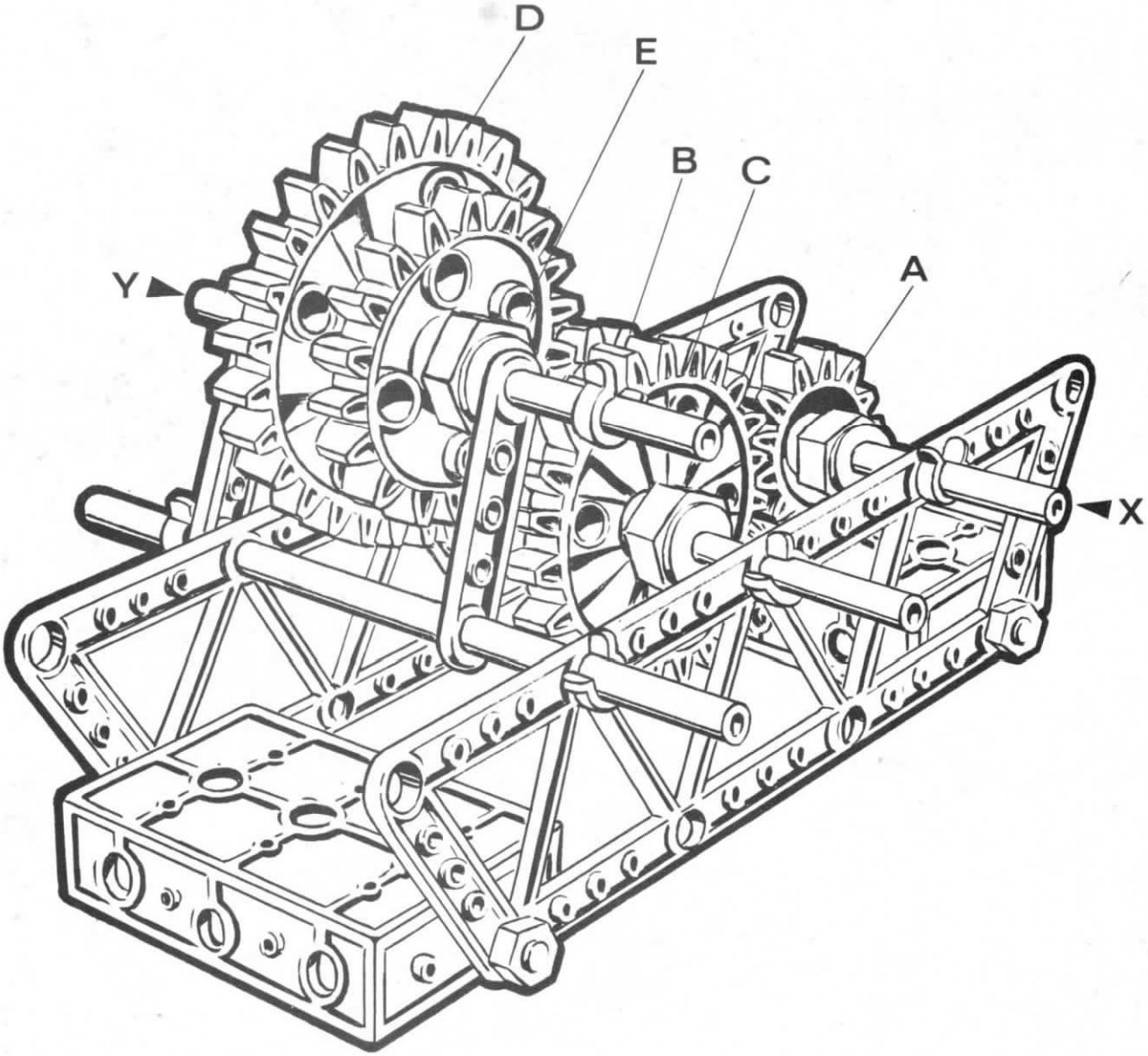


Cog A is the driving cog. It can turn cog C.

Cogs D and E can be slid on to cogs B or C.

