PAPER-WORK

A scheme of a course of manual training and vocational education, involving the use of waste paper and paper only.

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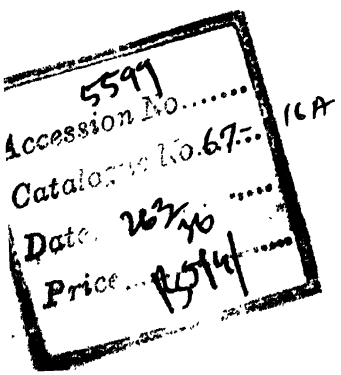

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FOREWORD.

I have great pleasure in contributing a foreword for the purpose of introducing this *vade-mecum* to occupations which have an absorbing interest and value to all who bear responsibility for the future training of the young in India.

To my certain knowledge, the compilation of this volume and the widespread recognition of its utility, has been the dream and ambition of my colleague Mr. Adinath Sen for some years, its inception and foundation being laid in days before he became the Inspector of Technical Schools. His interest and application to the kind of manual dexterity and ingenuity, revealed in this work, was, I firmly believe, inherited from his worthy father, the late Dinanath Sen,—a pioneer in Eastern Bengal in the cause of the manual and practical aspect of the educational programme for Bengal people. In its final presentation, he has been greatly helped by Miss Rani Ghosh of the Gokhale Memorial School, herself an expert in those great developments in the technique of educational methods which mobilise the senses and find expression in the use of the hand and eye, in addition to the memory of the spoken and written word. I offer them my warmest appreciation and congratulation on the practical result of their exhaustive labours. I commend the perusal of this book—so voluminously illustrated with diagrams, to all who desire to guide the young to those joys of creational activity and interest, which as this volume shows, can be had with the use of material available to all at practically no cost, and which will help to enlarge the number of educated people in India, who can do things with their own hands as well as possessing the more common accomplishment of merely talking about them.

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INTRODUCTION.

The following pages treat of a course, that might be introduced in the classes of secondary schools, along with the cultural subjects. It involves the use of paper and waste paper only, as the chief material. Such a course aims at the training of the hand, the eye and the mind at an insignificant cost. It is also expected that love of independent, orderly and accurate work, as well as habits of attention and industry will develop in the young mind by the enthusiasm created from the very first stages in the production of articles of personal interest and use. An acquaintance with forms of objects and the application of geometrical principles and the practical use of geometrical drawing (the latter* of which is intended to be run as a parallel course in the senior classes) are also bound to be instructive. The later stages deal with the properties and usefulness of paper products and give special technical instructions in an elementary way, in several trades, which might be followed with profit beyond school life. If such a course of instruction succeeds in fostering a feeling of self-help and enthusiasm for responsible work in the mind of the average educated Indian child, it certainly achieves more than the mere creation of a *bias* for manual work.

Accuracy is a very important point in this course. One of the requirements for correct drawing, is the proper use of the ruler, or straight edge, which might be graduated, but not too finely. The shape of objects and the geometry of the specimens to be made, should be given proper attention. Examples in Arithmetic and Mensuration could also be based on the work done during the course. The combination of the practical and the theoretical aspects of work is bound to have a highly educative value and is of help for an easy grasp of the subject matter. The teacher, if he desires, may multiply the exercises on the lines suggested, and it is hoped, he will do so.

* Plane Practical Geometry has been written by the author for the purpose.

I should mention here that about ten years ago, some of the models in this book were shown to the late Sir Asutosh Mukerjee, and the late Hon'ble Sir P. C. Mitter, who showed great interest in the undertaking. Their encouragement has been an asset in the accomplishment of this work, though belated, owing to multifarious duties.

I have at times borrowed my ideas from English and American books and magazines or papers, to which I acknowledge my indebtedness. As the collection has been made during several years, I have lost count of the individual sources of many of the items and can only make a general mention, amongst others, of the following: Work; Scientific American; Popular Mechanics; Amateur Mechanics; Teachers' World; Child Education, etc.

It may be mentioned that nearly every article or recipe suggested in the book, has been tried.

I have to acknowledge my indebtendness to many of my friends, but the immense co-operation, I have secured in the writing of the manuscript, in the preparation of the models, in the reading of the proofs etc., from one in particular, leads me to show my gratitude in the simplest way possible, by inserting the name of my co-laborator with that of mine, as authors.

23. 7. 34. A. S.

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Stage II. Paper Cutting.

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Stage IV. Cardboard modelling.

Stage V. Decorations and Stencils.

Stage VI. Paper Machie Work.

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PAPER-WORK.

STAGE 1. PAPER FOLDING.

1. In working this stage, no reference needs be made to Geometry, if so desired. In that case, this stage can be introduced into the lowest classes.

The only implements required for this stage, are a strip of bamboo with a sharp blade in the shape of a broad knife, to be used for slitting paper; a foot-rule for measurement; thread and needle, occasionally. The finished products are either interesting toys, useful articles, or outlines of objects commonly seen. Materials required are old newspapers to start with, and thicker white paper afterwards.

Note. The quality of paper used at this stage will depend on the nature of the work. (1) Old newspapers are easily available in quantities, for use in the earlier lessons, or at first trials; (2) old packing or brown paper, somewhat thicker and stronger than the above, can also be cheaply bought; (3) covers of reams of paper in various thicknesses, can be obtained very cheaply from local paper dealers or printers; (4) thinner and cleaner cardboards for finer work are also available, but are more expensive; (5) thin or thick pasteboards can also be bought cheap in the market, but the finish is rough.

2. **Paper-folding.** The operation of paper-folding should be done on a plain hard surface. One part of the paper is doubled, along the line in which the fold is to be made, over the other. Creasing is done by drawing the nail of the thumb or the bamboo strip, mentioned above, across the fold, with slight pressure. This will ensure an even straight fold. This incidentally, is the simplest method of obtaining a straight line, which the teacher may illustrate.

In the following three paragraphs instructions are given on simple paper cutting for obtaining a rectangular or a square sheet of paper for use later on.

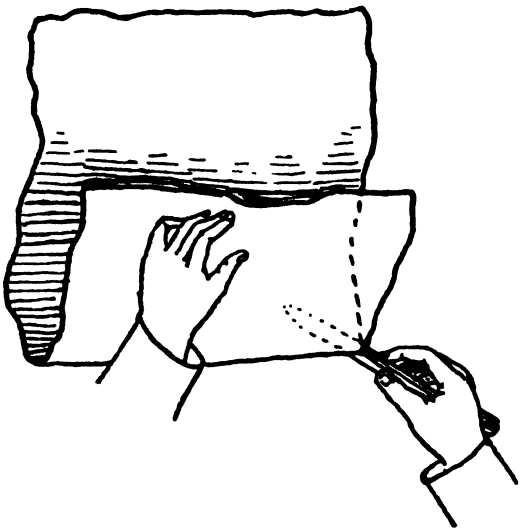


Fig. 1

3. **Paper-cutting.** For cutting a piece of paper, previous folding is necessary. The blade of the bamboo knife is pushed inside the fold (fig 1) and drawn across it with the right hand, while the left palm holds the doubled sheet of paper. In this way, irregular pieces of paper can be given a straight side.

