Toy Treasures

Written by Arvind Gupta
(Email arvindguptatoys@hotmail.com)

Illustrations by Avinash Deshpande

Publisher: EKLAVYA, E7-453 (HIG) Arera Colony, Bhopal 462016 (MP) India.
(Rupees Twenty)

SIMPLE TOYS

Children love toys. They love them all the more if they have shaped them and made them with their own hands. It is also a lot easier for them to make toys from materials around them. Take for instance the daily newspaper. After being read it is simply "junked" and sold off by weight. However, the newspaper's life need not end so abruptly. "Even a cat" they say, "has nine lives". Certainly, a newspaper deserves better treatment. It can be reused to give it a new lease of life. Children can fold newspapers to make a dozen or so, delightful caps. Newspapers can be folded into nice, useful boxes and made into gift packs. Small pieces of newspaper could be reborn into flapping birds, talking crows, flying fishes, helicopters, stunt planes and scores of other dynamic paper toys.

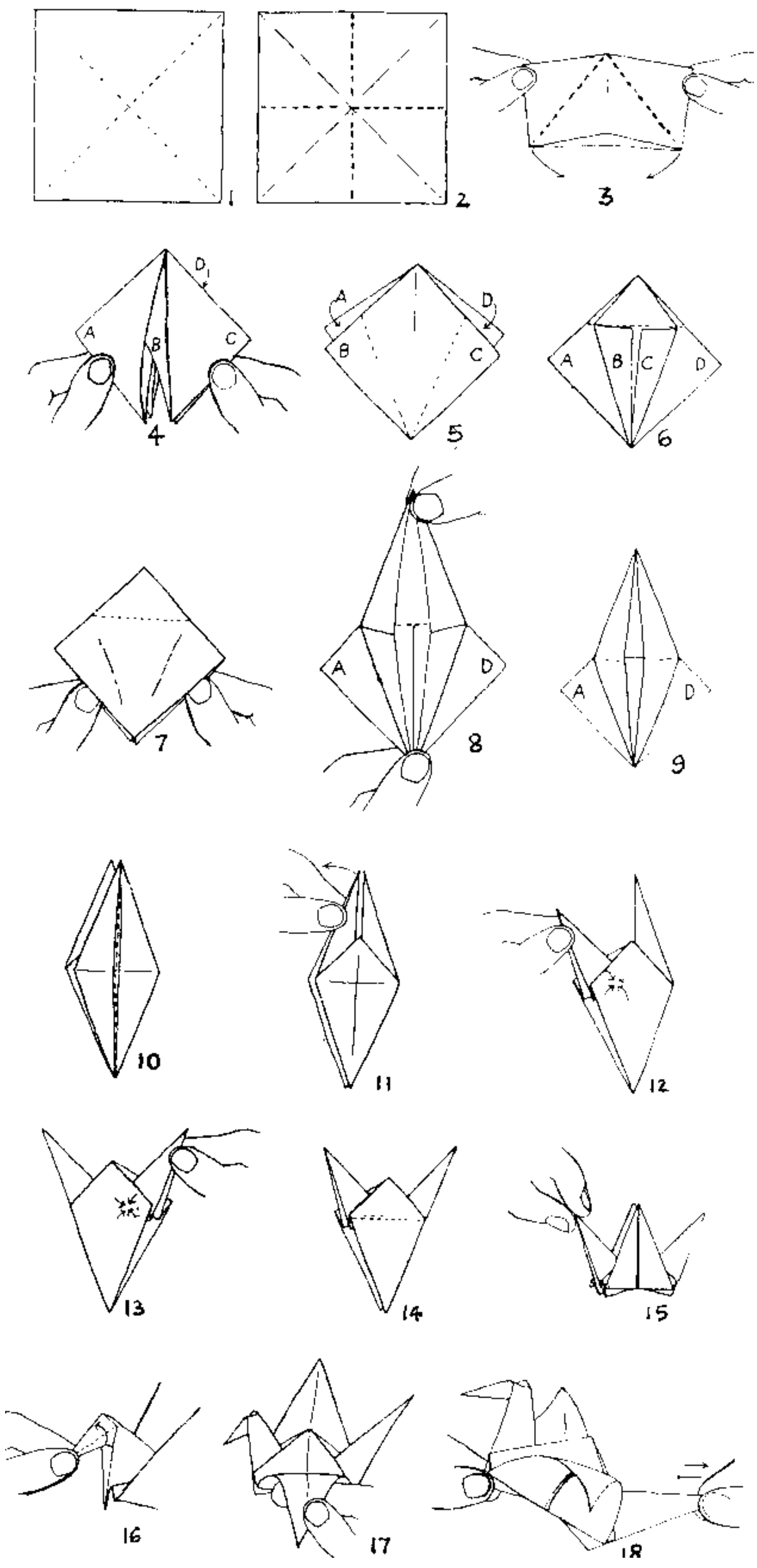
Many people have forgotten it, but we must not forget that each scrap of paper was once a living branch or a tree trunk. That each ball pen refill, broken pen and all other plastic comes from crude oil. The earth's resources are limited and we must use them sparingly with love and care. Today's throwaway culture offers new challenges for reuse, whether it is *Frooti* packets, batteries, bottles or ball pens. So, don't waste, don't abuse; instead recycle, reuse. This is the only way of making simple and environmentally sustainable toys.

This book is a collation of several ideas and activities. The names of individual contributors have been acknowledged.

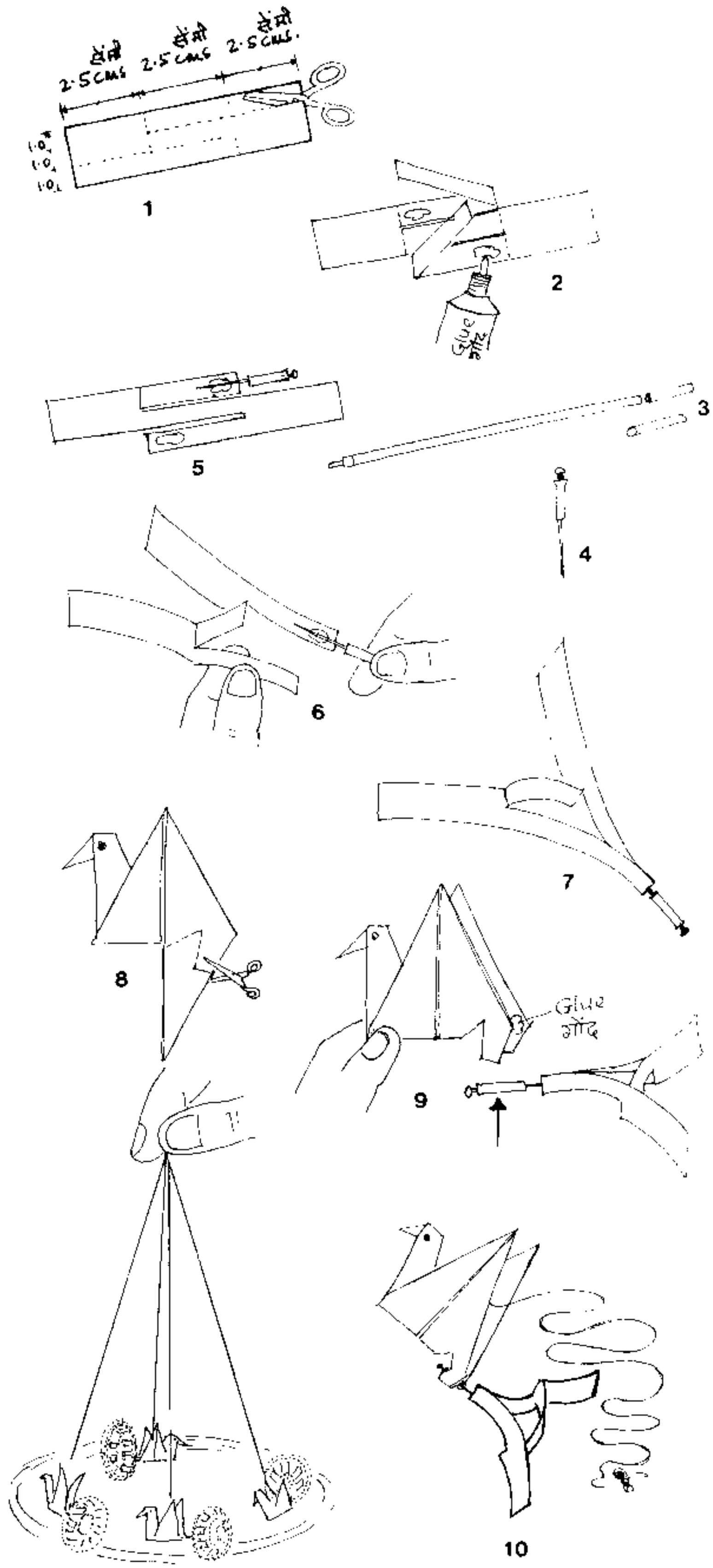
This book is dedicated to the memory of my dear friend Siddhartha Vohra.

Arvind Gupta
July 1993.

FLAPPING BIRD



Japanese children have been making this joyous bird for the last 300 years. Take a square of paper and fold its opposite corners in turn; make very firm creases and open up Fig (l). Turn the paper and this time fold opposite edges in turn. Keep the paper folded in half Fig (2). Hold the two ends of the folded edge between fingers and thumb. Bring the ends down so that the corners of the paper come together creating four naps A, B, C and D Fig (3). Fold flap B to the left and C to the right Fig (4). Fold the lower edges of naps B and C to the vertical central crease Fig (5). Fold the top triangular area forward over the horizontal edge. Make a very firm crease and return. Open B and C to its sides Fig (6). Raise the top layer of the paper on the horizontal crease you have just made Fig (7). Pull the bottom point right up as far as it will go. The two edges should come and meet Fig (8). Press firmly, then turn the paper over and repeat steps 5-8 on flaps A and D Fig (9). This is the result. Take the top left flap over to the right. Turn over and do the same again Fig (10). You should now have two narrow pointed naps at the top. Pull one to the left pressing the paper pat to fur the point in its new position Fig (11,12). Similarly fur the other point to the right Fig (13). Fold up the bottom point on a line just below the existing horizontal crease. Turn over and do the same behind Fig (l4). Take hold of one of the side points and turn it downwards to fur the beak Fig (15, 16). The bird has almost taken shape. Curve the wings slightly by rubbing them between your fingers and thumbs Fig (17). Hold the bottom of the bird's neck with one hand and pull its tail repeatedly with the other. Its wings will flap Fig (18).



FAN TAILED BIRD

This is an adaptation of a traditional Chinese toy.

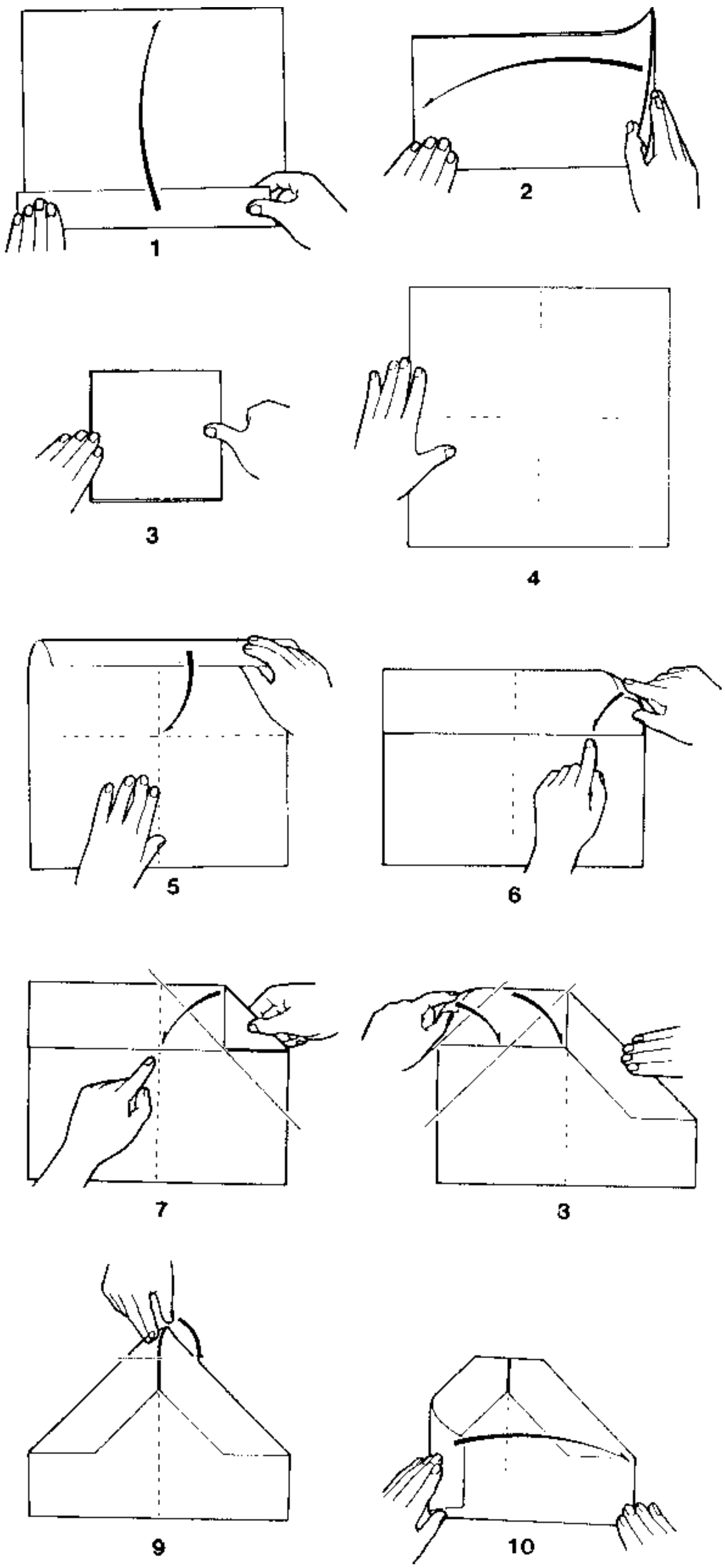
Take a 7.5-cm x 3.0-cm strip of bond paper.
Fold its length into three equal parts.
Leaving one third of the width cut two sectors along the length.
Repeat the same at the other short edge Fig (1).
Fold one third of the thin strips inwards and glue them Fig (2).
Take a piece of used refill about 1-cm long and flatten one of its ends between your teeth Fig (3).
Put a pin through this end.
The oval refill end prevents the pinhead from going through Fig (4).
Apply glue (*Fevibond, Vamicol* are best) on the doubled up ends. Fix the pin as shown in Fig (5).
Now turn the strip and stick the two glued portions together Fig (6).
If you hold the refill in Fig (7) and blow air then the fan will rotate.

Fold a FLAPPING BIRD (previous model) using a 10-cm square of thick paper.

Cut the bird's tail as shown in Fig (8).
Apply glue on both the inner portions of the tail and stick the plastic refill of the fan as shown in Fig (9).

Tie a thread to the bird Fig (10) and then rotate it Fig (11).
The tail fan will rotate giving a feeling of the bird in flight.

STUNT PLANE



When you chuck this fascinating plane it will take a round and come back to you.

So, you can chuck it with one hand and catch it with the other.

Take a 15-cm square of thin but strong paper.

Glazed newspaper will do very well. Fold the paper in half from the bottom to the top Fig (1).

Fold it in half from side to side Fig (2).

Press the paper flat Fig (3).

Unfold it again Fig (4).