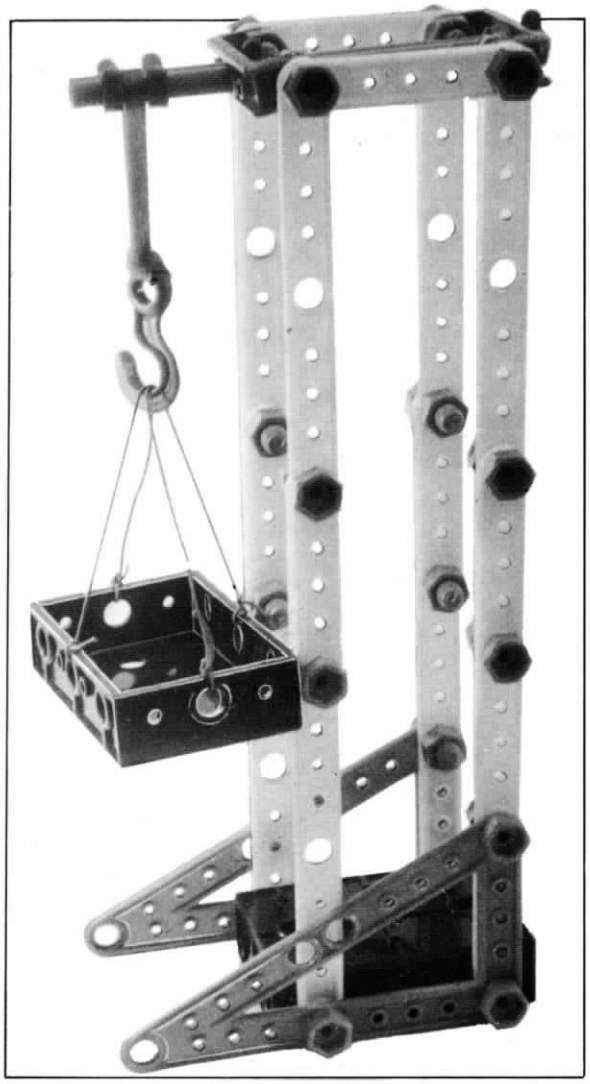
Slide the cogs into different positions.

Find out what happens when the driving cog A is turned.

Make a gear box of your own so that spindle Y turns much faster than spindle X.

Pulleys, Gears and Levers Study Kit Card 8

Stretching a rubber band



You will need these items:–

Rubber bands.
Weights – 1oz. (28gms) 2oz. (57gms) 4oz. (113gms) and 8 oz. (227gms)
Piece of card – 12″ (30cm) long by 3″ (8cm) wide.
Pencil.

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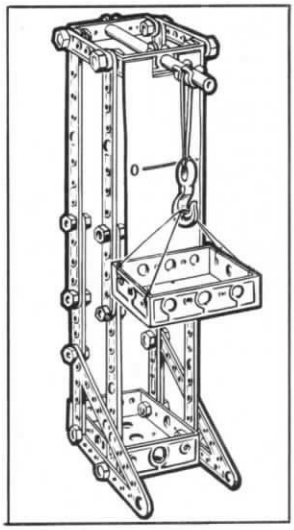


Fasten the card with Sellotape to the Meccano apparatus.

Fasten a hook on to a rubber band.

Loop the other end of the band over the rod.

Hang the weight pan on the hook.

Make a pencil mark on your card at the top of the hook.

Label this zero (0). This is the starting position for a scale.

Place a 1oz. (28gms) weight in the scale pan. Mark where the top of the hook comes now.