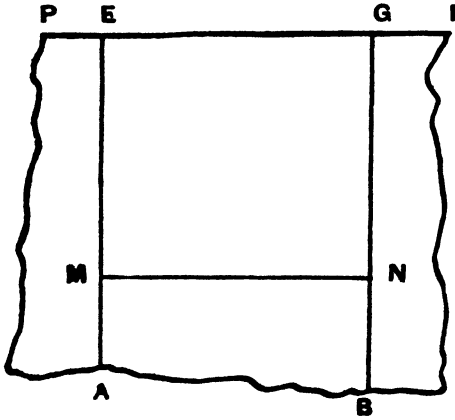


Fig. 2

4. **A Rectangle.** To cut a rectangular sheet of paper, first obtain a straight edge PF, if that is wanting (fig. 2). Now fold at E, near one extremity P, of this straight edge, so that the edge doubles on and coincides with itself. The fold is perpendicular to PF and is

indicated by the line EA. Crease and cut through. Next measure EG along EF from E, a length equal to a side of the rectangle required. Fold at G, along GB perpendicular to PF, as indicated above. Crease and cut through in the same way. On these sides, EA and GB, perpendicular to EG, measure and mark lengths EM and GN with the foot-rule, equal to the second side of the rectangle. Fold along the marks, crease and cut.

Note. The original angle at E or G is 180°. Doubling the edge on itself, means bisecting the angle, so that finally, the angles at E and G are right angles. The two sides EM and GN, perpendicular to EG, are also equal. Thus we get a rectangle.

5. **A Square.** To cut a perfectly square sheet of paper, one of the following methods may be adopted.

(i) Proceed according to the instructions given under the rectangle, but make EG (fig. 2), EM, GN, equal to one another, and

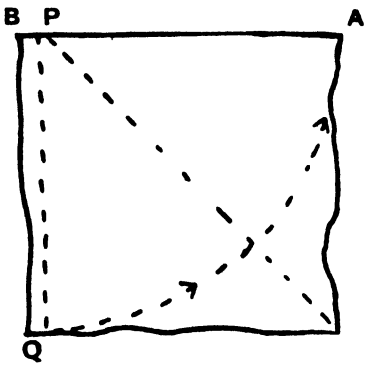


Fig. 3

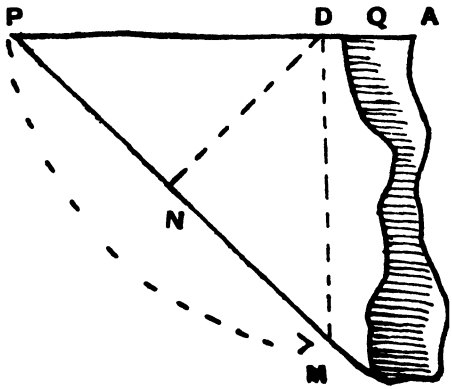


Fig. 4

equal to the side of the square, if given. The sheet of paper, finished as in the case of the rectangle, will be of the shape of a square.

(ii) Obtain a straight side of the paper AB (fig. 3). Let P be a point on AB, near one of its extremeties B. Fold the sheet through P, to obtain a line PQ, perpendicular to AB. Crease and cut through. Now fold the sheet diagonally from the corner P (fig. 4), so that PQ (fig. 3) coincides with PA. Mark a point D on PQ, so that the length PD represents a side of the required square. Next fold the doubled paper through D, to obtain DM perpendicular to DP, and cut through the

fold. When the sheet is opened out, a square sheet of paper is obtained.

(iii) Fold the sheet of paper diagonally and crease. Fold again along a line perpendicular to and through the middle point of this diagonal, to obtain fig. 5. Measure from the corner O, equal lengths OA and OB, along the two edges, marking their extremeties, A and B. Fold on AB, and cut through.

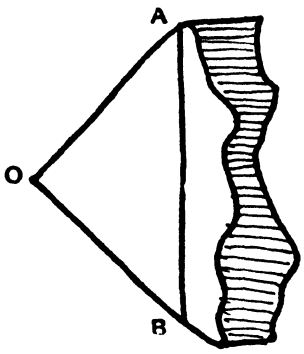


Fig. 5

Note. In case of (i), the angles at E and G (fig. 2) are right angles and the sides are equal Hence the figure EN is a square. In case of (ii), three angles, one at P (fig. 3) and two at D (fig. 4), are right angles and the two coinciding adjacent sides at PD, (fig. 4) are equal. Hence the figure is a square. In case of (iii), since OA is equal to OB (fig. 5), angle OAB is equal to the angle OBA, equal to 45°. On opening out, each of the four angles will be found to be double of 45°, i.e., a right angle. Also, the half diagonals OA and OB, are equal. Hence the figure is a square.

6. **The Boat.** This is a popular model and is widely known amongst children. Take a rectangular sheet of paper. Fold it double

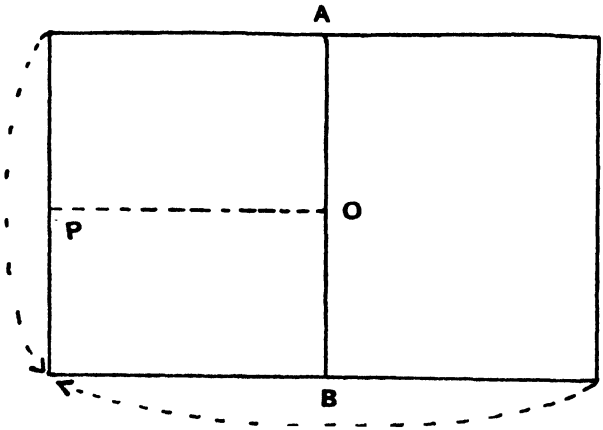


Fig. 6

along the middle line AB (fig. 6), so that its small sides coincide with one another. Crease and fold again, perpendicularly, to double it, to

obtain the middle line OP, and open out. Next fold diagonally on OC and OD, as shown in fig. 7, so that OA and OB meet along OP. A portion CDEF should remain clear now. This consists of two flaps EF and E′ F′, which are turned back on CD, each on its own side. The former corners A and B are now locked under a flap. A slit, now seen along CD, is gently widened out, and the paper is pressed flat into the shape of a square RMSD (fig. 8), the points C and D being made to meet. The vertices C and D of the triangles CRS and DRS,

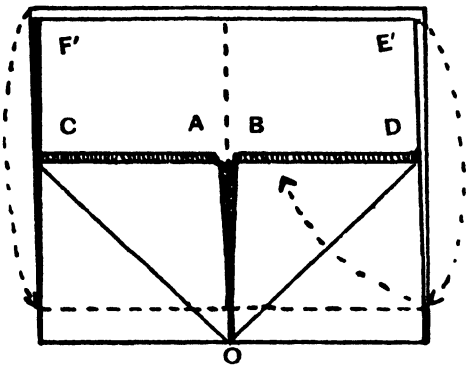


Fig. 7

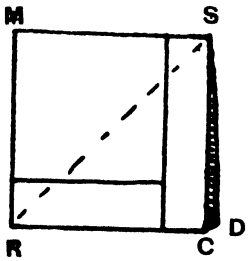


Fig. 8

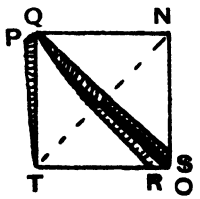


Fig. 9

on opposite sides, are now folded back on RS in their respective sides. The slit formed at RS is now widened out and a smaller square is again formed, the corner R being made to meet S at O (fig. 9). The corners R and S on O, are now pulled out, leaving O in position.

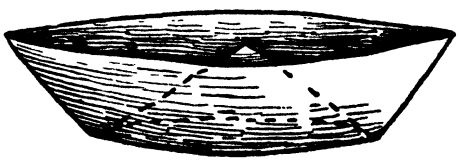


Fig. 10

The model is then pressed flat and widened out a little at the slit at the bottom, so that the boat (fig. 10), now formed, will stand erect.