Now fold the top edge to meet the centerfold line Fig (5).

Fold the right side edge down to meet the centerline Fig (6).

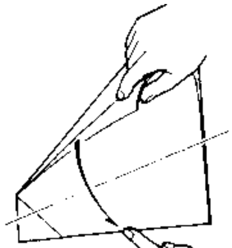
Then fold it down again to meet the center of the paper Fig (7).

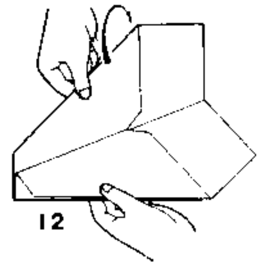
Repeat the process on the left side edge Fig (8).

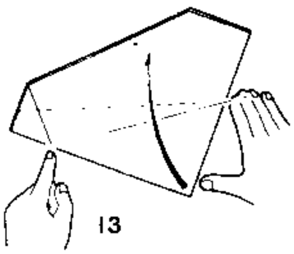
Fold the top point backward to meet the centerline Fig (9).

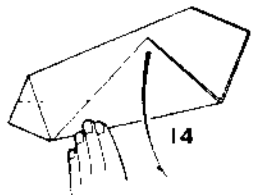
Now fold the paper into half from side to side Fig (10).

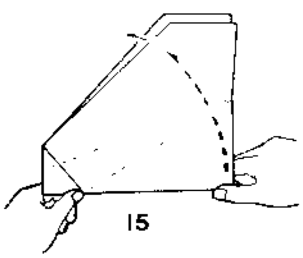
STUNT PLANE CONTINUED

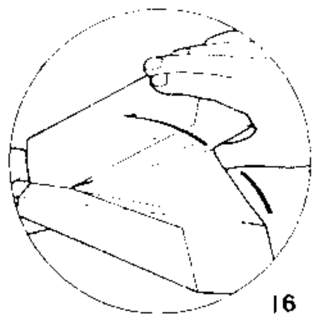

11

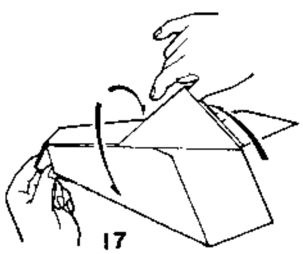

12

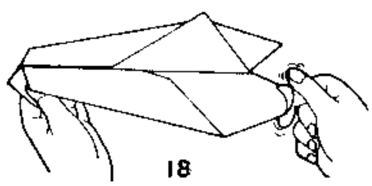

13


14

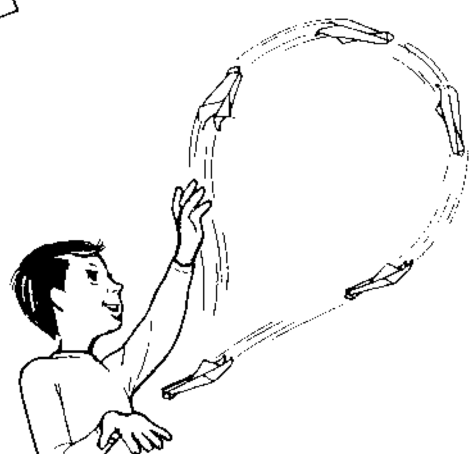

15


16


17


18


19


20

Fold down the top wing so that it meets the side edge Fig (11).

Fold the bottom wing in just the same way Fig (12).

Unfold the wings again.

Fold up the tail section.

The picture shows you where the fold line starts and ends Fig (13).

Press the tail flat and unfold it again Fig (14).

Push the tail section inside itself along the fold line Fig (15).

Fig (16, 17) shows this process in more detail.

Fold the wings down again and open them out.

Shape the wings by curling the bottom edge upwards Fig (18).

To loop the loop, hold the plane with its nose pointing upwards and with the underside facing you Fig (19).

Throw the plane smoothly upwards.

It should loop away from you and then come back Fig (20).

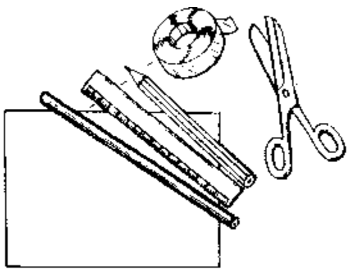
So, have great fun throwing it with one hand and catching it with the other.

You can make this plane perform several other stunts and tricks.

LOOP GLIDER

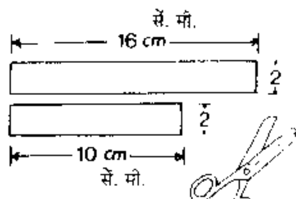
For the best performance you must fly the loop glider in a big room where the air is still.

For making the loop glider you will need scissors, a sheet of bond paper, ruler, pencil, a plastic soda straw and some sticky tape Fig (1).



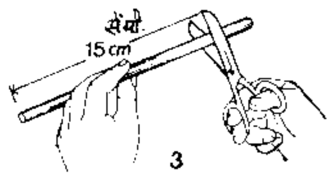
1

Cut two strips of paper, one measuring 2-cm x 16-cm and the other 2-cm x 10-cm Fig (2).



2

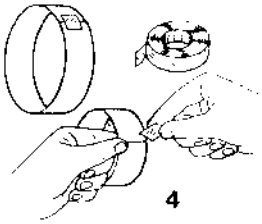
Cut the plastic soda straw so that it is 15-cm long Fig (3).



3

Bend the small strip into a loop so that its ends slightly overlap.

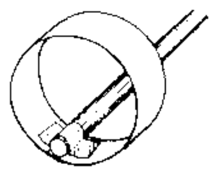
Tape the overlapping ends together. Repeat this step with the large strip Fig (4).



4

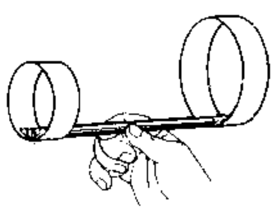
Instead of sticky tape you can use any good adhesive.

With a piece of sticky tape attach the small loop to one end of the soda straw Fig (5).



5

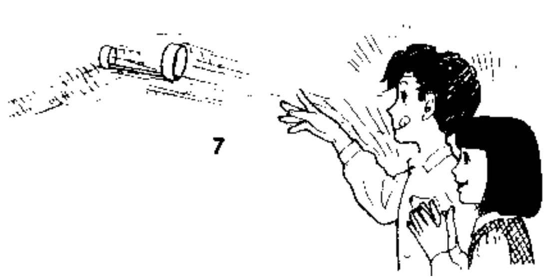
Attach the larger loop to the opposite end Fig (6).



6

The glider is now ready for a take-off.

To fly the loop glider, hold it high with the small loop in the front and throw gently Fig (7).

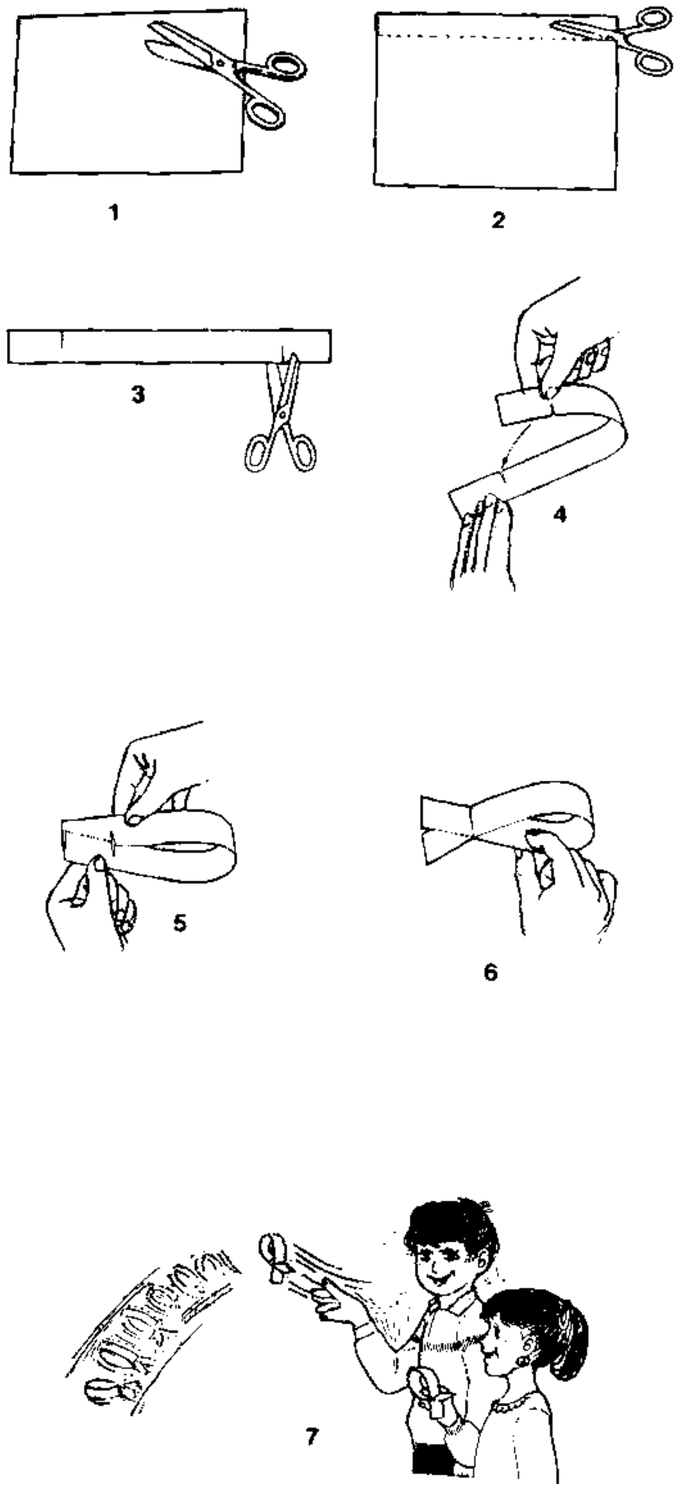


7

The loop glider will glide through the air, losing height slowly.

If the loop glider wobbles about then adjust the position of the loops.

See what happens when you fly the loop glider with the large loop in the front.



FLYING FISH

This is the simplest and the most amazing flying object that you can make.

The flying fish will twist and turn round and round.

To make it all you will require is a sheet of paper (old newspaper will do well) and a scissors Fig (1).

Cut a long strip of paper about 2-cm wide Fig (2).

Place the strip in a horizontal position.

On the lower right-hand side, cut a slit half way across the strip.

Repeat on the upper left-hand side Fig (3).

Bring the right-hand slit over to meet the left-hand slit Fig (4).

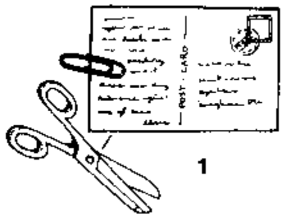
Slip both the slits into each other so that they are interlocked together Fig (5).

This is what your completed flying fish would look like Fig (6).

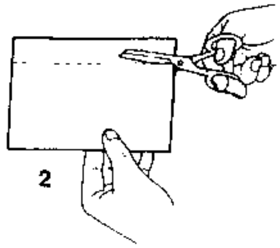
Throw the flying fish high up in the air and it will twist and turn around on its way to the ground Fig (7).

Try making flying fishes of various sizes and coolers.

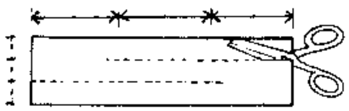
HELICOPTER



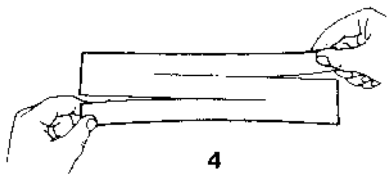
1



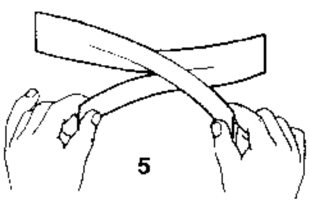
2



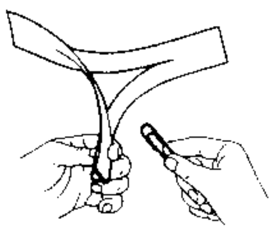
3



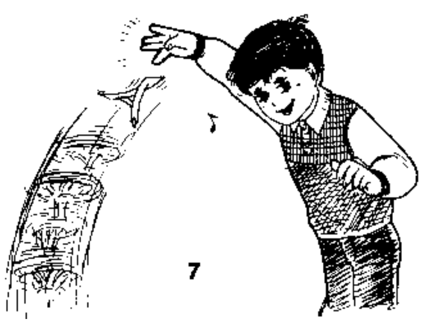
4



5



6



7

It is a great fun to make and fly this helicopter.

It will turn around just like a real helicopter.

For making it you will need a scissors, an old post-card and a paper clip Fig (1).

Cut a long strip of postcard about 3-cm wide Fig (2).

Turn the strip and keep it sideways.

Make two slits in the strip as shown, being careful each time to cut only two-thirds of the distance Fig (3).

Hold the upper right-hand end and the lower left-hand end Fig (4) and bring them together Fig (5).

Fasten the two ends together with the paper clip, so that the helicopter will stay vertical while flying Fig (6).

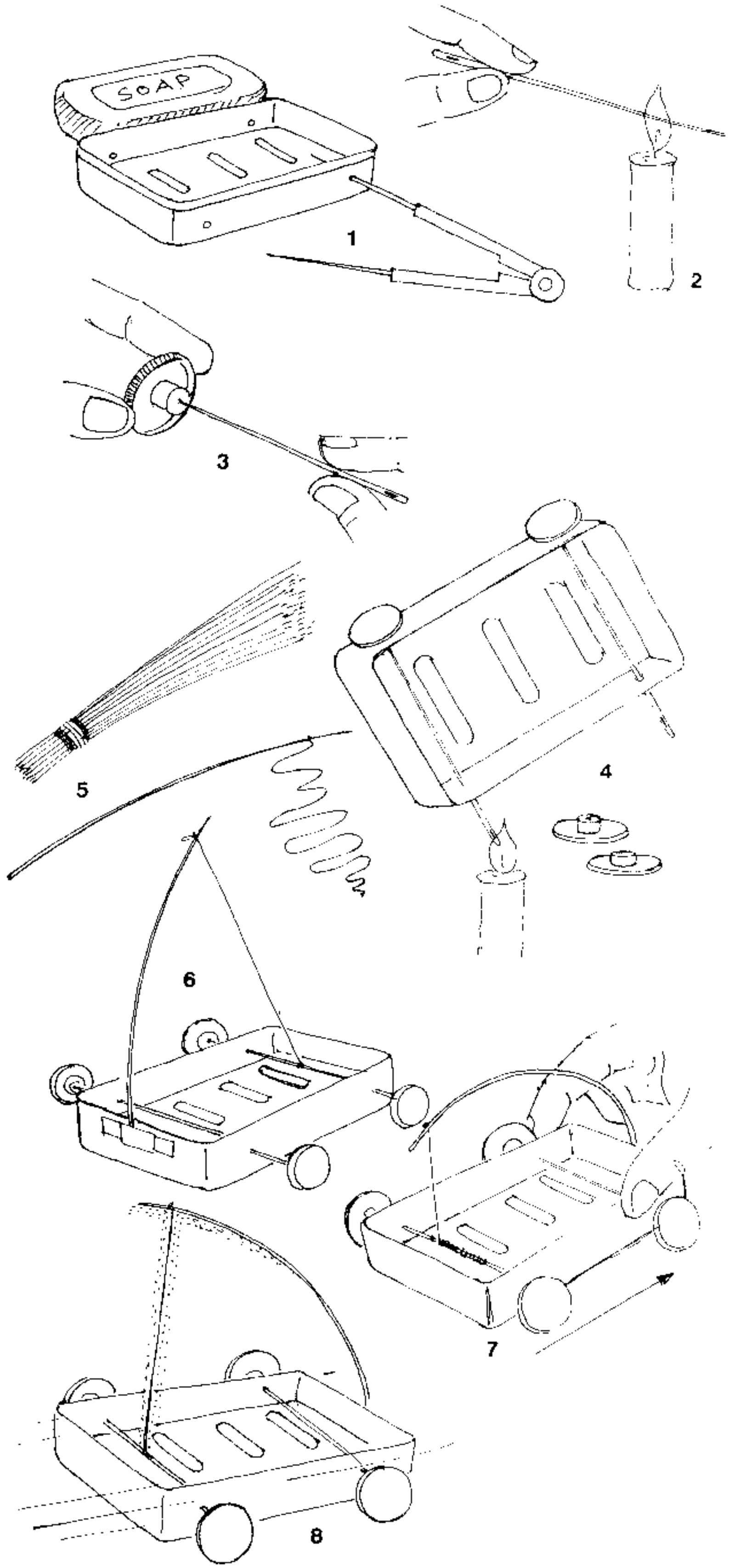
Now drop the helicopter from a height and watch it whirl round and round Fig (7).