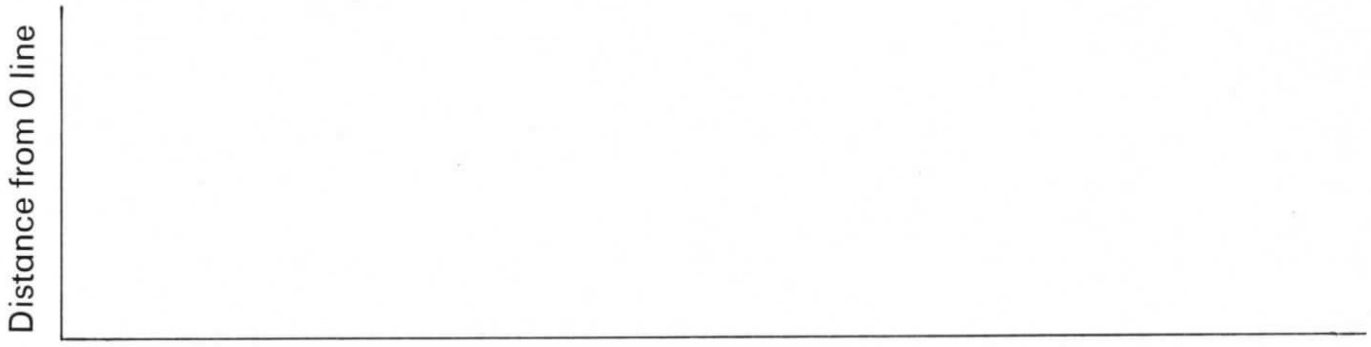
Label this 1oz. (28gms).

Increase the weight in the pan 1oz. (28gms) at a time.

Mark and label the card at each extension.

Record what happens in your experiments.

Use the results on your card to draw a graph:



What can you tell from your graph ?

Try the experiment with different elastic bands.

Now make a weighing machine which will weigh in half ounces up to 12oz. (340gms).

Use this to find the weight of small objects.

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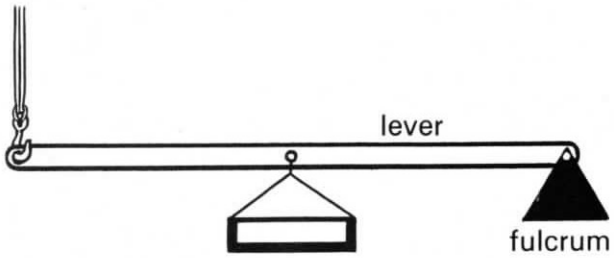
Pulleys, Gears and Levers Study Kit Card 9

Levers 1

You will need these items:–

The elastic balance which you made in Card 8 with the same rubber band you calibrated.
A copy of the scale on the elastic balance.
An 8oz. (227gms) weight.



NOTE

Use two 5 hole strips side by side for your lever. (Where the lever pivots is called the fulcrum.)

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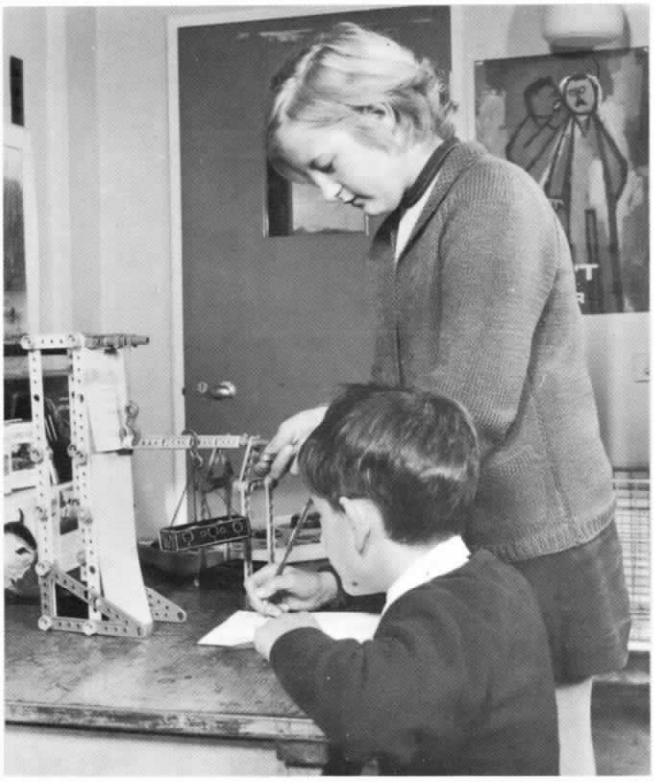