7. **Boat with Pockets and Roof.** Proceed as in the last example but instead of opening out R, S from O (fig. 9), the points at the opposite corner at P and Q are doubled back on TN to meet on O, from opposite sides. The slit appearing at TN, after folding, is again widened out to form a still smaller square like figure 9. As previously, corners are

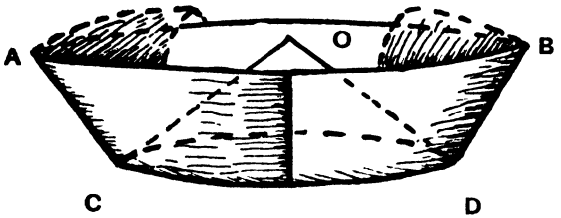


Fig. 11

opened out, leaving the core in position. A smaller boat ABDC (fig. 11) with side pockets, is obtained. If will be observed that the central core O, of the boat, consists of a triangular upright, backed by two triangular flaps from the two sides. Open out these flaps and bend back on AB and finally on CD, on their respective sides and put the points of the flaps inside the slit at CD Now open out the lining from the inside at AC and BD to form the roofs, at the ends, as shown dotted in figure 11.

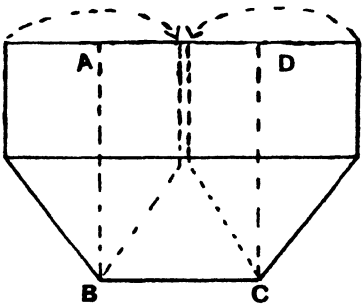


Fig. 12

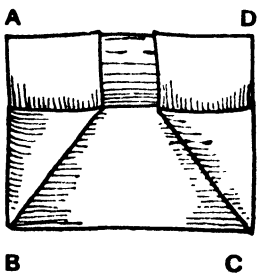


Fig. 13

8. **A Square Cap with Flaps.** Prepare a boat (fig. 10) as in sec. 6. From the inside, open out the two flanks of the boat (fig. 12). We now obtain a rectangular middle portion ABCD, with two flaps on each side. Fold back the four flaps on the rectangular portion along AB and DC on their respective sides (fig. 13). A rectangle is now

formed, one edge of which, namely BC, is closed ; its opposite edge AD, opening out in two flaps. Fold back the two flaps on their respective

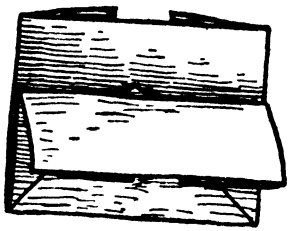


Fig. 14

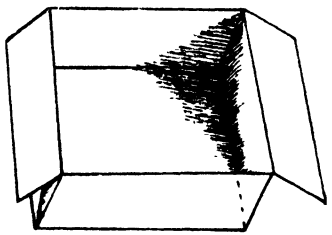


Fig. 15

sides (one is shown in fig. 14) and gently open from the middle, pulling out the flaps. A cap with flaps (fig. 15) will be obtained.

9. **A Book Marker.** Take a clean, thin rectangular sheet of stiff paper, about 3 ins. by $4\frac{1}{2}$ ins. and folding diagonally from one corner A

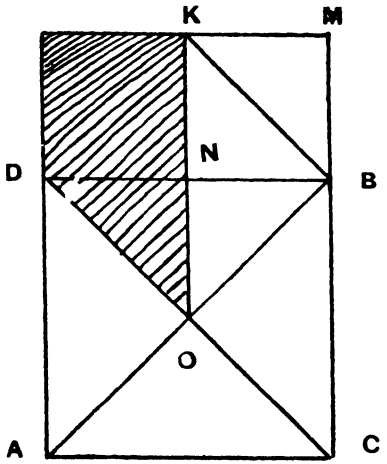


Fig. 16

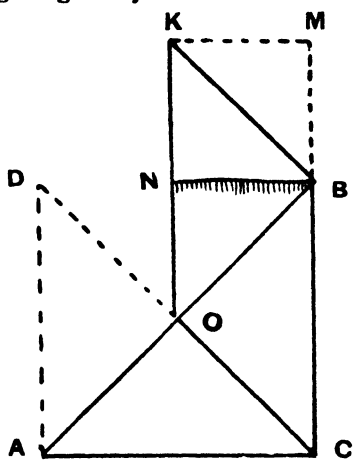


Fig. 17

on AB, as shown in fig. 16, double back the portion outside the 3 ins. square ACBD, on BD. Now open out and again fold diagonally from the next corner C on CD. Open out and next fold the rectangle evenly on the longer middle line OK, so that B and C coincide with D and A respectively. Open and cut out DO and KO and throw away the shaded portion DOK. Now fold DAO on AO ; this again on OC (fig. 17). Then fold the triangle BMK on BK (fig. 16), so that BM coincides with BN (fig. 17). Next fold OKB on OB and tuck the

tip (fig. 18), inside the slit at CB. This makes a splendid book marker.

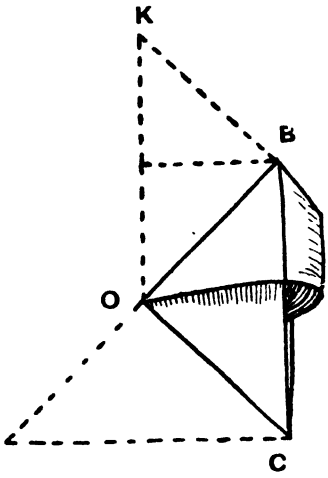


Fig. 18

10. **A Luggage Label.** Take a clean and rectangular sheet of paper ABCD (fig. 19) measuring about 4 ins. by 6 ins. Make it three fold on the 6 ins. sides. To do this, gather from the small sides to overlap and fold along the dotted lines, making the three leaves equal to one another. We obtain the small rectangle MNO (fig. 20). Next fold the adjacent corners M and N of a small side MN, diagonally to meet in the middle line OP, which can first be found by doubling on OP and then opening out. Finally, the tip P of the corner is folded inside and a

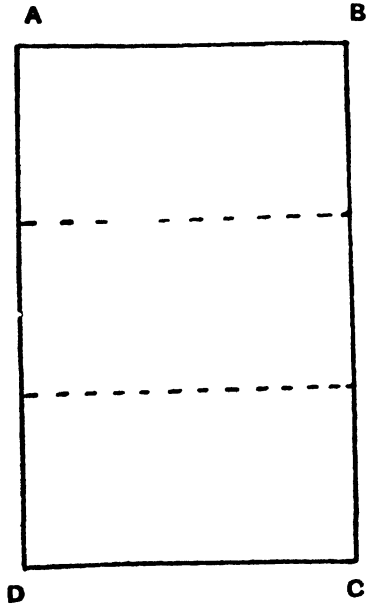


Fig. 19

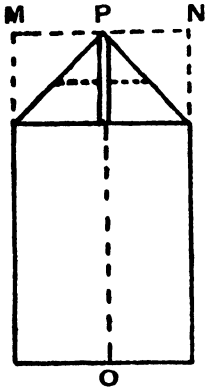


Fig. 20

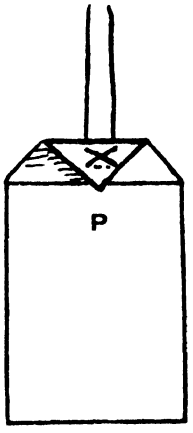


Fig. 21

stiff thread passed through four holes as shown, and held together (fig. 21).