Make a loop with the thumb and first finger of your right hand.

Try and catch the vertical tail of the falling helicopter in this loop.

It will require a bit of coordination but it is great fun.

PULLBACK CAR



Mr. K.V.S. Kartha - an active member of the Kerala Sastra Sahitya Parishad (KSSP), devised this very delightful car.

On being pulled back this car stores energy.

On leaving it - this energy is released and the car dashes forwards.

Take a small plastic soap case and make four holes in it with a divider point as shown in Fig (1).

Heat the tip of a long needle Fig (2) and poke it in the center of a cheap quality plastic button Fig (3).

Put two such button and needle assemblies in the holes of the soap case.
Heat the eye end of the needles and affix one button each Fig (4).

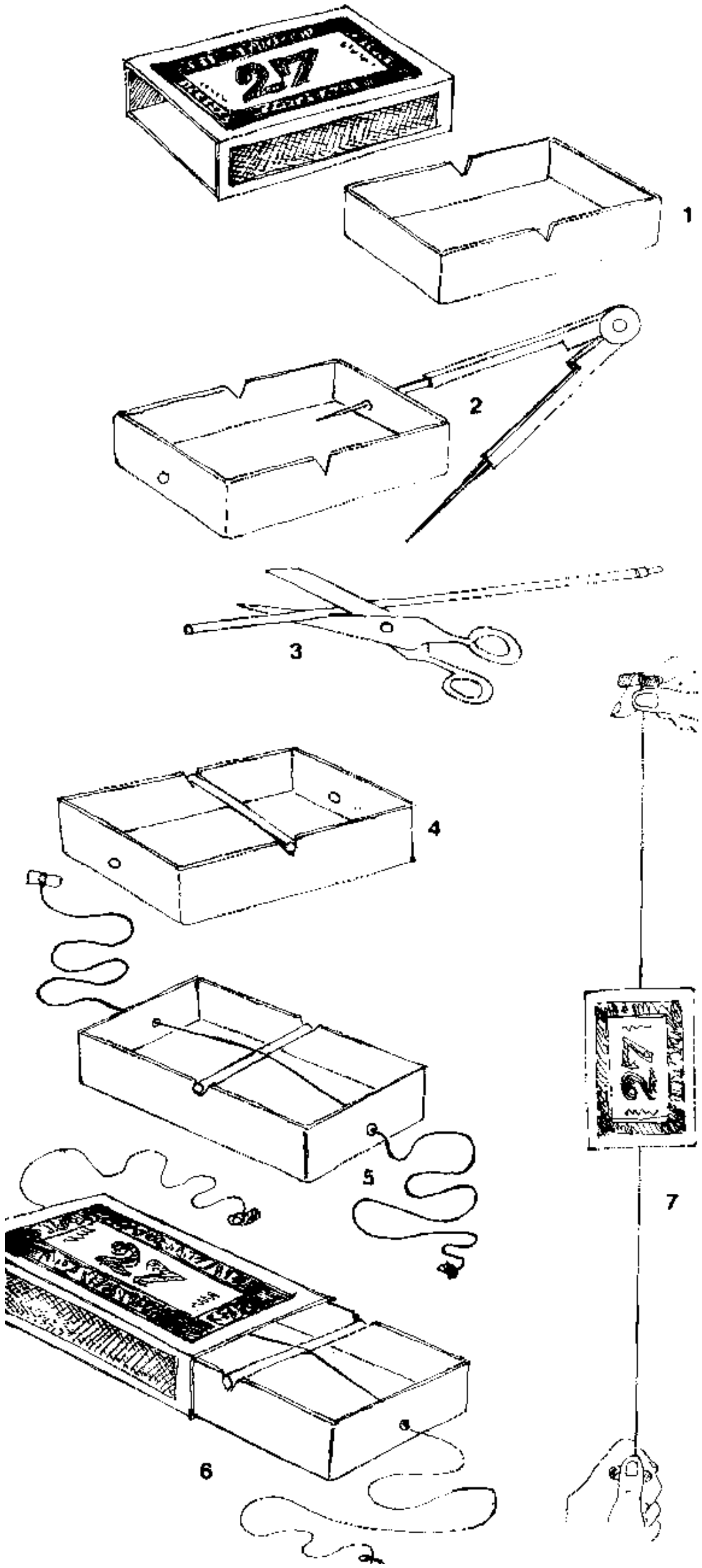
The buttons become the wheels and the needles become axles.
Now tie some sewing thread on the thin end of a 20-cm long broomstick Fig (5).

Tape or tie the broomstick well to the side of the soap case.
Tie the other end of the thread to the needle of the front wheels Fig (6).

Now keep the car on the ground and pull it back.
You can see the thread rolling up on the needle axle.
This results in the broomstick bowing down and storing energy Fig (7).

On releasing the car the stored energy in the broomstick propels the car forwards Fig (8).

GO-NO GO MATCHBOX



Mr. K.V.S.Kartha - an active member of the Kerala Sastra Sahitya Parishad (KSSP), also contributed this toy.

Well, this matchbox is a very obedient one. It will instantly obey your orders. When you say GO then it slides down the string. When you say STOP then it immediately halts. To make it is quite easy.

Take a cardboard matchbox drawer and cut two V notches in the middle of its two long edges Fig (1).

Make a clear hole in the center of both the ends of the drawer Fig (2).

Cut an old ball pen refill equal in size to the width of the drawer Fig (3).

Affix this refill in the V notches of the drawer Fig (4).

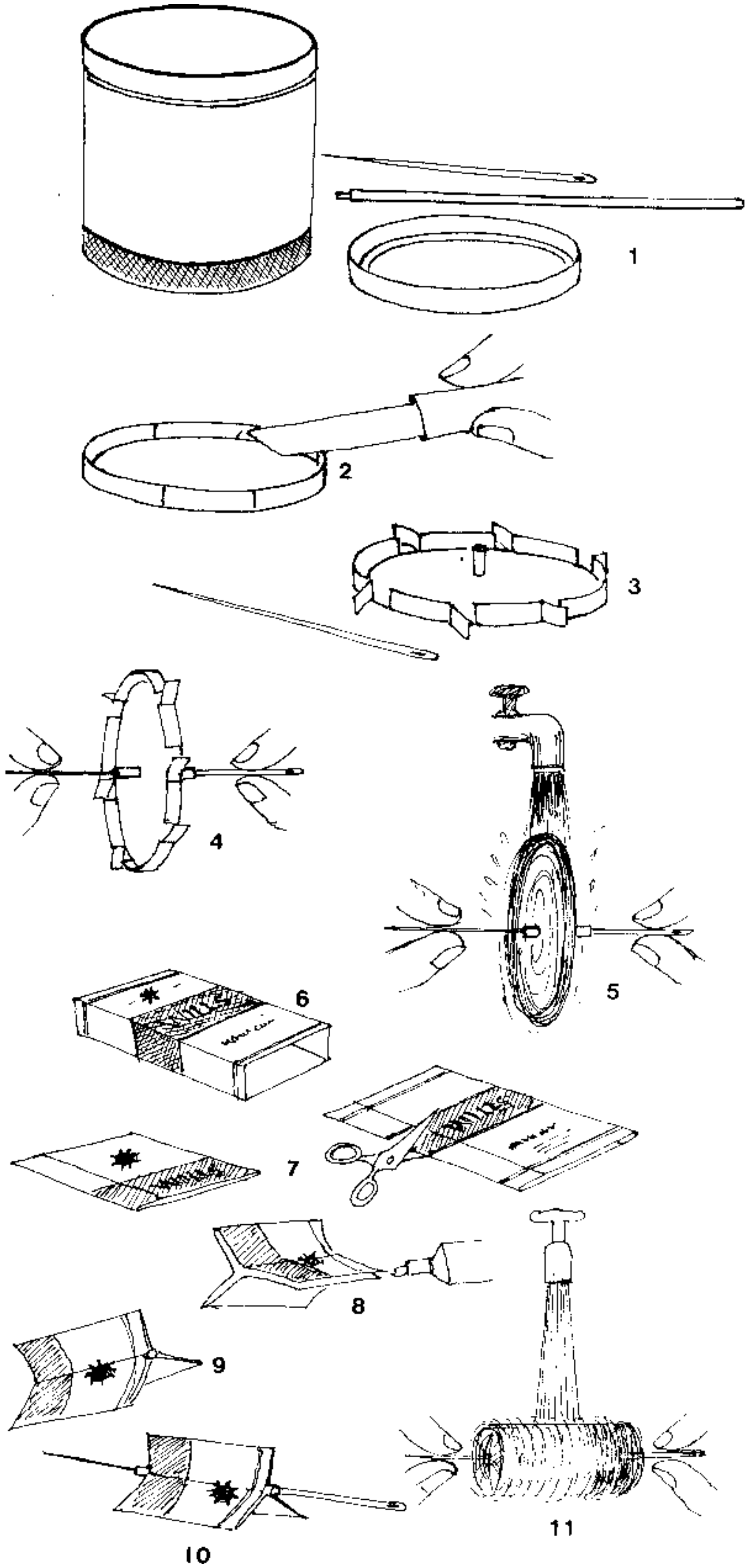
Weave a 70-cm long thread through the two holes in the drawer.
The thread should go over the refill.
Tie small pieces of folded paper at the ends of the thread for a good grip Fig (5).

Carefully cover the drawer with the outer shell of the matchbox Fig (6).

The outer shell keeps the refill in place.
Now hold the two ends of the string upright.
On pulling the two ends of the string, the string inside the matchbox rubs against the refill and brakes it to a stop Fig (7).

On loosening the tension even slightly the matchbox slides down the string because of its own weight.
This simple toy is based on friction and gravity.

TWIN TURBINES



Both these turbines work very well and are very easy to make.

Take the plastic lid of any round tin.

A *pan masala* tin lid is ideal Fig (1).

Mark out six equally spaced lines on its rim.

Cut these lines and about 1 cm. of the perimeter Fig (2).

Offset the cut portions to make the blades of the turbine.

Make a hole in the center of the lid and press fit a 2-cm long piece of used ball pen refill in it Fig (3).

Put a long needle inside the refill bush to complete the turbine Fig (4).

Hold the turbine under a water stream and see it spin Fig (5).

For the second turbine take the outer cover of a cigarette pack Fig (6).

Cut it into half its length Fig (7).

Using the existing creases fold three equally spaced blades.

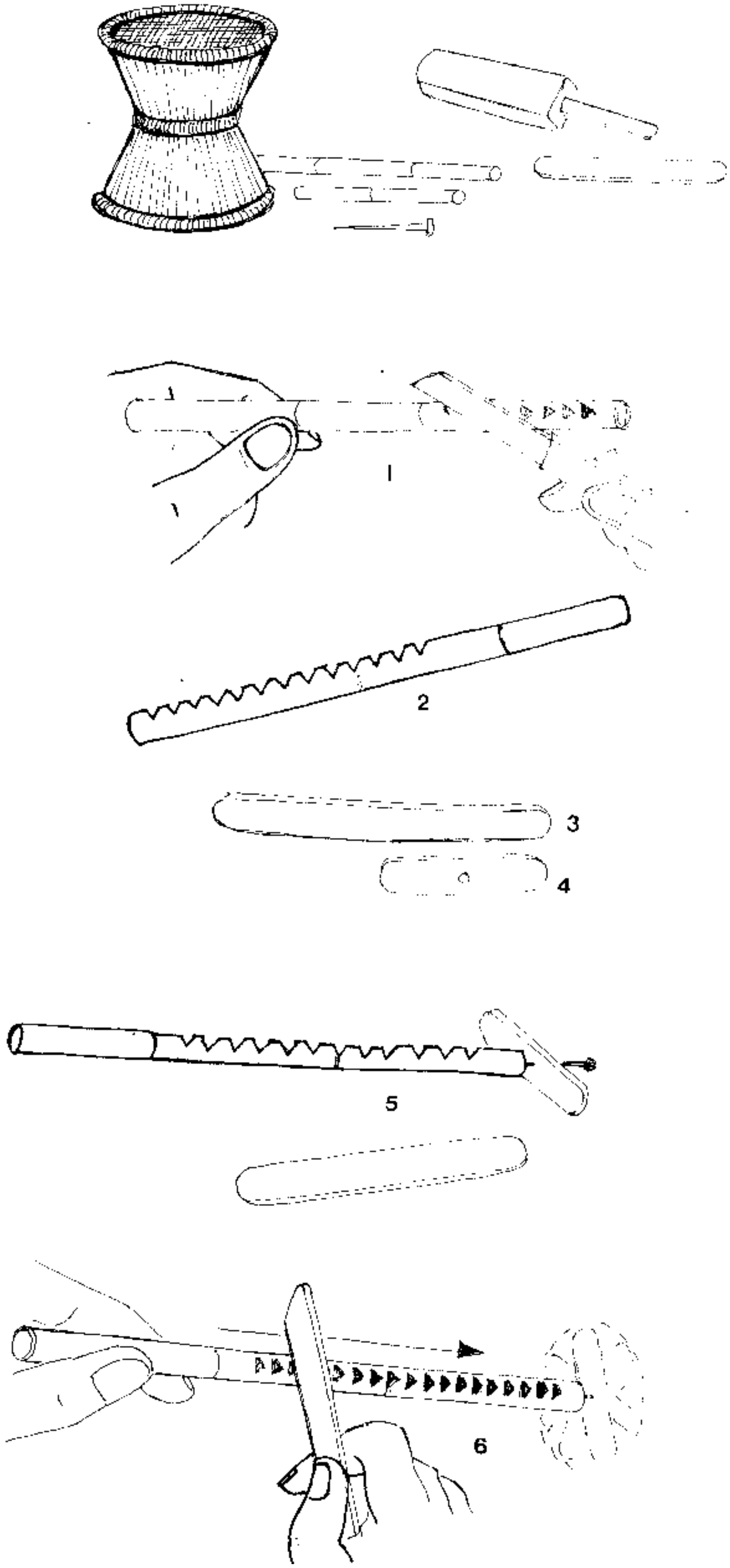
Trim the blades into equal size and stick them Fig (8).

Affix a 6-cm long used ball pen refill through the center using some glue Fig (9).

Put a long needle through the refill for the axle Fig (10).