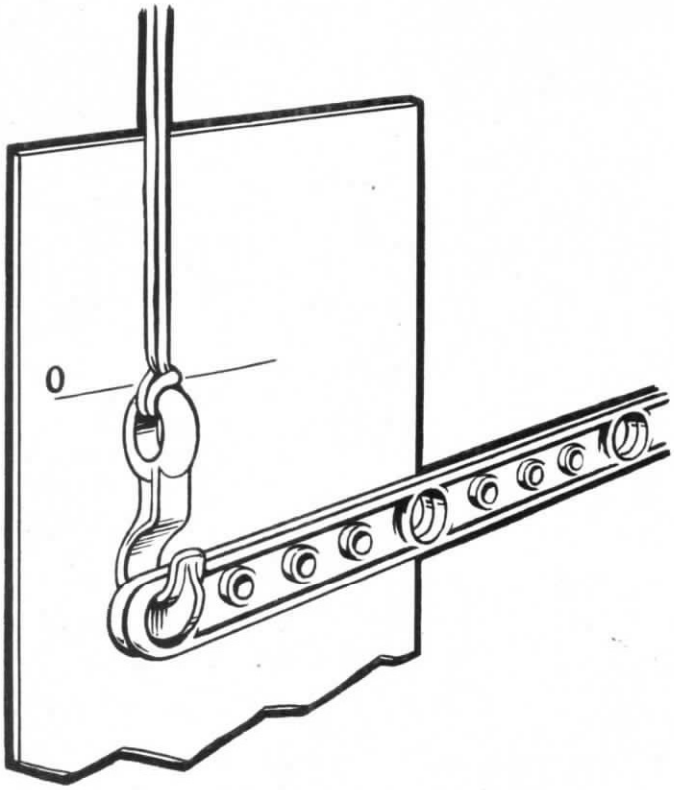

Set up the apparatus without the weight pan.

Stick your copy of the scale on to the card so that the zero (0) is at the top of the hook.

Put the 8oz. (227gms) weight in the weight pan.

Hook the pan anywhere on the lever.

Does the balance show 8 ounces (227gms) ? Why not ?

Move the pan first towards the hook on the balance; and then towards the fulcrum.

What happens ?

Copy this table in your note book and record your results.

Distance of elastic balance from fulcrum	Weight shown on elastic balance	Distance of weight pan from fulcrum	Weight in weight pan

What can you discover from your results ?

Carry out more experiments with the elastic band in different positions and use different weights. Always follow this order: Balance – Weight – Fulcrum.

Make your lever longer if you wish.

From your experiments can you explain why it is possible to lift more weight in a wheel barrow than you can lift without help ?