11. **A Double Boat.** Take a square piece of paper **ABCD** (fig. 22). Obtain the middle line **MN** by doubling the sheet so that **AD** coincides with **BC**. Open out and fold from two opposite sides, so that the edges **AD** and **BC** meet on the middle line **MN**. Turn over. A rect-

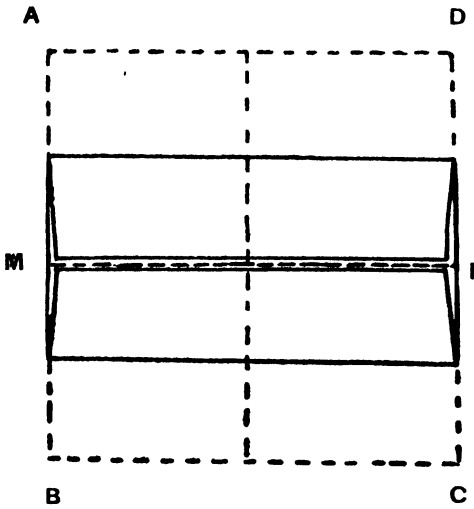


Fig. 22

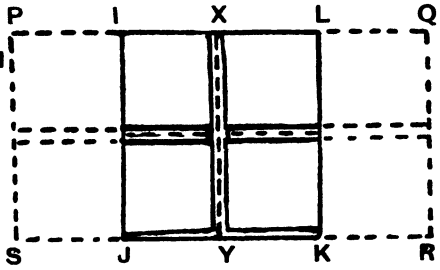


Fig. 23

angle **PQRS** is obtained (fig. 23). Again find the middle line **XY**, by doubling the folded paper, so that **PS** coincides with **QR**. Crease and open out. Next fold from the two opposite sides, so that the edges **PS** and **QR** meet on the middle line **XY**. The folded paper now assumes the shape of a square **IJKL** containing four smaller square flaps, placed side by side. Now hold the paper with the left hand having the three flaps **IJK** pressed down, and insert the right thumb (fig. 24) inside the fourth square flap **L**, pulling it out to the right and folding it in the shape of a triangle, half of which projects out of the square. Repeat the same process in the case of the three other flaps so as to obtain the

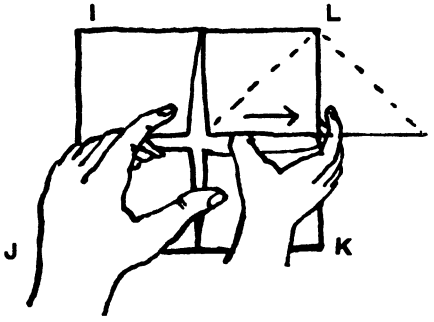


Fig. 24

shape as shown in fig. 25. Fold the two sides upwards along the middle line (long diagonal) and a double boat is formed (fig. 26). Suspended

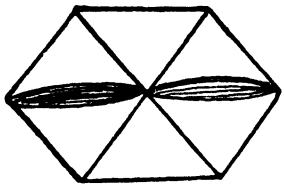


Fig. 25

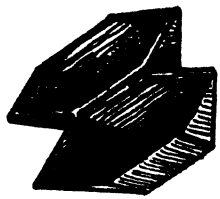


Fig. 26

by cords as shown in fig. 36, it becomes a handy *double pocket.*

12. **Variations.** If in the above, the final folding is done outwards, a model, commonly called the *quadruple boat* is formed

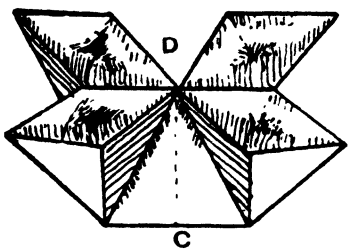


Fig. 27

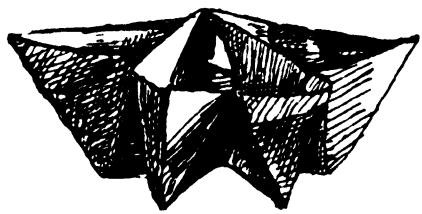
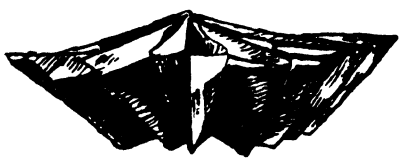


Fig. 28

(fig. 27). This folded, across the middle line **CD**, as shown, and properly attached to the wall, forms a *quadruple pocket* (fig. 28). Two



Eig. 29

such models, attached together, along the folding line will form 8 pockets (fig. 29) in a semicircle.

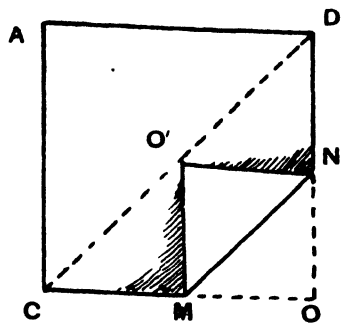


Fig. 30

13. A Triangular Pocket. Cut a square sheet of stiff paper **ACOD** of 5" sides and fold one corner **O**, to the centre **O'** so as to form the triangle **O'MN** (fig. 30). Fold again along the diagonal

CD (fig. 31). Next fold along O'M and O'N as shown in fig. 32, and tuck the corners C and D, inside MN. One of the corners is illustrated in

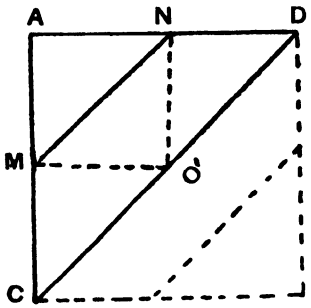


Fig. 31

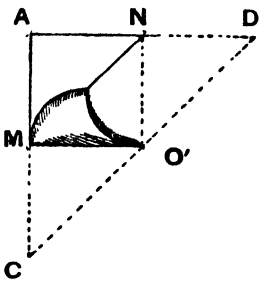


Fig. 32

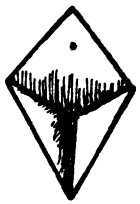


Fig. 33

the process of being tucked. Pin it on the wall as shown (fig. 33).

14. **A Rectangular Double Pocket.** Cut a rectangular sheet of stiff paper ABCD (fig. 34) of 5 and 10 ins. sides and fold at two inches from each of the short edges AD and BC, leaving a portion of about 2 ins. uncovered in the middle. Turn upside down and fold upwards, an inch in width from the sides AB and CD One fold from AB

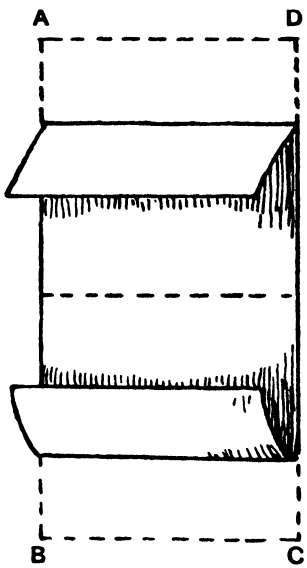


Fig. 34

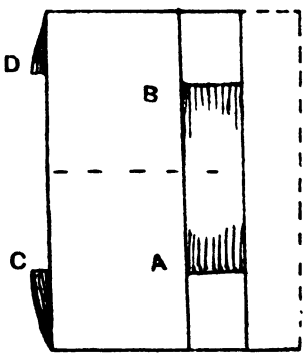


Fig. 35

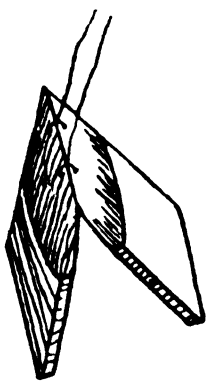


Fig. 36

is shown in fig. 35. Now fold inwards across the short middle line of the rectangle, shown dotted. We now obtain a double pocket which can be suspended by means of cords as shown (fig. 36).