Hold the two ends of the needle and blow or else keep the turbine under a stream of water and see it spin Fig (11).

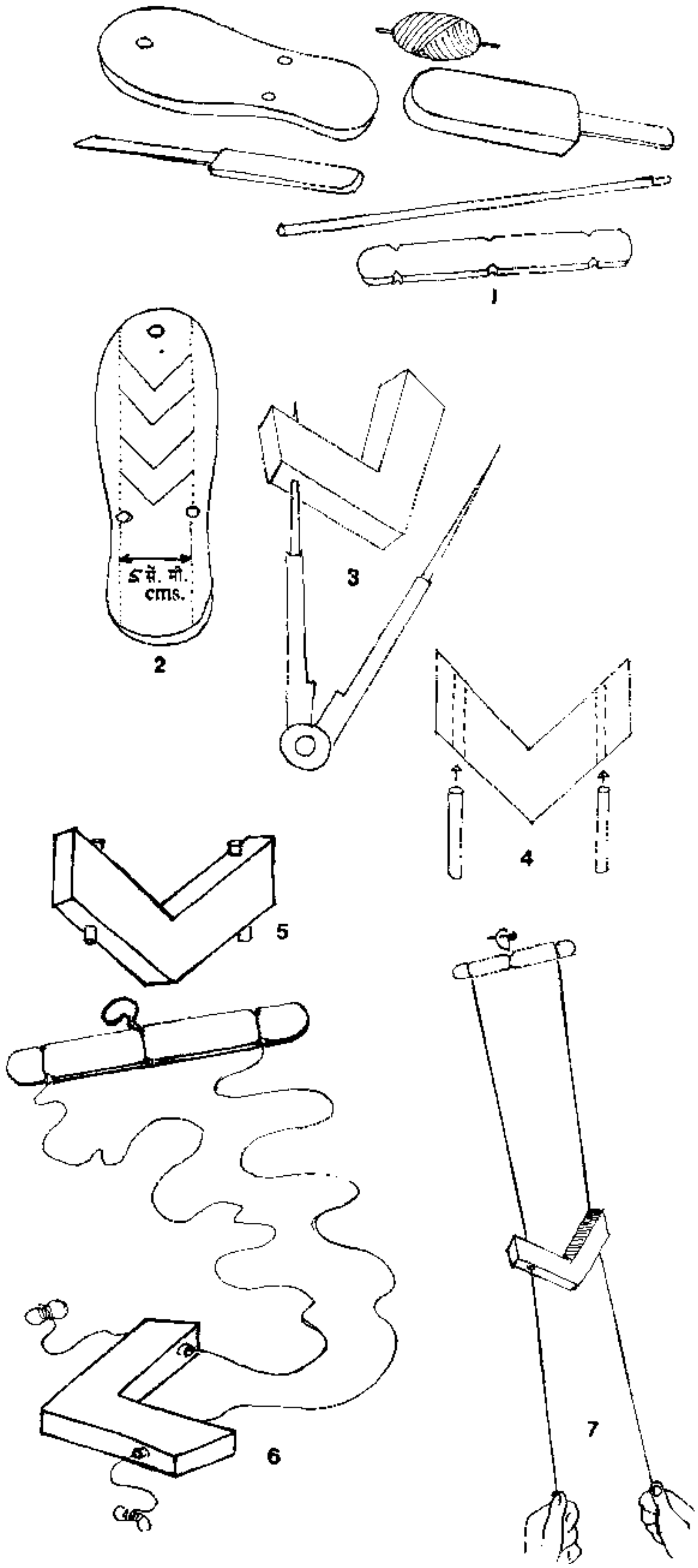
MAGIC WINDMILL



This windmill is essentially a propeller on a notched stick. Its working has puzzled and baffled people for over a century.

Take a 25-cm long reed stick, or even a used sketch pen or a pencil with a rubber on one end will do.
Cut 5-6 notches on it using a knife or a triangular file Fig (1).
The notched stick is shown in Fig (2).
The ice-cream stick (an old ball pen refill is better) shown in Fig (3) is used to stroke the notches.
Make a small propeller about 3-cm long from another ice-cream stick (or thick card sheet) Fig (4).
Put a loose pin or nail through the propeller hole and fix it at the end of the notched stick Fig (5).
Holding your forefinger on the far side of the notched stick and your thumb on the near side, stroke the ice-cream stick back and forth on the notches.
The propeller will turn in one direction Fig (6).
Now loosen your forefinger and let your thumb press against the stick, stroking the stick back and forth all the while.
The propeller will now turn in the opposite direction.
The horizontal and vertical vibrations of the notched stick are not the same frequency and amplitude.
The resulting vibrating motion of the stick and thus of the pin is elliptical.
Depending on the finger pressure and the side, which is rubbed, these elliptical vibrations can be clockwise or anti-clockwise.
The friction between the pin and the propeller sets the propeller in motion.

CLIMBING TOY



Why buy a toy when you can make it yourself.
This toy is certainly a delight to make and play with.
Take an ice-cream stick and make three pairs of notches - two near the ends and one at the center Fig (1).
From an old rubber slipper cut out a 5-cm wide strip Fig (2).
Cut a "V" shaped piece from this strip Fig (2).
Make two holes in this "V" rubber piece using a divider point Fig (3).
These holes should not be divergent or parallel. They should be pointing a little inward.

Insert old ball pen refill pieces in these holes Fig (4).
The refills should be jutting a little out of the rubber Fig (5).

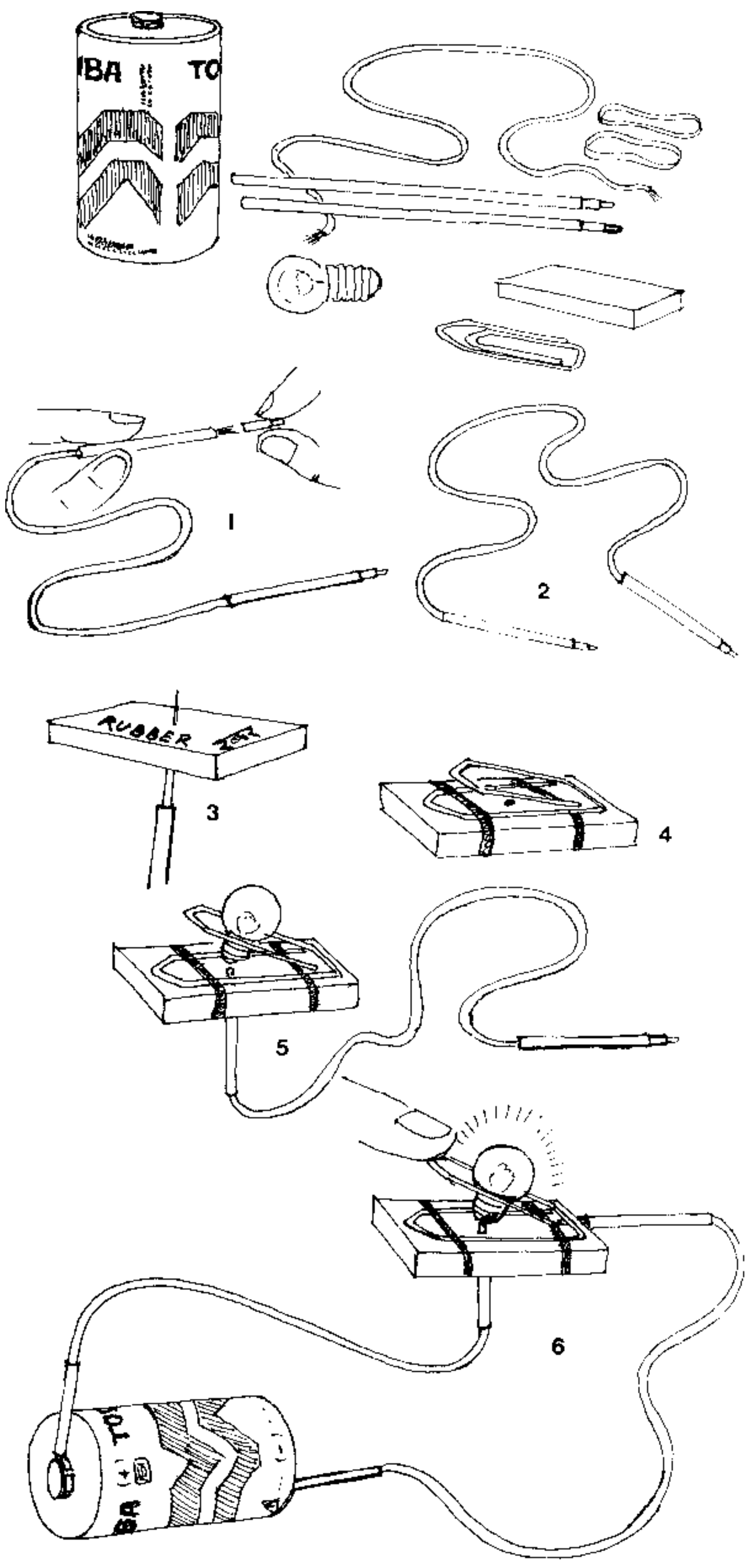
Cut two pieces of 125-cm long strong string.
Tie one end of each string to the end notches of the ice-cream stick.
Tie a string loop at the center of the stick.
The notches prevent the string from sliding.

Now weave both the strings through the ball pen refills of the V rubber.
Tie small rubber pieces as handles to both the ends of the string Fig (6).

Now hang the center on the stick from a nail. Hold both the ends of the string and tug at them alternately.
The "V" rubber piece slowly climbs up Fig (7).

On loosening the tension of the strings the "V" rubber falls down.
This simple toy is based on friction.

SIMPLY ELECTRIFYING



Often children find it difficult to solder a wire to a torch bulb.
This simple electrical probe and torch bulb holder does not require any soldering.

An old ball pen refill can be used to make an excellent probe.
The brass tip of the refill has negligible electrical resistance.
Take a 5-cm long used ball pen refill.
Remove its brass tip.
Slip a thin electrical wire through the refill, so that some of its wire strands come out from the other end.

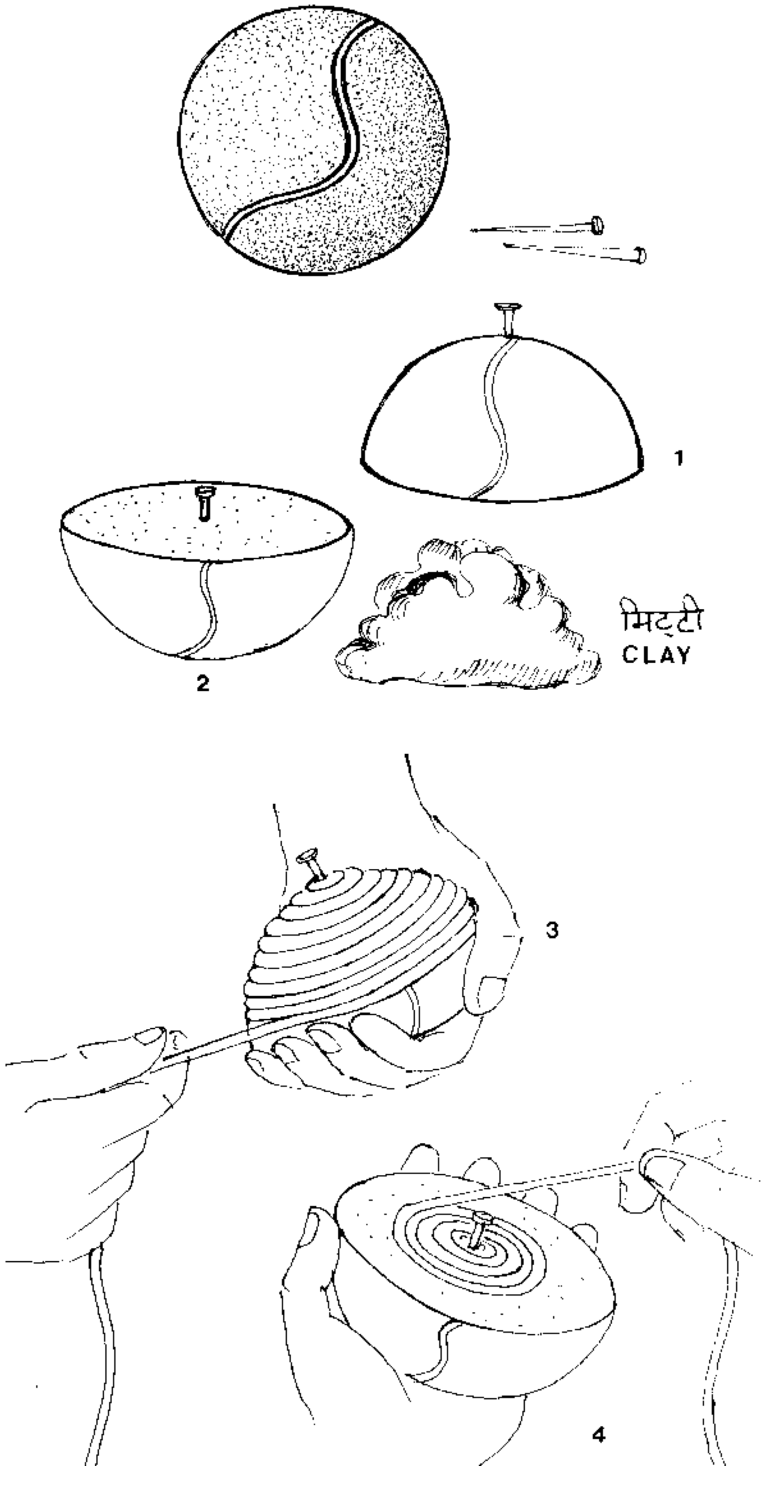
Now wedge the brass tip back into the plastic refill, along with the wire strands.
The plastic refill makes an excellent holder and the brass tip a fine probe Fig (1).
Fix two such ball pen refills as probes on the two ends of an electrical wire Fig (2).
For making the torch bulb holder-cum-switch, take a piece of 5 mm. thick rubber and make a hole in its center with a divider point Fig (3).

Place a paper clip on it and fix it in place with two rubber bands Fig (4).
Open out the clip to accommodate the torch bulb screw. Insert the ball pen refill probe through the center of the rubber Fig (5).

The other end of this probe can be directly wedged between the brass button and the plastic seal of the battery.

Fix the right hand probe as shown in Fig (6). On pressing the paper clip the circuit will be completed and the bulb will light up.

SURFACE OF A SPHERE



Here is a very simple and practical way to prove that "the surface area of a sphere is equal to four times the surface area of the circle through its center."

In other words when you cut a lemon into half, the size of one of its flat faces is one quarter of the area of the whole fruit.

Take an old ball and carefully cut it into two equal halves.
Fill the two halves with clay and let them dry.
Take one of the half circle sections and drive a nail into its upper most point Fig (1).

Attach one end of a cord to the nail and curl the rope around it spiraling outward in ever-increasing rings.