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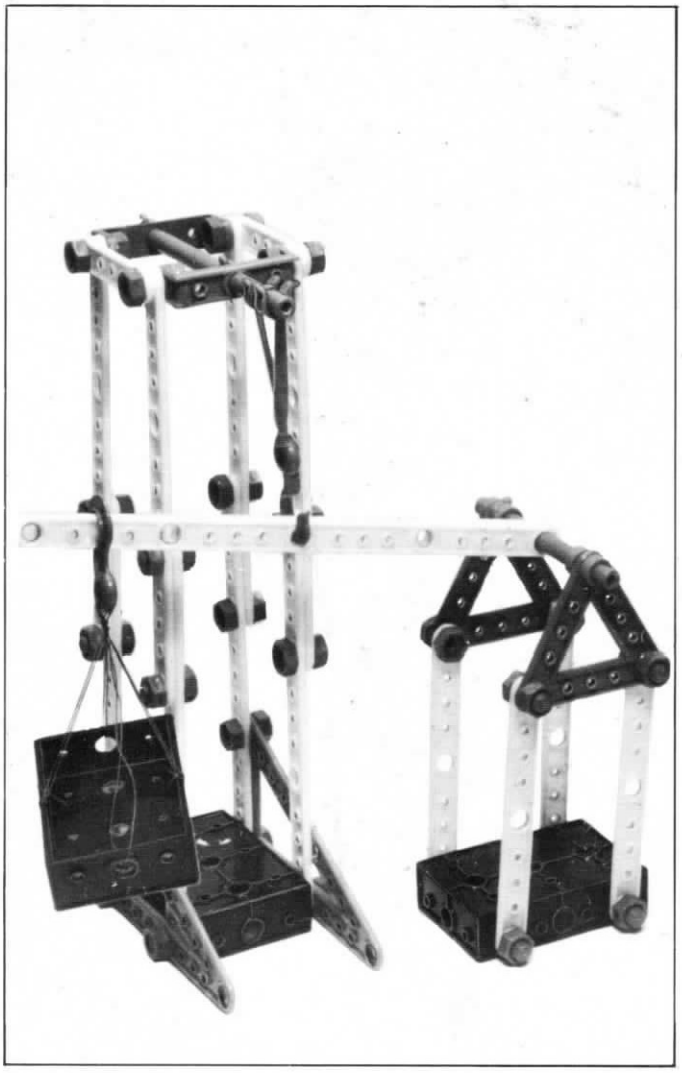
Pulleys, Gears and Levers Study Kit Card 10

Levers 2

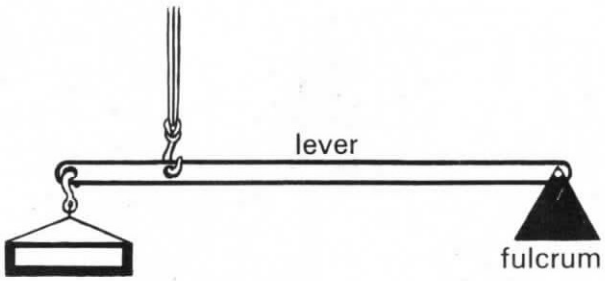


You will need these items:–

Your elastic balance which you made in Card 8 with the same rubber band you calibrated.
A copy of the scale on the elastic balance.
A 2oz. (57gms) weight.
Weights to keep the fulcrum firm.

NOTE

Use two 5 hole strips side by side for your lever.



(Where the lever pivots is called the fulcrum.)

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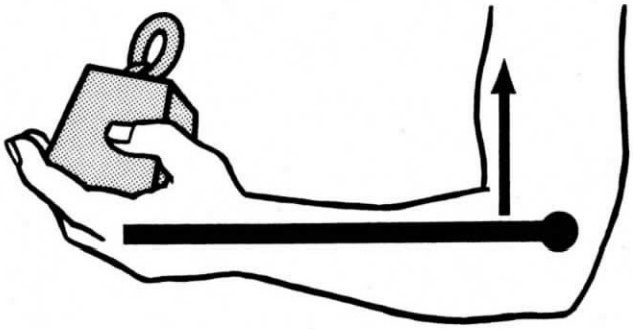
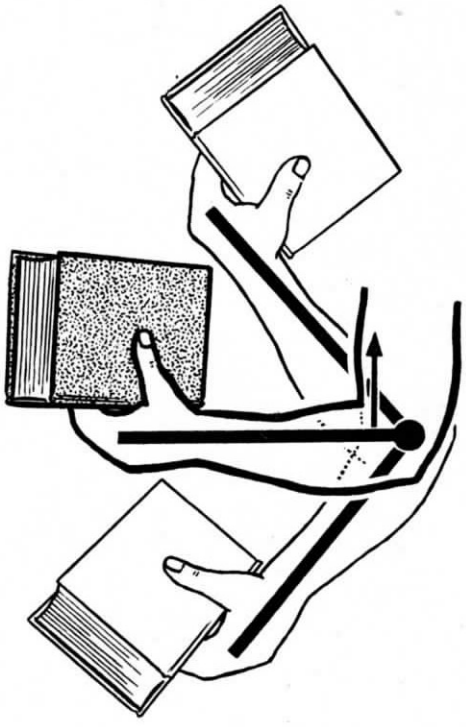
Set up your apparatus without the weight pan.
Stick your copy of the scale on to the card so that the zero (0) is at the top of the hook.
Put a 2oz. (57gms) weight into the weight pan.
Hook the pan on to the opposite end of the lever to the fulcrum.
In your experiments, always follow this order:– Weight – Balance – Fulcrum.
Move the pan into different positions.
Record what happens.
Move the hook of the elastic balance to different positions.
Repeat your experiments.
Record all that you have discovered.