15. **A Hanging Double Pocket.** Take a square sheet of paper, **ABCD** (fig. 37), with 6 ins. sides. Fold along one diagonal **AC** and crease. Open out and turn over. Fold and crease along the other diagonal **BD**. Open out. Now hold the two ends of the diagonal **AC**,

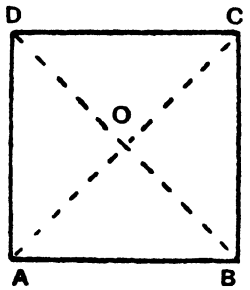


Fig. 37

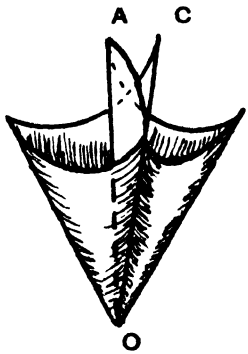


Fig. 38

doubled along the crease already given, and gather the paper in, towards the centre, so that the ridges on the half diagonals **AO** and **CO**, meet one another along the middle. The half diagonals **AO** and **CO** (fig. 38) are then crossed over one another, so that the folds overlap about an inch. Next turn over the two corners **A** and **C**, in the middle,

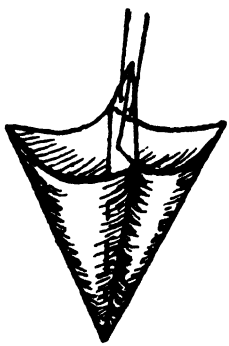


Fig. 39

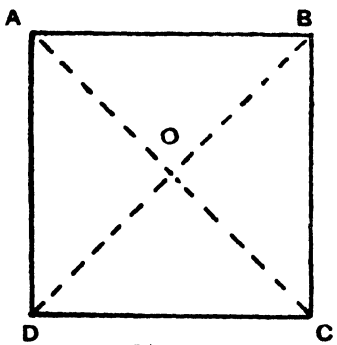


Fig. 40

inside the opposite pockets respectively (fig. 39). Now arrange to hang the finished pocket, with a piece of cord as illustrated in fig. 39.

16. **Hanging Quadruple Pocket.** Cut a square sheet of stiff paper **ABDC** (fig. 40) about 6 ins. sides and fold diagonally to obtain

the centre O. Now fold the corners A, B, C, D to the centre (fig. 41) and press the whole thing flat. Turn over and fold the new corners, E, F, G, H, formed, to the centre. It now appears as shown enlarged

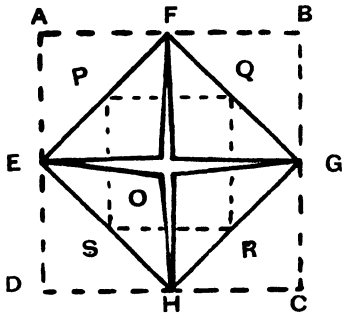


Fig. 41

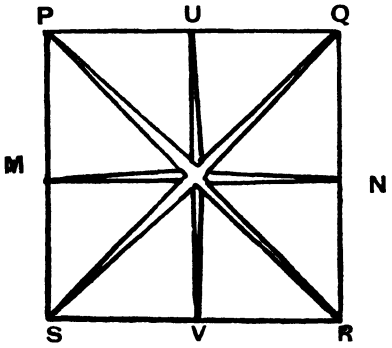


Fig. 42

in fig. 42, the opposite surface showing four square flaps meeting at the centre. Press flat and fold the square along the line MN, through the centre, parallel to one side of the square. Unfold. Do the same along the other line UV through the centre, perpendicular to the first, MN. Turn over. Gather back the four corners, P, Q, R, S, to a point below the centre, and open out the four square flaps (fig. 43). Suspend by threads, as shown.

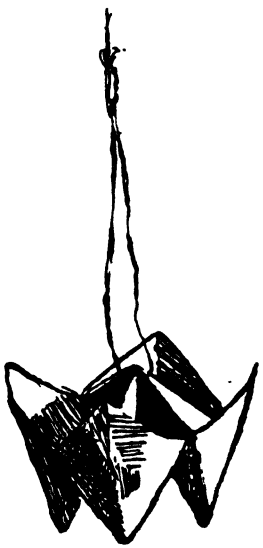


Fig 43

17. **Variations.** The above is sometimes used to represent the *beaks of a bird.* Insert the 1st, 2nd, 3rd fingers and the thumb in the four pockets. Keeping the 1st pair pressed against one another, and also the 2nd pair in the same way, seperate the two pairs, and then close and seperate alternately. The idea of the beaks is well illustrated. Another variation is to paint the inside, in one open position with ink. Form two different pairs with the four fingers, opening them out alternately, in order to exhibit the black and white insides. This process is supposed to

represent the alternations of *day and night*, and can be shown as a magic trick.

18. **A Photo Frame.** If the specimen in figure 42 be turned over, and the loose halves of the four square flaps are turned cornerwise, and each inserted inside its respective flap, a fairly strong photo frame is formed, where a photo can be placed in the square portion and held by the flaps. If the paper is stiff, one of the flaps at the back may be opened out at right angles to the frame, serving as a stand (fig 44).

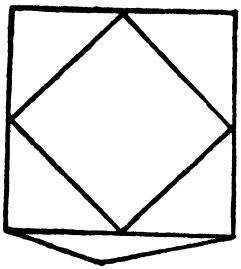


Fig. 44

If however, the specimen in figure 42 be turned over and folded inwards on a diagonal and the two small square flaps at the extremities of this diagonal on the inside, be opened outwards, an article with the outline of a *crown*, is formed (fig. 45).

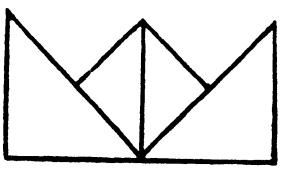


Fig. 45

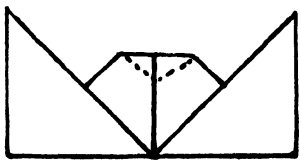


Fig. 46

Again, if the tip of the central triangle be turned in, we get an object with the outline of a *candle stand* (fig. 46)

It will, however, be observed that the two above examples and those given in sections 19, 20, 21 and 23 below, are meant to show the form or outline of objects, unlike the actual models prepared in other examples. These forms are to be pasted on a differently coloured paper, to make the most effective show.

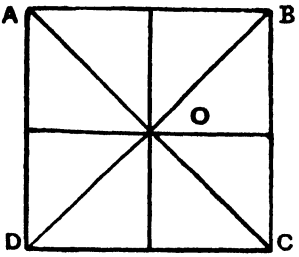


Fig. 47

19. **A Steamer.** Proceed as in section 16, but continue the process of folding the corners of the square piece of paper, to meet at the centre, three times, instead of twice. The specimen now acquires the shape (fig. 47) of a

square ABCD, with four smaller square flaps, slit diagonally, the diagonals, AO, BO, CO, DO, meeting at the centre O. Two opposite flaps AO, CO are gently pushed out from the centre O, so that the slits open and the two flaps assume the form of rectangles at the corners A and C as shown in fig. 48. Now insert the two thumbs right inside the two other flaps BO and DO, pull them out gently, folding the specimen on BD, at the same time, so that the two rectangles at A and C, coincide. By this process, two right angled triangles are formed with the flaps BO and DO, standing on the two sides of the line BD, the right angles being situated at the two extremities B and D (fig. 49).

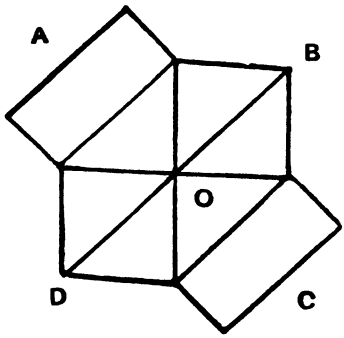


Fig. 48

The model is supposed to have the outline of a *steamer.*

20. **Variations.** If rectangles are formed at all the four

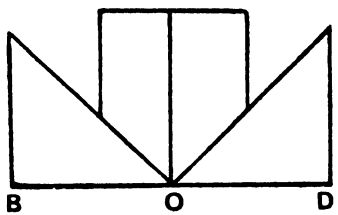


Fig 49

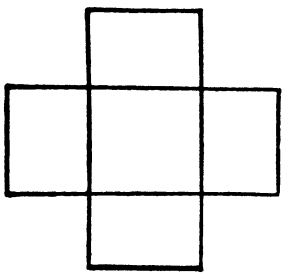


Fig. 50

corners, A, B, C, D, (fig. 47) a *Greek cross* is formed (fig. 50), composed of four rectangles, surmounting the sides of the square. Turn over and by folding the cross about the middle, so that the flaps remain on the outside, the outline of a *steamer* of a different mould, to that described above, is obtained (fig. 51).