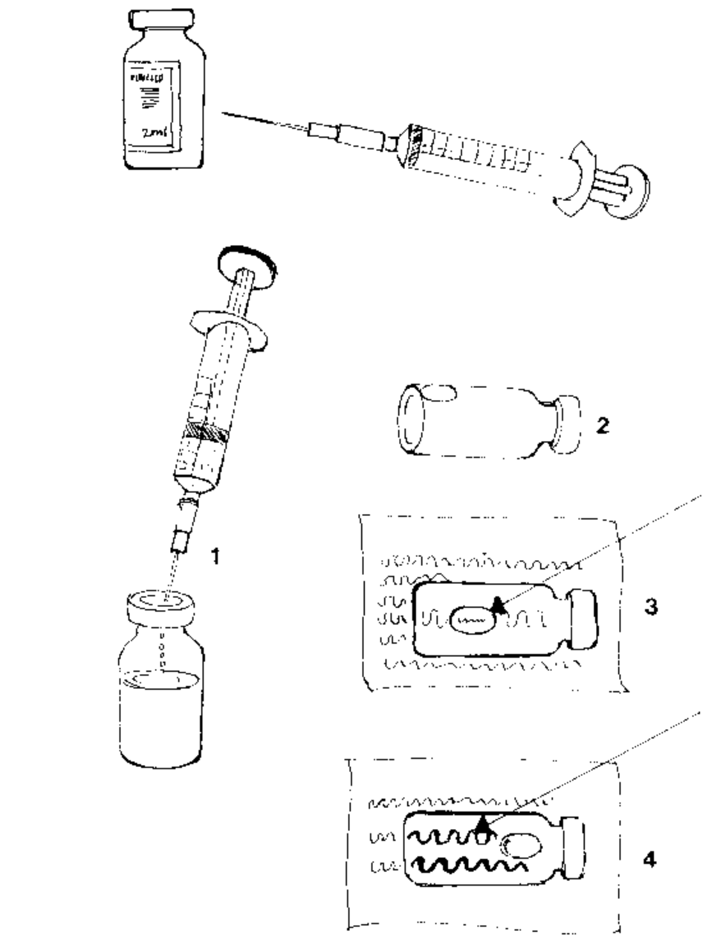
When the entire circle is covered cut the cord and put it aside Fig (3).

Drive a nail into the center of the flat surface of the other half-sphere Fig (2).

Use the same size rope as before and coil it around the nail until the entire surface area is covered Fig (4).

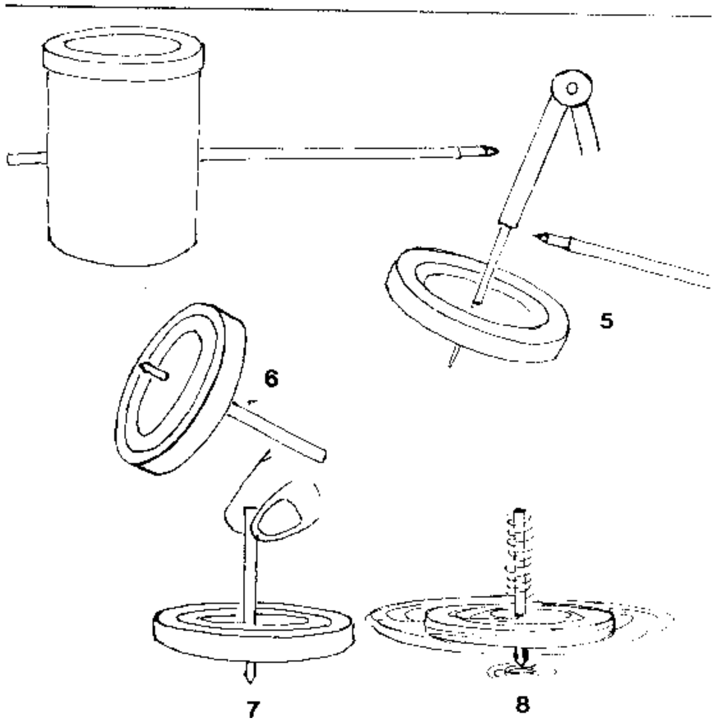
Unroll and measure the two lengths of cord you now have.
The first will be exactly twice the length of the second.
But as it is only half the surface of the entire sphere, we can conclude that it is actually four times as great as the other, the circle through the center.

BUBBLE BOTTLE LENS



Take a 2 ml. used injection bottle.
Do not remove its aluminum cover or the rubber cap.
Using an old plastic syringe inject some water into the bottle.
Be careful not to poke yourself with the old syringe needle.
Shake the bottle and suck out its contents with the syringe.
This way the bottle will be pushed clean.
Now inject clean water into the bottle until only one air bubble remains Fig (1).
Keep this bottle in the lying down position Fig (2) and roll it on a newspaper.
If you look through the bubble- which acts like a concave lens then you will see the newsprint size reduced Fig (3).
On the other hand if you look through the bottle - which acts like a bi-convex lens then the newsprint appears enlarged Fig (4).

CAP TOP



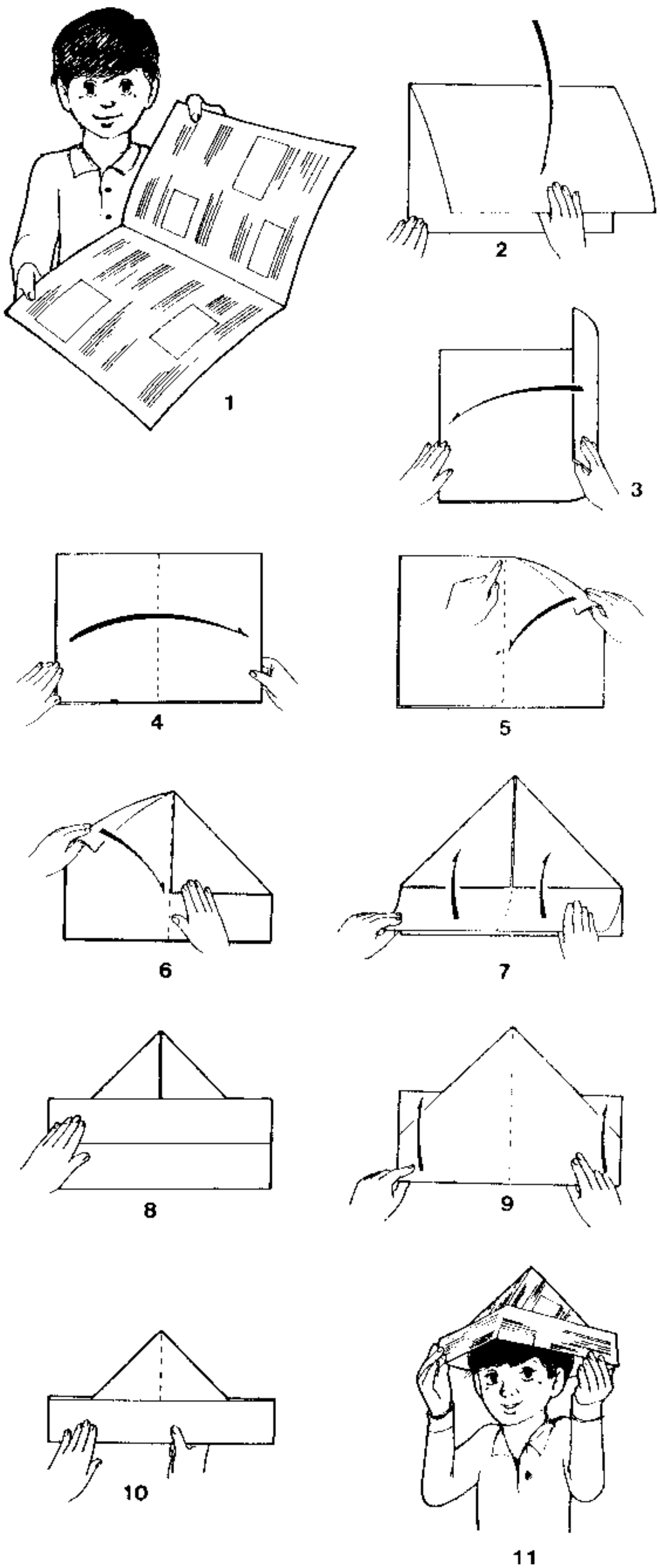
Take the plastic cap of a white film roll bottle.

Make a hole in the center of the cap with a divider point Fig (5).

Make a 5-cm long used ball pen refill (the long variety of the refill is best for this) and press the brass tip into the hole of the cap Fig (6).

Now hold the plastic refill and spin this almost perfect top Fig (7, 8).

This toy has all the attributes of a great top - a low center of gravity and a large moment of inertia.



THE CAPTAIN'S HAT STORY

Lillian Oppenheimer - founder of the New York Origami Center, has told this delightful story for the last 50 years.

To entertain the passengers the captain used to have a fancy dress party everyday.

Each day the captain used to fold a new cap for himself from an old newspaper. Take one full sheet of newspaper Fig (1).

Leave the sheet of newspaper folded in half along its middle fold Fig (2).

Keep the folded edge on top and fold the newspaper in half from right to left.

Press the paper flat Fig (3).

Unfold the paper Fig (4).

Fold down the top right - hand corner to meet the middle fold line Fig (5).

Fold down the top left - hand corner to meet the middle fold line Fig (6).

Fold up one single layer of paper, from the bottom up as far as it will go Fig (7).

Press the paper flat.

Turn it over from side to side Fig (8).

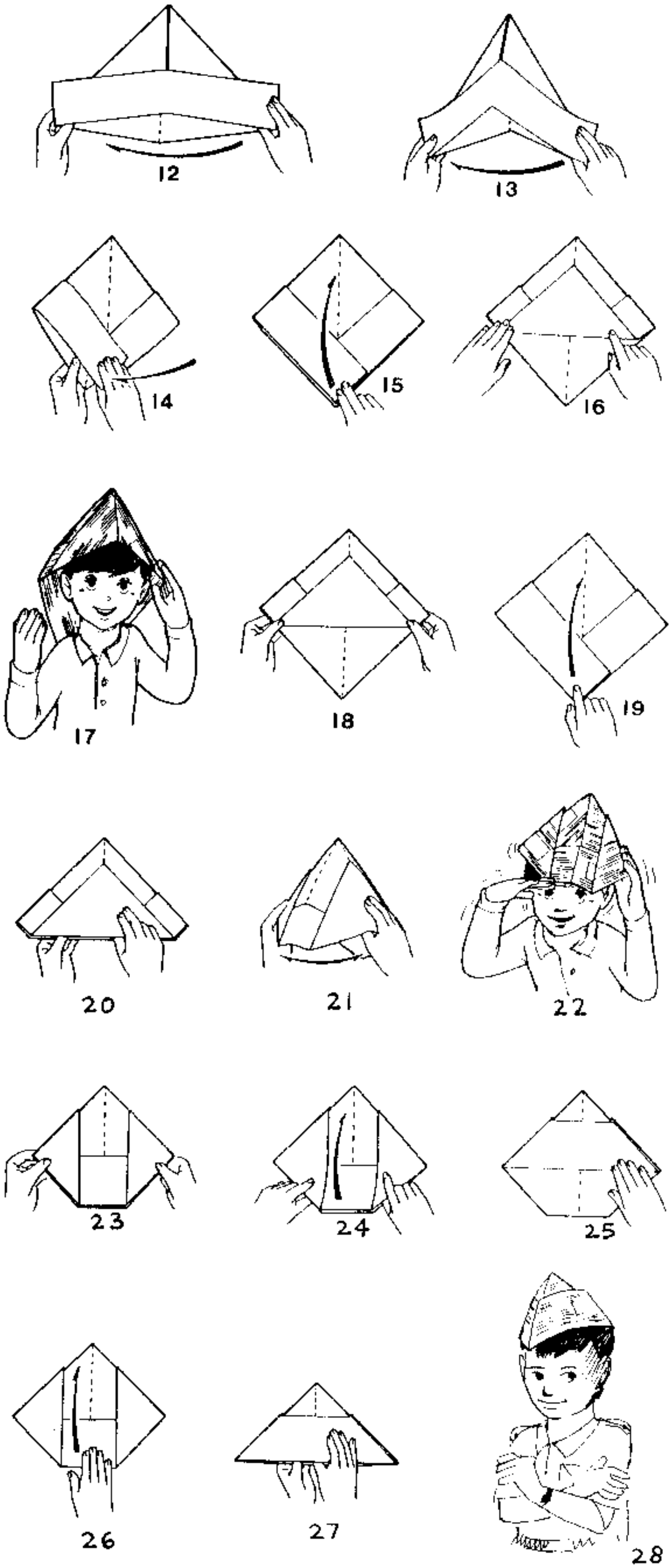
Fold up this single layer of paper as far as it will go Fig (9).

Press the paper flat. From the inside open out the paper a little Fig (10).

This is the captain's first cap - a SAILOR'S CAP.

It protects the captain from the scorching sun and the pouring rain.

The story continues on….



FIREMAN, HUNTER, OFFICER'S HATS

…. The captain did not use a new newspaper everyday.

He would simply give his old cap a few more folds and transform it into a brand new cap.

So, hold the SAILOR'S CAP in both hands and start Fig (12) to collapse it Fig (13) into this shape Fig (14).

Fold up the top bottom point Fig (15).

Press the paper flat so as to make Fig (16), the FIREMAN'S CAP Fig (17).

Press the paper flat and turn it over from side to side Fig (18).

Fold up this bottom point Fig (19), Hold the front and back of the hat.

Carefully open out, and the hat will Fig (20) again collapse to make Fig (21) the HUNTER'S HAT Fig (22).

Press the paper flat Fig (23).

Fold up the top layer from the bottom of the hat Fig (24).

Press the paper flat and turn it over from side to side Fig (25).

Fold up this bottom layer Fig (26).

Open the paper out to make...Fig (27) an AIRFORCE OFFICER'S CAP.

The captain's story continues on…

OF SHIPS AND SHIRTS

…Well up till now we had been talking about captain's caps.

But what about the captain's ship!

Well now, pinch the two side points Fig (29) and pull them a to make a traditional newspaper boat Fig (30).

This is the captain's ship.

Now you begin to tell the story.

There is storm at sea Fig (31).

There is lightening and thunder al the ship gets stranded in the storm.

One huge wave comes and knocks off the stern (you tear one corner of the ship) Fig (32).

Another wave comes and knocks of the bow you tear the other corner off Fig (33).

One last huge wave knocks of the bridge (you tear the triangle in the middle) Fig (34).

Now the ship is sunk.

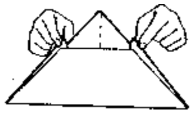
The captain looses all hats (you start to unfold what is left) Fig (35).

The captain has nothing left! (Now put your-head through the hole) Fig (36).

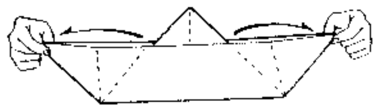
All that remains is a TORN SHIRT Fig (37).

So, with just one old newspaper you can make four different caps and a ship, which you tear up into pieces to make a shirt.

What fun!