Try lifting a heavy book by just bending your arm.



Record what you felt.
What is the heaviest weight you can lift by this method ?
Find out how the other muscles in your arms and legs work.

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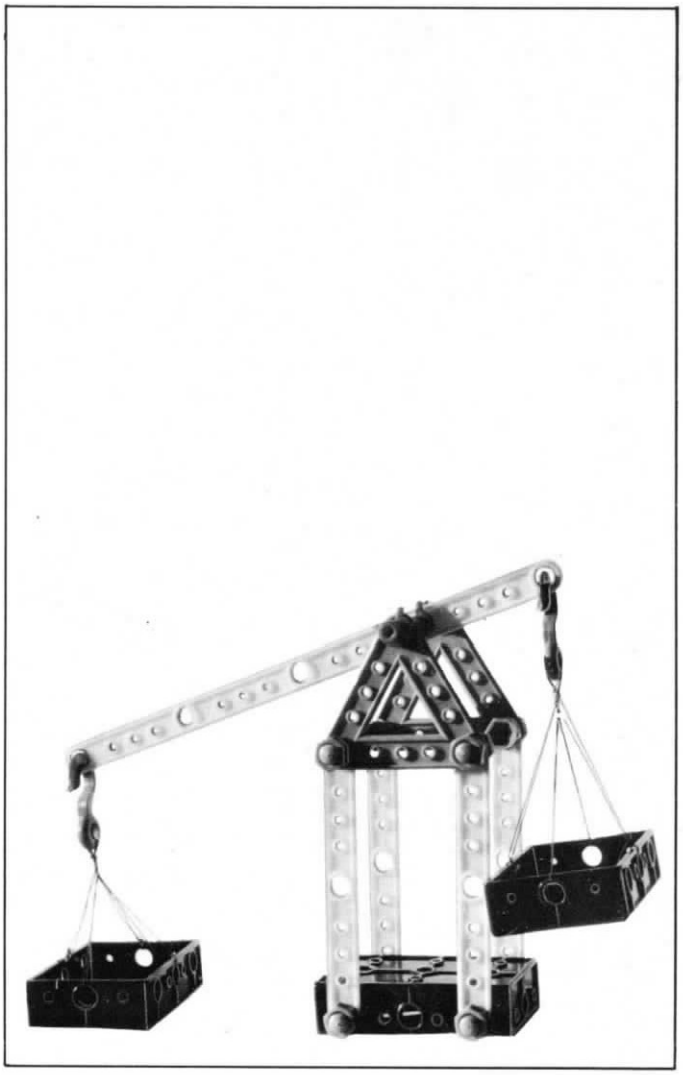
Pulleys, Gears and Levers Study Kit Card 11

Levers 3



You will need these items:–
Plasticine.
1oz. (28gms) 2oz. (57gms)
4oz. (113gms) and 8oz. (227gms) weights

(Where the lever pivots is called the fulcrum.)

NOTE
Use two 5 hole strips side by side for your lever.

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Set up your apparatus.

Balance the pans with Plasticine.

Put a weight in pan B.

What weight in pan A will balance this?

If pan A or pan B is moved towards the fulcrum what happens?

Pan A		Pan B	
Weight	Distance from fulcrum	Weight	Distance from fulcrum

Put different weights in pan B, and balance them.

Record your results in the table.

What can you find out from your table?

Move your fulcrum to different positions.

Each time you move the fulcrum, balance the pans with Plasticine.

What else can you discover?

From your discoveries, can you explain how a pair of pincers and a crowbar works?

Experiment with them.