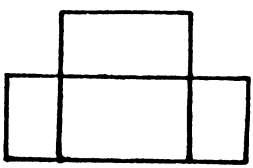


Fig. 51

The Grecian Cross may also be utilised as a *photo frame,* where

the picture can be placed in the square portion, the four rectangles serving as catchers.

By forming one rectangle only, at one corner, an article having the outline of an *inkstand*, or a small *scent stand* is produced (fig. 52).

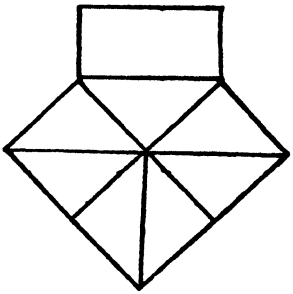


Fig. 52

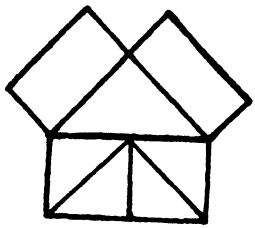


Fig. 53

When two rectangles are turned out at two adjacent corners, a *double inkpot* is outlined (fig. 53).

21. **A Hut.** Fold a square sheet of paper, making the four corners meet at the centre, as in section 16. Now turn over and fold two of the opposite corners to meet at the centre. Turn over the paper again. It now appears like fig. 54; fold one other corner at D to the centre. The two flaps **AOPB** and **AORG** of the remaining corner at A, are now pulled outwards, until the specimen assumes the shape in figure 55, which, in the position shown, has the outline of a *hut*. Turned upside down, it represents a *cup* placed on a *saucer*.

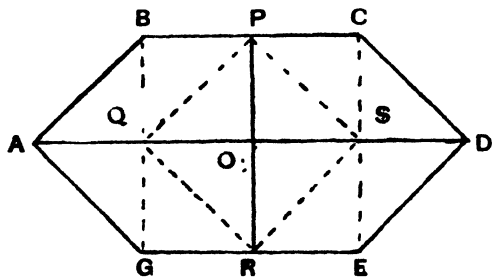


Fig. 54

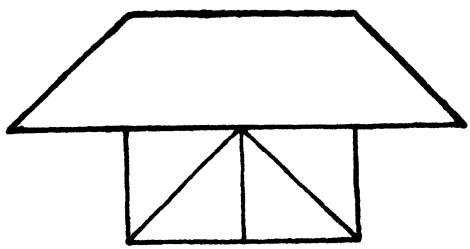


Fig. 55

If in the specimen, as formed and shown in figure 54, portions **PSDC** and **RSDE**, are folded on **PS** and **RS** respectively,

the lines CS and ES meet on OS, and a right angled triangle stands on OS, D forming the vertex. Repeat the process to obtain another triangle on the other side on QO. Press the right angled triangles downwards. Further, push the two triangular flaps on the bottom face outwards from the centre, so that they acquire the shape of rectangles. The outline of a *coat* is obtained (fig. 56), in this final form.

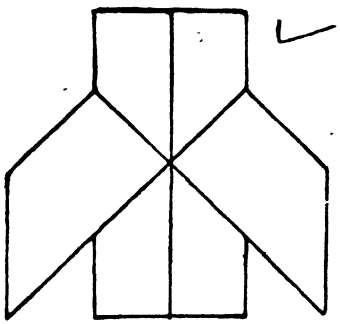


Fig. 56

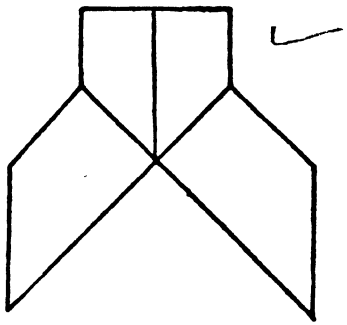


Fig. 57

If only one of the flaps on the bottom face (say, top) is pushed out, while the whole of the lower half of the square be folded back and tucked under the upper rectangle formed, the model resembles a *pair of trousers* (fig. 57).

22. **Variations.** Unfold the coat to fig. 41. From the four corners, fold similarly to the way in which the two corners A and D have been folded in fig. 54, and press to form a *table* (fig. 58), which stands. Now turn the specimen upside down, and fold downwards along a diagonal of the square portion of the paper. On gathering the two bottom flaps (right angled triangles) to a side, a *boat with a sail* is formed (fig. 59). It may be noticed that the same model can be obtained with either of the two top flaps as the sail, according as the two bottom flaps are gathered one way or the other.

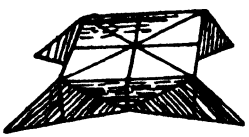


Fig. 58

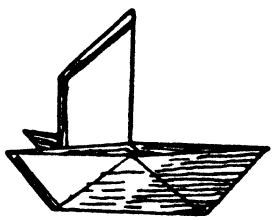


Fig. 59

Next revert to fig. 58, and turn over (fig. 60). Open out the inside from the top half (fig. 61) and pressing the bottom half down, spread the top leaf over it (fig. 62). Now fold backwards each of the

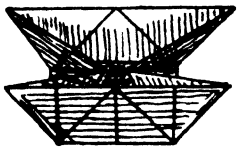


Fig. 60

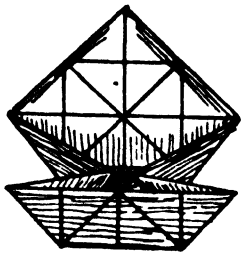


Fig. 61

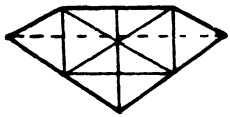


Fig. 62

three corners of the leaf to meet at the centre, so as to form a central square (fig. 63). Double the lower half of the square on the top half. Proceed exactly with the lower half, as from figure 61, and obtain

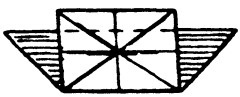


Fig 63

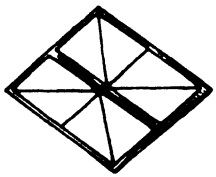


Fig 64

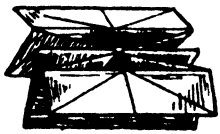


Fig 65

figure 64. Double back from the middle. A *purse* with two pockets (fig. 65) is obtained.

Open out from the middle, when a *square cap with flaps* is formed (fig. 66).

Revert to fig. 64 and fold the top and bottom edges to meet

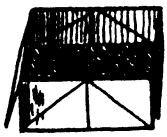


Fig 66

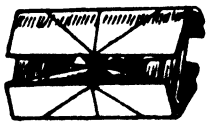


Fig 67

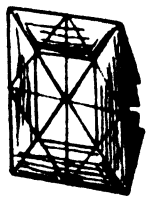


Fig 68

in the middle (fig. 67), at the back. Open out the top and bottom sides neatly, from the front. A *square tray* is formed (fig. 68).

Fold the tray backwards on the middle line vertically and holding it in the position of fig. 69 pull out the top corners on opposite sides

Fig. 69

Fig. 70

(fig. 70). Next turn over and lift out end covers. A *Chinese junk* is formed, which floats well in water, if slightly loaded (fig. 71).