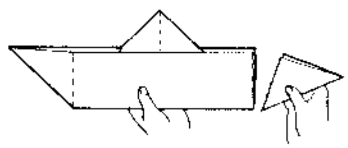


29

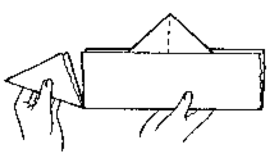


30

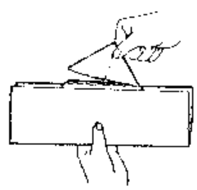
31



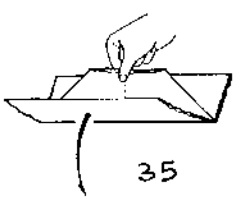
32



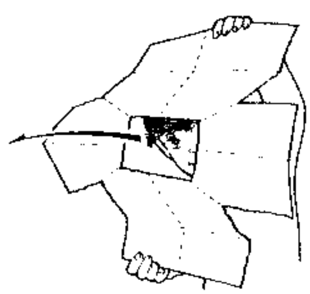
33



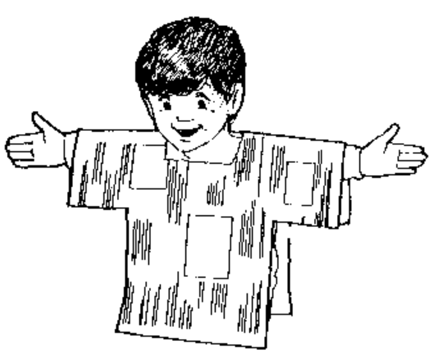
34



35

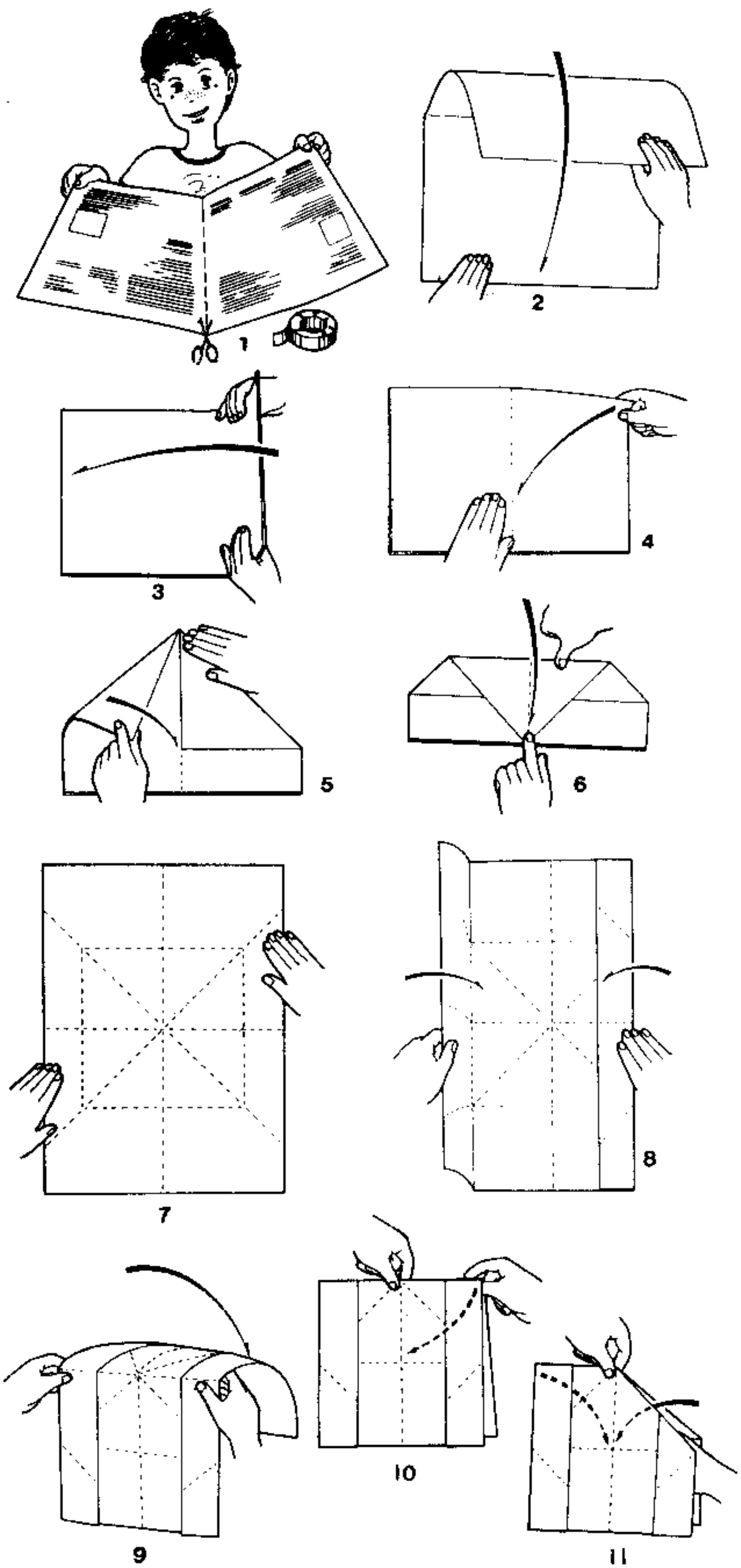


36



37

CRICKET CAP



This lovely cap can be made using a newspaper and some sticky tape.

The flap in the cap will help to shade your eyes from the sun.

Take a full newspaper and cut it into two parts Fig (1).

The cap will be made only from one part.

Take one part and fold it in half from top to bottom Fig (2).

Then fold it in half from side to side and unfold it again Fig (3).

Fold one half of the top edge in so that it lies along the centerfold line Fig (4).

Fold the other half down as well Fig (5).

Fold the top down to meet the bottom edge of the paper Fig (6).

Unfold the paper again Fig (7).

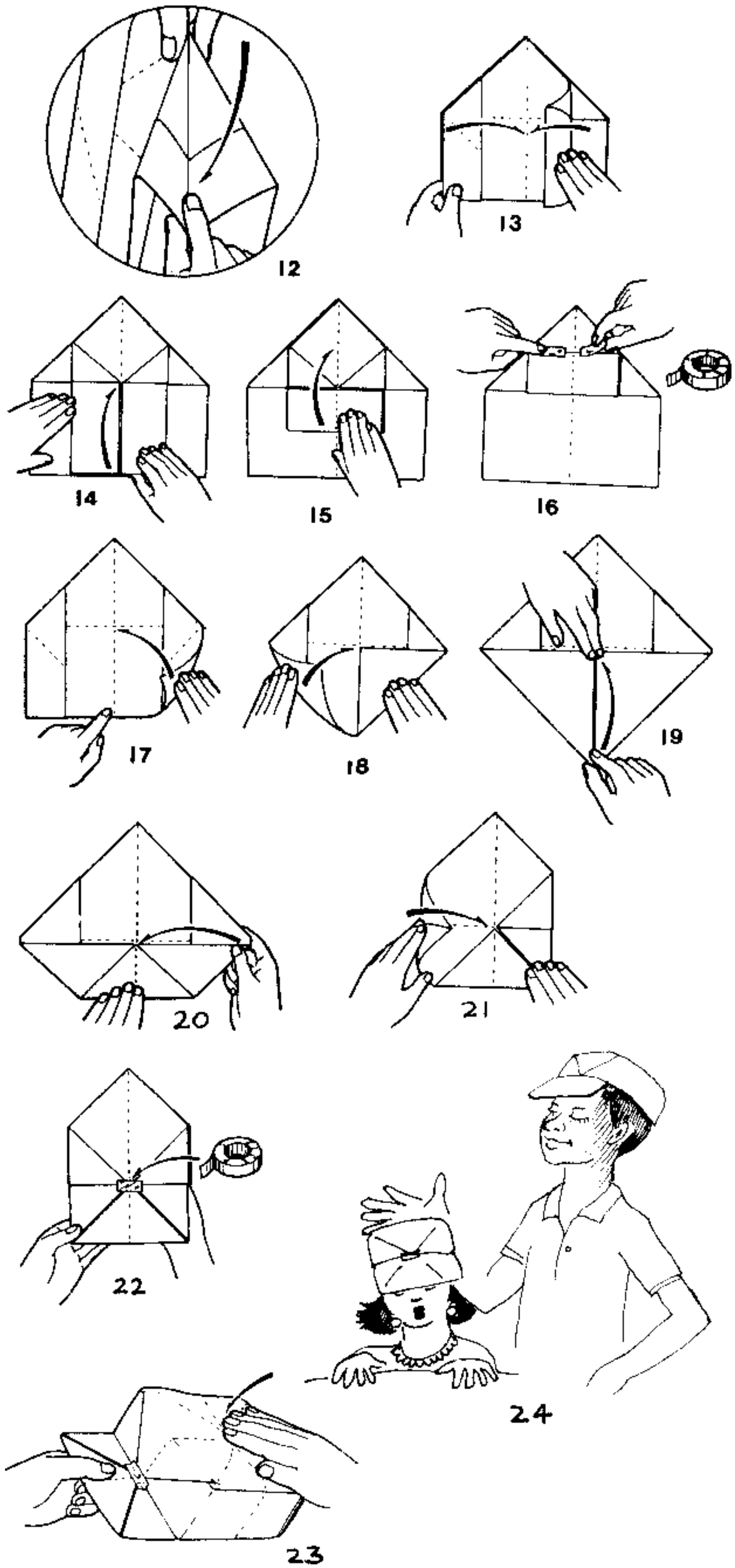
Fold in each of the long sides along the fold lines Fig (8).

Then fold the paper in half away from you Fig (9).

Put your thumb inside and forefinger on top Fig (10).

Push the top corner down inside itself along the fold line Fig (11).

The cap is continued on the next page.



CRICKET CAP CONTINUED

Fig (11) shows Fig (12) in more detail.

Fold the right - hand edge of the top layer of paper into the center.

Also fold the left - hand edge of the top layer of paper into the center.

Press them flat Fig (13).

Then fold the bottom edges up to meet the middle Fig (14).

Fold them again over the middle Fig (15).

Fasten them down with sticky tape.

Turn the paper over Fig (16).

Fold up the bottom right - hand corner to meet the center Fig (17).

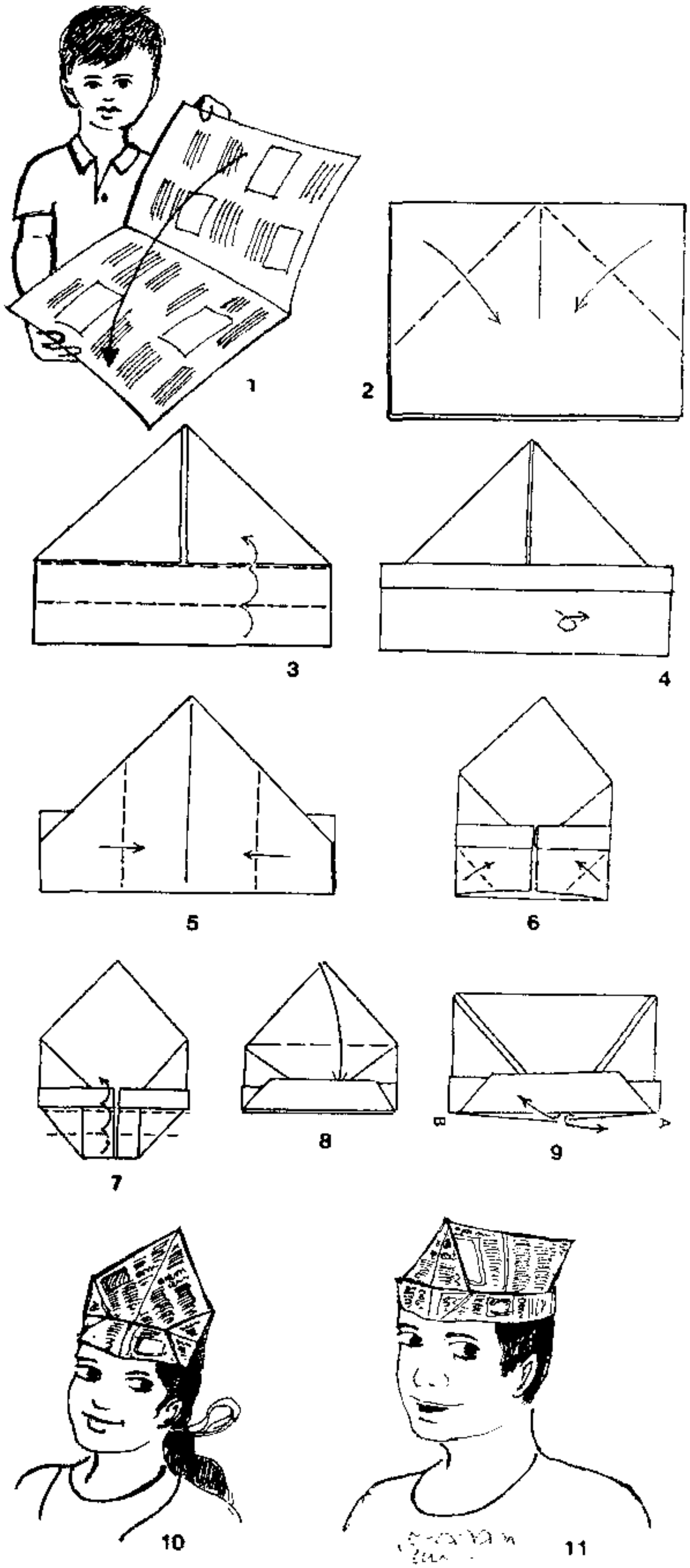
Then fold up the bottom left - hand corner as well Fig (18).

Fold up the bottom point to the middle Fig (19).

Then fold the right - hand earner into the middle Fig (20), and the left - hand corner as well Fig (21).

Fasten the corners down with sticky tape Fig (22).

Open out and press it into shape Fig (23) and then wear your cricket cap Fig (24).



THREE - IN - ONE CAPS

With a sheet of newspaper you can make three different kinds of caps.

Take a double spread newspaper and fold it into half Fig (1).

Keep the folded edge on top and fold the top left and right corners to the middle - fold line Fig (2).

Fold up the top layer of paper from the bottom into half.

Then double fold it Fig (3).

Now turn over the paper Fig (4).

Bring the left and right edges to the middle line and crease Fig (5).

Fold the bottom left and right hand corners Fig (6).

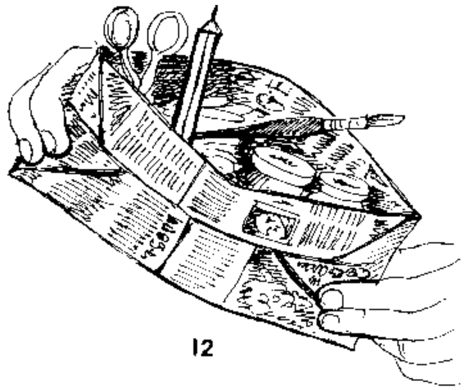
Fold the bottom portion into half. Fold it up once again and tuck the edge inside Fig (7).

This cap looks like a KING'S CAP Fig (10).

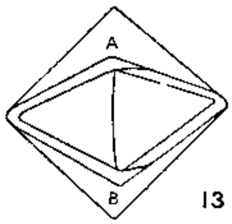
Now fold the top corner to the midpoint on the base and tuck it in Fig (8).

Open out the long edges Fig (9) and wear it like a NEHRU CAP Fig (11).

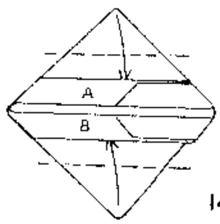
The caps are continued on the next page.



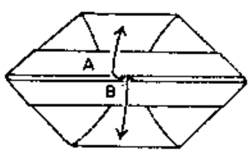
12



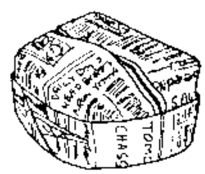
13



14

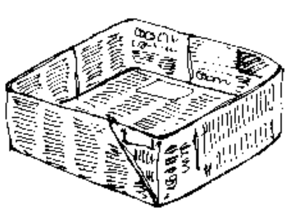


15

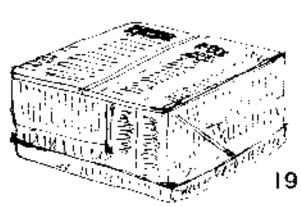


16

17



18



19

THREE - IN - ONE CAPS CONTINUED

The NEHRU CAP can be inverted and used as a very nice purse Fig (12).

Slowly press the purse and squash such that A meets B Fig (13).