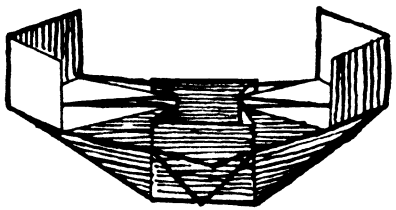


Fig. 71

The above examples, obtained from the fundamental form (represented in figure 41) derived from folding a square sheet of paper, illustrate a few objects, which come of use in life.

The fundamental form can also be made the basis of certain forms of beauty. Open out the fundamental form, turn over and press the middle of the upper and lower sides, and then those of the remaining two sides to the centre of the square. The figure formed is that of the table of fig. 58, inverted. Place the specimen, the square resting on the table and press down the flaps in order. From this, fig. 72, in which four different designs are shown in the corners 1, 2, 3, & 4, is obtained.

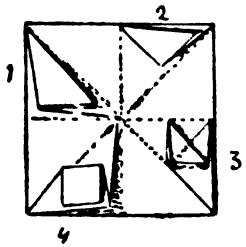


Fig. 72

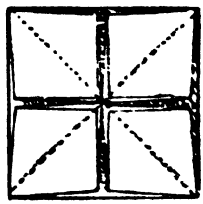


Fig. 73

If all the four corners are patterned like any one of these four designs, we obtain specimens with symmetrical forms of beauty. From a second fundamental form (fig 73), obtained by forming small squares from each of the legs of the table (fig. 58), 8 other designs may be obtained with all corners shaped like any one of the forms,

1 to 8, in figs. 74 and 75. A third fundamental form is that obtained by inverting fig. 42, which gives 10 other designs with corners

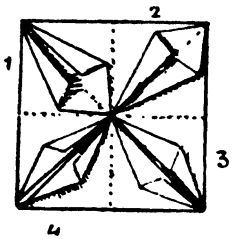


Fig. 74

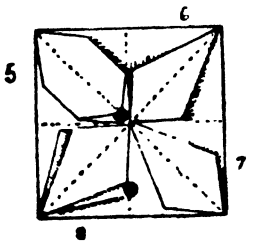


Fig. 75

shaped like any one of the 10 forms, 1—10, in figs. 76 and 77.

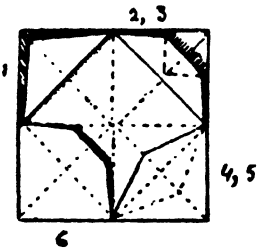


Fig. 76

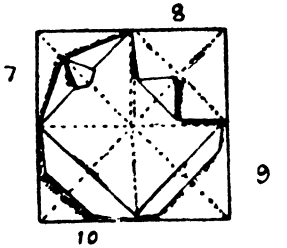


Fig. 77

23. **The Pig.** Take a square sheet of paper ABCD (fig. 78) and fold to obtain the middle line PQ. Fold again from the two sides, so

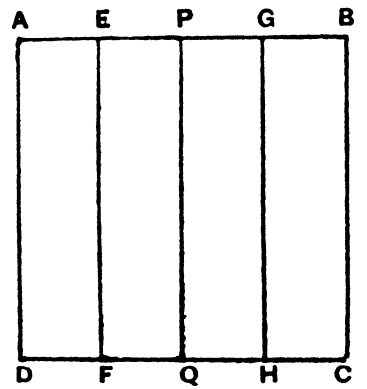


Fig. 78

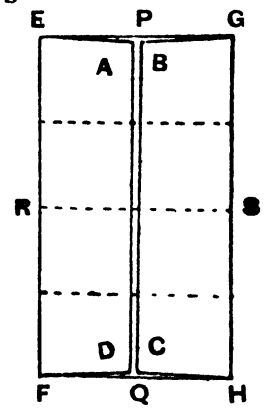


Fig. 79

that BC and AD meet on PQ (fig. 79). Press flat and again fold perpendicularly on the middle line RS. Open out and fold again, so as to make

EG and **FH** meet on **RS**. Open out the original corners **ABCD** to obtain fig. 80. Now fold back along **AC**, and finally

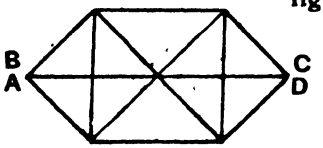


Fig. 80

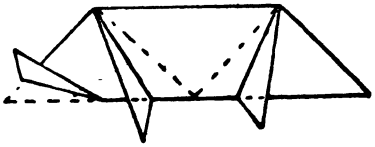


Fig. 81

form the legs and the tail of the pig, by folding as shown in figure 81.

24. **A Cube.** Take a square sheet of stiff paper **ABCD** (fig. 82) about 10 ins. sides. Fold and crease along the diagonals **AC**, **BD**. Open

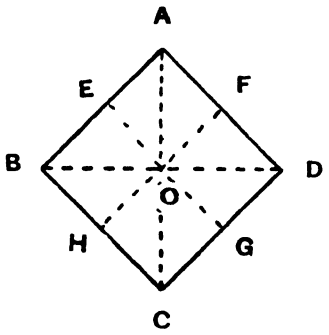


Fig. 82

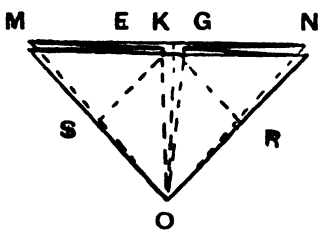


Fig. 83

out and turn over, and fold along **EG** and **FH**, lines through the centre perpendicular to the sides. Open out. Turn over and gather **E** and **G**, back to back, over the centre **O**. Fold to the shape **MNO** (fig. 83) and crease. Now fold along the dotted lines **KR** and **KS**, the four corners at **M** and **N**, each on its own side to meet at **O**. The shape in fig. 84 is now obtained with two corners at **S** and two at **R**. Fold each of these corners back on its own side to the centre **V**. One of the folds **VXY** is shown on the right of fig. 84. Fold the flap **TOY** on **TY** and again on **VY**, and tuck this, inside the slit at **VY**. Similarly proceed with the three other flaps on their respective sides. Now blow through **O**. An approximate *cube*

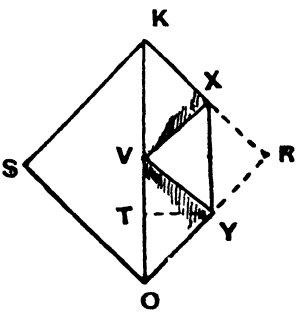


Fig. 84

(fig. 85) is obtained. Work with the fingers to obtain straight edges at the top and bottom faces of the cube. This model is commonly

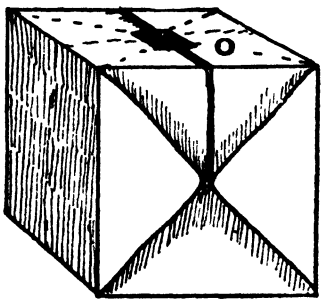


Fig. 85

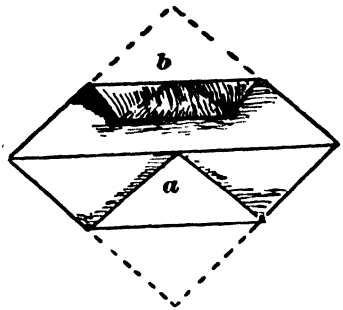


Fig. 86

supposed to represent an *inkstand*, or a *balloon*.