Bring the top and bottom corner points to the center tucking, them in at the same time Fig (14).

Now open out the midline as shown in Fig (15) to form the cap shown in Fig (16).

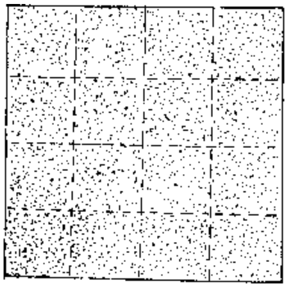
This looks like a HIMACHALI CAP or a KULU CAP to be more specific Fig (17).

The corners of the KULU cap can be straightened up to form a square box Fig (18).

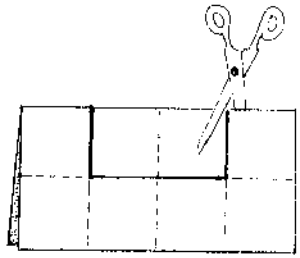
These boxes can be used a variety of sorting out and storing activities.

One box can be overturned as a lid on the other to make a closed gift box Fig (19).

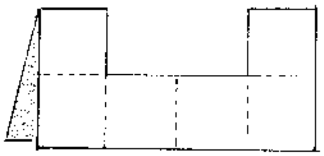
Using different sizes of newspapers you can make big and small boxes too.



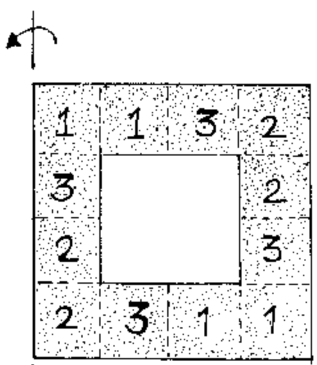
1



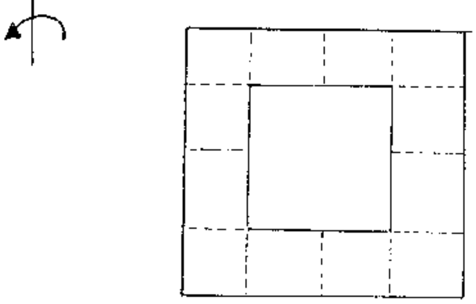
2



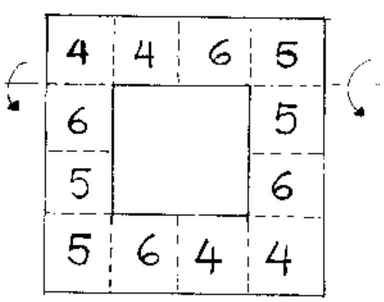
3



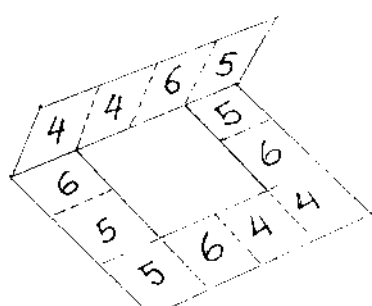
4



5



6



7

FLAT FLEXAGON

The great thing about this almost magical flexagon is that you do not require any tools to make it.

All you need is a 10-cm x 10-cm square of bond paper.

For convenience the paper is white on one side and tinted on the other.

Fold the tinted side into 16 equal squares Fig (1).

Fold into half and cut or tear accurately along the bold line Fig (2).

Remove the central cut square Fig (3).

Write numbers 1, 2 and 3 on the twelve tinted squares as shown in Fig (4).

Then turn the paper over as shown in Fig (4).

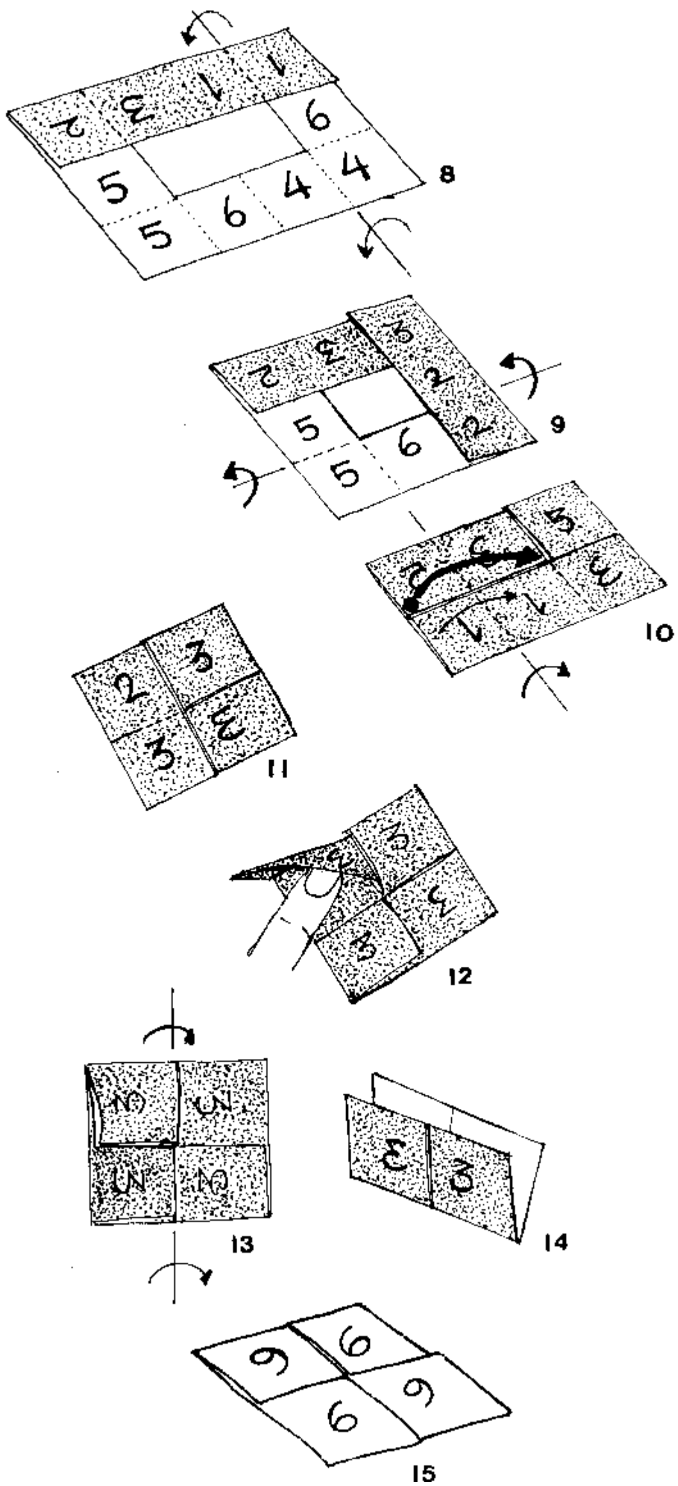
On turning twelve white squares will be exposed Fig (5).

Write numbers 4, 5 and 6 on these twelve squares as shown and then turn the edge numbered 4, 4, 6, and 5 inwards along the axis shown in Fig (6).

An intermediate stage is shown in Fig (7).

The process of making the flat flexagon is continued on the next page….

FLAT FLEXAGON CONTINUED



…Now keep folding one edge in the clockwise direction.

Fold edge 1, 6, 4 as shown in Fig (8).

Now fold edge 5, 6, 2 as shown in Fig (9).

Also fold edge 1, 5 in Fig (10).

The square Fig (11) thus obtained has three 3's but one odd man number 2.

We want all the four numbers to be the same - namely 3.

For this we come back to the stage in Fig (10).

Lift up the corner marked with the black dot and bring it td the center, locking the flexagon in the process Fig (12).

This lock is very crucial so try making it a few times.

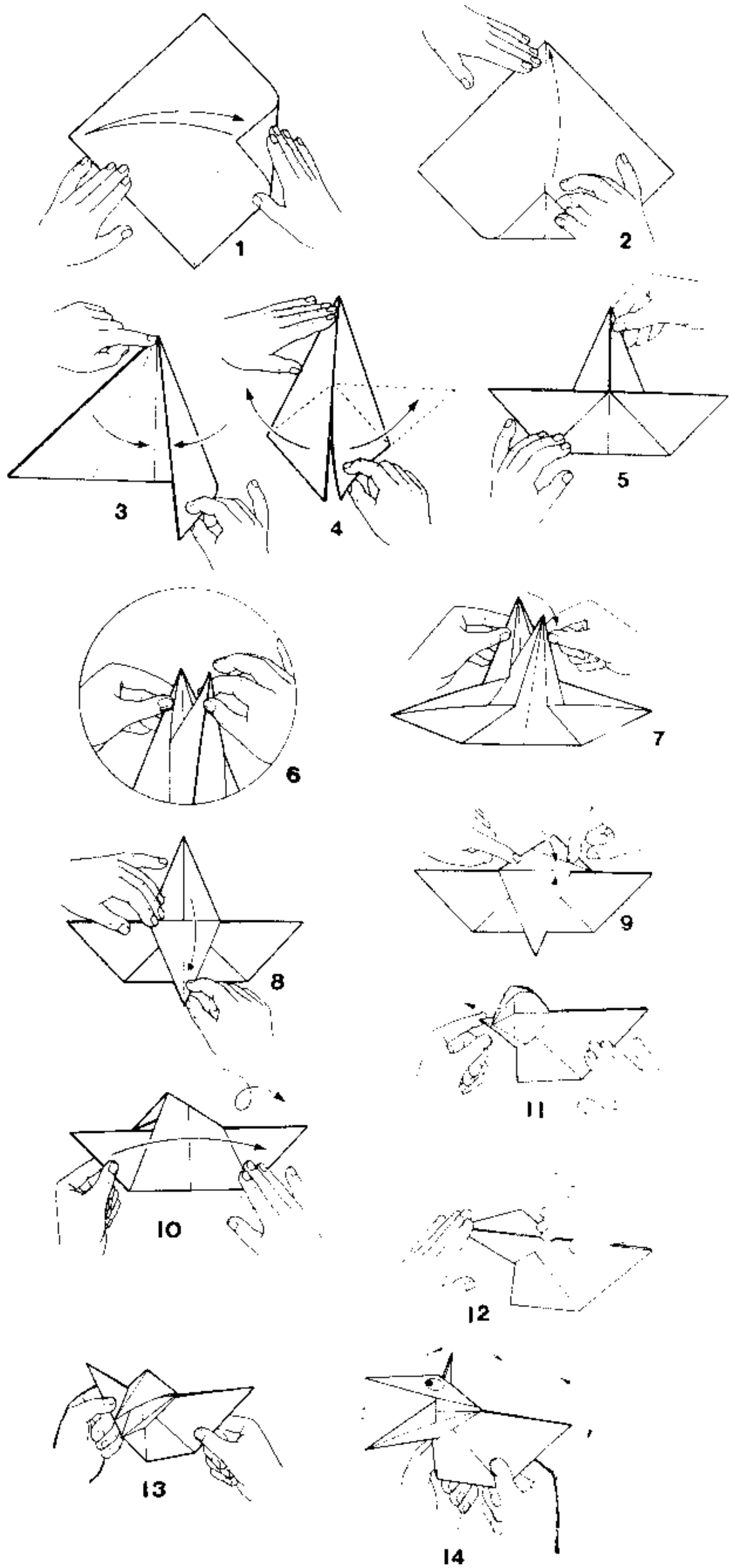
Now all the four small squares will have the number 3 on them Fig (13).

Flex it along the axis shown in Fig (13) to get the face with number 6 on it Fig (14, 15).

This flexagon can be endlessly rotated / flexed to get faces with 1, 5, 3, 4, 5 and 6 (not necessarily in the same order) written on them.

You could draw different pictures on this flexagon and use it to depict a cycle or a sequence.

TALKING CROW



This delightful piece of action origami can be made with a square of paper.

Turn the square to look like a diamond.
Fold and unfold it in half from side to side Fig (1).
Fold it in half from bottom to top Fig (2).
From the top point, fold the sloping sides in to meet the middle fold - line Fig (3).
Fold the bottom points up into the position as shown by the dotted lines Fig (4).

This should be your final result Fig (5).
From the top point, pull the inside layer out Fig (6).
Keep on pulling until the layers separate Fig (7).
Arrange the two layers one over the other Fig (8).
Fold the top point down as far as possible Fig (9).

Fold the two points across to the right Fig (10).

Turn the paper over.

Fold it into half from side to side Fig (11).

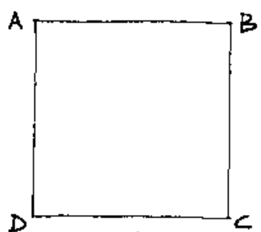
Pull the points across to the left Fig (12) and press them down neatly, so as to make the crow's beak Fig (13).

To complete the crow, draw on eyes with a sketch pen Fig (14).

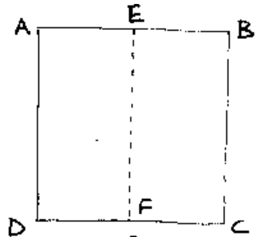
Open and close the crow's wings to make him talk.

It is even possible to pick up small lightweight objects in the crow's beak Fig (15).

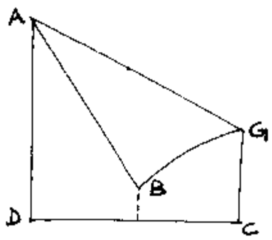
PAPER PROTRACTOR



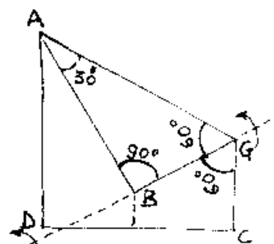
1



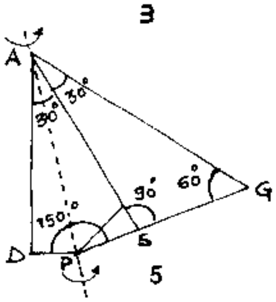
2



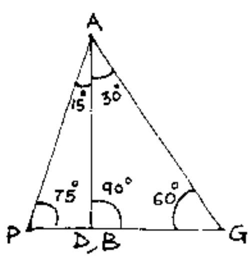
3



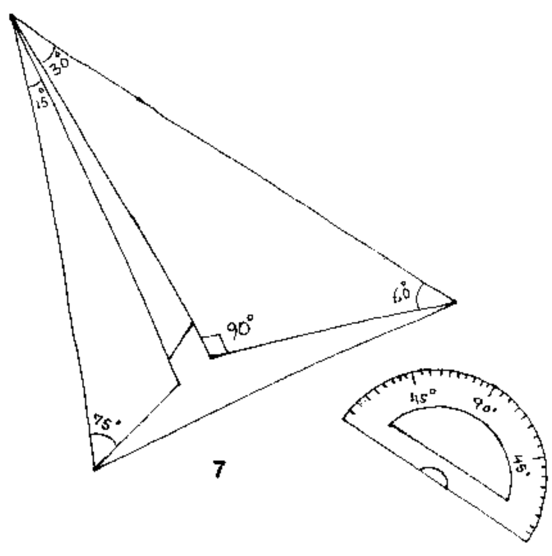
4



5



6



7

Take a 10-cm x 10-cm piece of square paper (ABCD) Fig (1).

Fold its middle line EF Fig (2).

Fold corner B and move it up and down on midline EF until line BA passes through the left - hand corner A Fig (3).

Crease AG, Fig (3). By doing this angle AGB will become exactly 60-degrees.

Now consider triangle ABG; as angle ABG is right angled - being the corner of the square, and as angle AGB is 60-degrees, so the remaining angle BAG will be 30-degrees Fig (4).

Now fold the lower triangle along line BG and tuck it below triangle ABG Fig (5).

Bring edge AD and AB together so as to bisect angle DAB (30-degrees) into half.

Now angle PAB will be 15-degrees.

As angle ABP is a right angle - being a corner of a square so the remaining angle APB will be 75-degrees Fig (6).

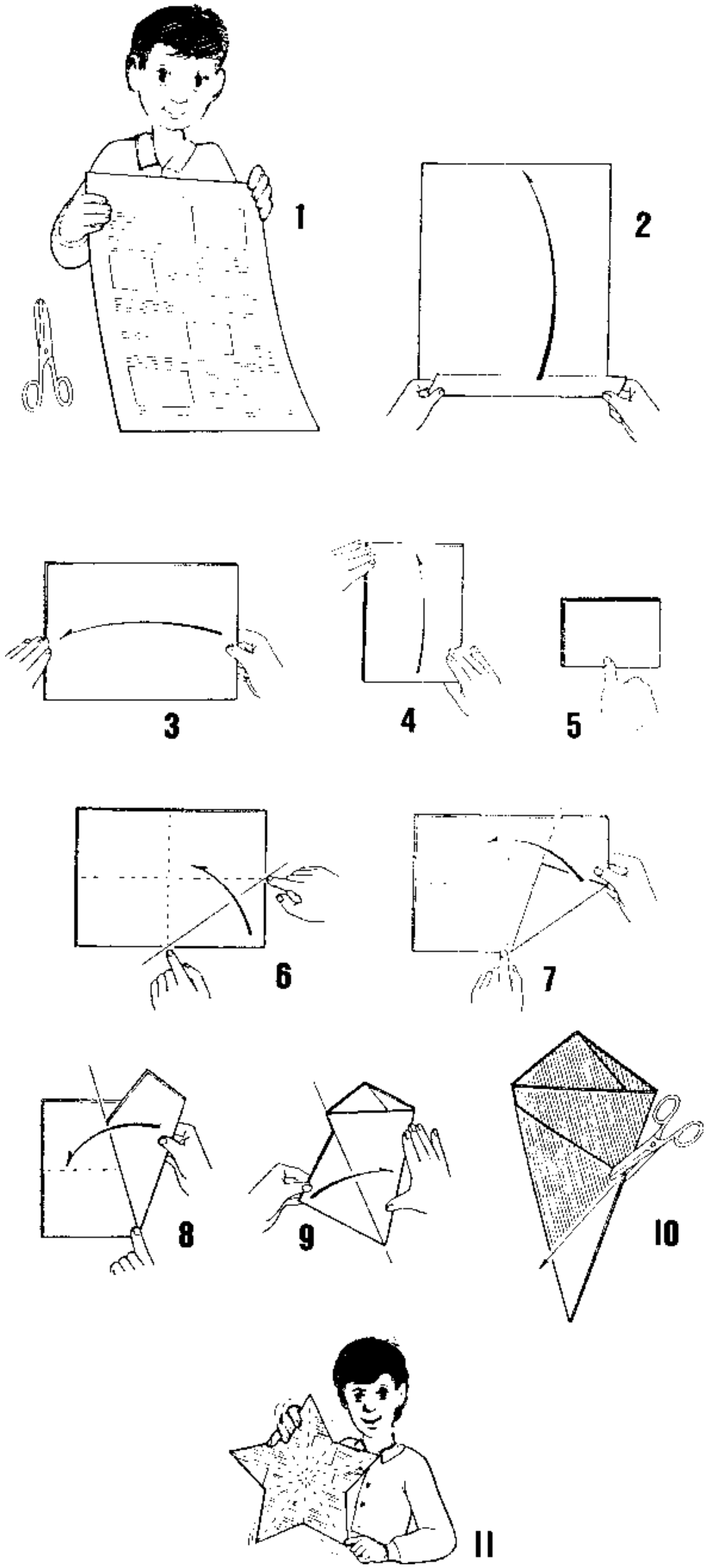
Now we have a beautiful paper protractor with angles of 15, 30, 45, 60, 75, 90 degrees marked on it.

Corners P (75-degrees) and G (60-degrees) can always be opened and doubled up to make angles of 150-degrees and 120-degrees.

So, next time if you forget your geometry box there isn't much to worry about.

Just fold a paper protractor.

FIVE-POINTED STAR



This is a very easy way to make a five-pointed star.

All that is required is a few simple folds and just one cut with the scissors.

Lay a single newspaper flat on a table Fig (1).

Fold it in half from bottom to top Fig (2).

Fold it in half from right to left Fig (3).

Fold it again in half from bottom to top Fig (4).

With your thumb press the paper flat Fig (5).

Open out the paper back to the start of Fig (3).

From the middle of the bottom folded edge and the right hand edge, fold the bottom right - hand corner over Fig (6).

Again from the middle of the bottom folded edge, fold over the right hand side Fig (7).

For the last time, fold over the right - hand side from the middle of the bottom folded edge Fig (8).

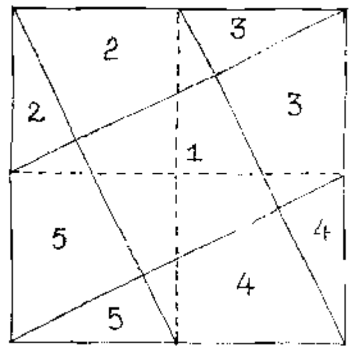
Fold over the bottom left - hand corner, so that it lies along the sloping edge of the right - hand side, and press the paper flat.

The folding may not be exact but this does not matter Fig (9).

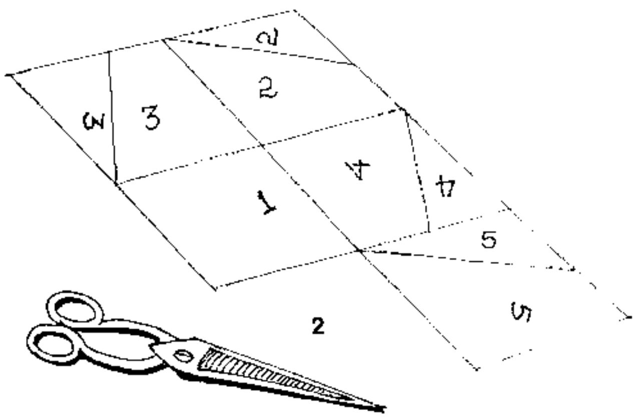
Cut away the shaded part with the scissors Fig (10).

Open out the small triangle to make your five-pointed star Fig (11).

FIVE SQUARES



1



2

Dividing a square piece into four equal squares is no problem at all.

But dividing a square into five equal squares is no easy task.

It will keep most people scratching their heads.

But it is quite easy.

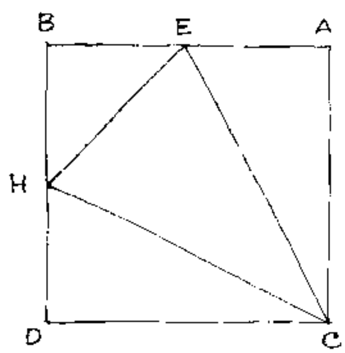
First cut a square and fold a plus sign along the dotted lines.

This will fix the midpoints of the four sides. Now mark one diagonal each, of the four rectangles so formed.

Cut along the dark lines Fig (1).

Now arrange the nine pieces into five squares as shown in Fig (2).

PUZZLING SQUARE



3

At first sight it looks so easy to assemble a mere four pieces that were originally cut from a square.

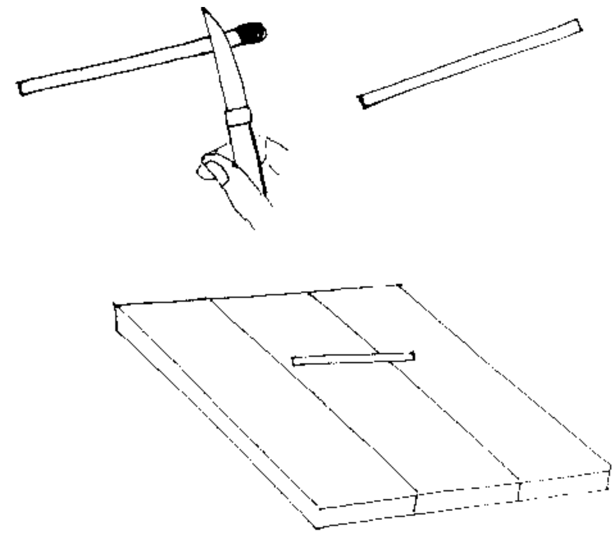
Yet the fact is that most people are not very good at making up certain shapes from a jumbled collection of other shapes.

On one square of paper (ABCD) find point E at the center of AB and H at the midpoint of BD.

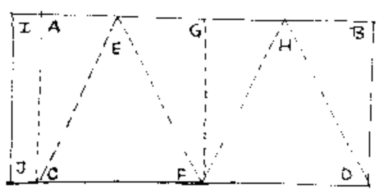
Join up EC, CH and HE, then cut the paper along the lines you have drawn Fig (3).

You will be left with four triangles.

Hand them to your victim and enjoy the sight of a perplexed puzzler trying to put the four pieces back together as a square.

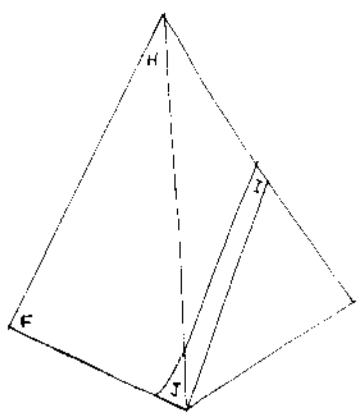


1



2

3



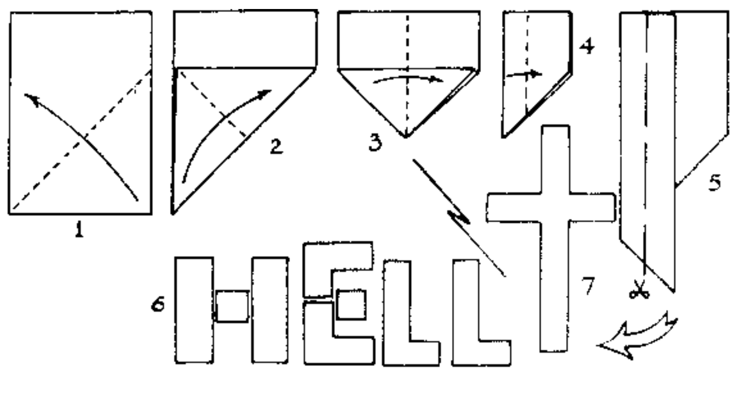
4

HOW & WHY OF PI

Strange as it may seem, there is a way of calculating the value of Pi by dropping a stick on the floor. The floor has to be made of planks of the same width. You need a matchstick, which is as long as the planks are wide. Remove the sulfur from the matchstick head. Simply drop the stick many times Fig (1). Keep counting the number of times it falls on a crack. Double the number of times you drop the stick and then divide it by the number of times it fell on a crack. The result will be the value of Pi. For example, if you drop the stick 100 times, and it falls on the crack only 62 times then divide 200 by 62. The result is about 3.2. This is not a very accurate value of Pi. The more times you drop the stick the more accurate you will get. When you drop the stick whether or not it crosses the crack depends on where its center falls, and how it is turned about its center. When a stick turns around its center, it moves around a circle. That is why Pi, which is related to measuring a circle, is also related to the chance that the stick will cross a crack.

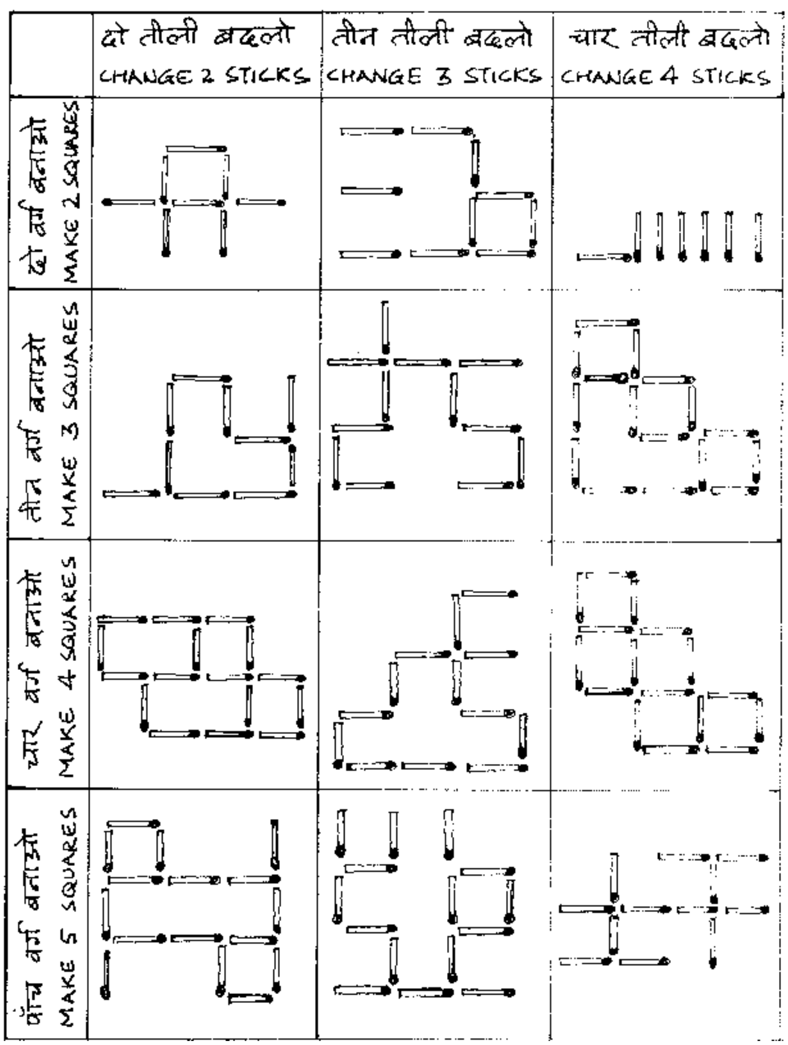
PIPES INTO TETRAHYDRONS

Take a rectangular strip of paper and mark out two equal rectangles AGFC and GBDF; E and H are midpoints of AG and GB. Crease the paper along lines CE, EE, FH and HD. Apply glue on strip IJ and stick the two ends of the paper so that B and D coincide with points A and C Fig (2). You have a cylinder Fig (3). Now you rapidly squeeze the cylinder to transform it into a Tetrahedron Fig (4).



HELL HEAVEN PASSPORT

A story goes with this one.
A young man asked his father what thing he needed most to travel round the world.
"A passport" replied the father, who took a rectangular piece of paper and started to fold it.
After several folds, he cut the paper and from the remaining pieces he produced a cross, which he lay before the boy.
"Here" said the father, "is the passport that will carry you not only through the whole world, but through the whole of life.
And this is another one."
He then took the remaining pieces of paper and formed the word HELL shown in Fig (6).
Follow the folds in Fig (1, 2, 3, 4) and then make a single cut as shown by the scissors in Fig (5).
The biggest resulting piece will give the cross Fig (7) and the smaller pieces may be arranged to form the word HELL in Fig (6).



SQUARE THE MATCH

Every one loves playing with matches, but not all match games are easy.

These involve moving matches to create new patterns made up of squares.

By moving only as many matches as directed and creating as many squares as requested, you can complete these puzzles (squares may overlap and have corners in common) Fig (8).