25. (a) **A Cap.** Take a square sheet of stiff paper about 18 ins. sides. Fold diagonally twice to find the centre and crease. Open out and fold (fig. 86) two opposite corners to the centre (one is shown at *a*) and then fold again each inwards ; one is shown at *b*. Turn over and proceed similarly with the two remaining corners. A form, of which

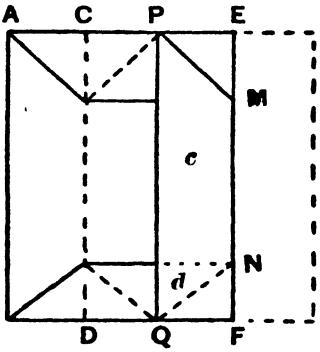


Fig. 87

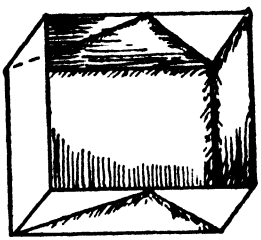


Fig. 88

AQ (fig. 87) shows half, will be obtained. Fold the sides on CD and EF to meet on the middle line PQ. The fold on FE is shown done at *c*. Raise the flap PMNQ, and fold inwards, EPM on PM, and FQN on QN, the latter fold being shown at *d*, and put the flap back. Proceed similarly with the other side. Now open out at the middle slit and press to form straight edges. A strong square cap will result (fig. 88).

(b) **An Indian Cap.** Take a square sheet of paper **ABCD** (fig. 89). Fold along the diagonal **BD** (fig. 90). Now fold from the corners **B** and **D** along lines **EF** and **GH** respectively, so that

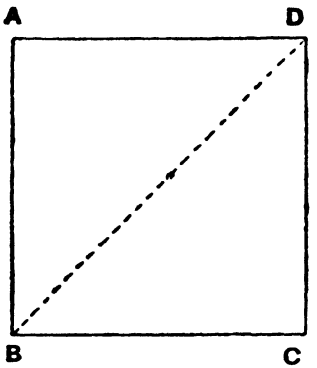


Fig. 89

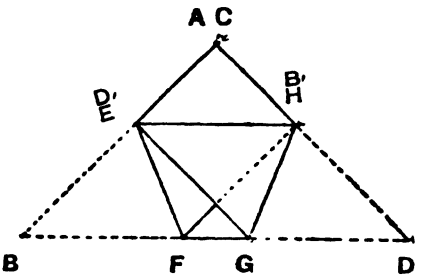


Fig. 90

the sides **HD** and **EB**, in their new positions **HD'** and **EB'**, lie in the same straight line, the two folds crossing one another. The flaps with corners **A** and **C** are folded back along **EH**, each on its respective side.

The Cap (fig. 91) can now be placed on the head by opening out the slit at **EH** and placed across the head from ear to ear.

(c) **A Red Indian Cap.** Take a square sheet of paper **ABCD**

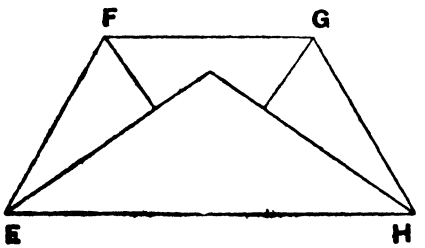


Fig. 91

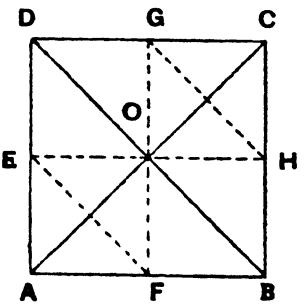


Fig. 92

(fig. 92). Obtain the middle point **O** by folding along both the diagonals **AC** and **BD**. Bring the corners **A** and **C** to the middle

point O and fold along lines EF and GH. Next fold along BD with flaps inside (fig. 93). Now fold along EO and FO from corners

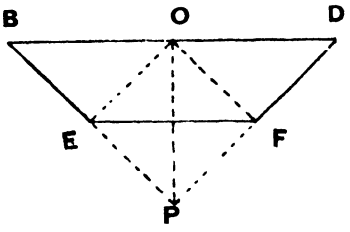


Fig. 93

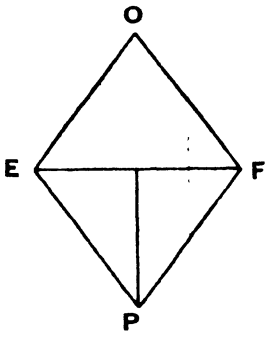


Fig. 94

Fig. 95

B and D respectively, B and D meeting at P. Turn over (fig. 94) and tuck in the two corners at P, inside the slit at EF. Now turn over, and decorate the cap (fig. 95) by fixing a feather inside the vertical slit OQ in the middle.

In smaller sizes, the article can be used as a *drinking vessel.*

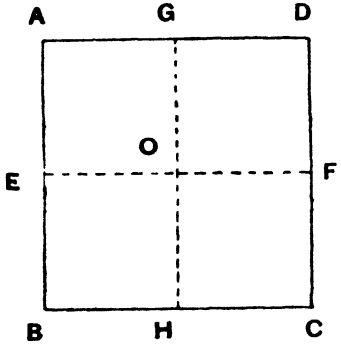


Fig. 96

(d) **A Fool's Cap.** Take a square sheet of paper ABCD (fig. 96) and fold it along the middle line EF to obtain the shape in fig. 97. Again fold along the middle line GO to obtain fig. 98. We now have four flaps, with the corners at M. Fold back one flap along AG. The three other flaps should be folded together likewise

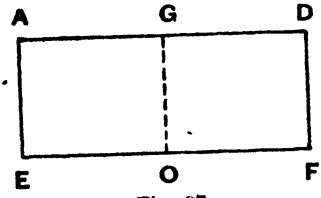


Fig. 97

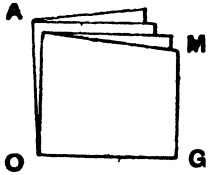


Fig. 98

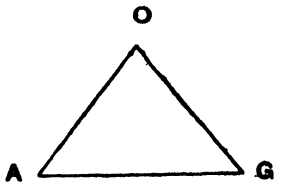


Fig. 99

on GA, but on the other side. A fool's cap (fig. 99) is formed, which can be opened along the slit at GA.

26. **A Book Cover.** This is a very useful article, and keeps the covers of new books, handled by children, in a fresh condition. Take a rectangular piece of paper, the length of which should exceed twice the width of the book, plus its thickness, by 4 or 5 inches. The width of the paper should also be 4 or 5 inches longer than the length of the book. Place the open book symmetrically on the sheet. The thickness of the book, at the back, between the two covers, lies between four points **P Q R S**, (fig. 100), on the sheet. From these points as shown, cut out the shaded triangles, leaving tongues **M**, projecting out. The leaves of the book are then gathered together, vertically, by the hand. The projections of the sheet at the sides are folded over the cover, one corner being marked **ABCD** in fig. 101. The point **C** of the inner edge is slipped in between the cover and the outside paper (fig. 102). The part above **AD** is now turned in, over the cover, and kept in position, if desired, by some adhesive. The other corners are then worked in a similar manner. Tongues **M** are also turned down, between the

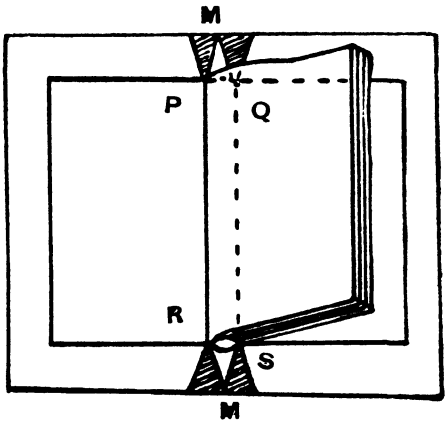


Fig. 100

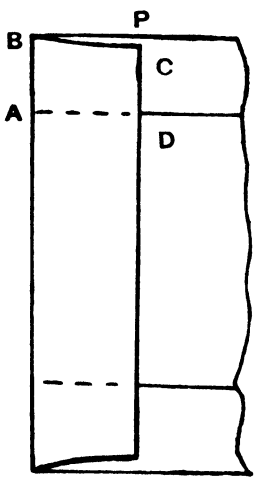


Fig. 101

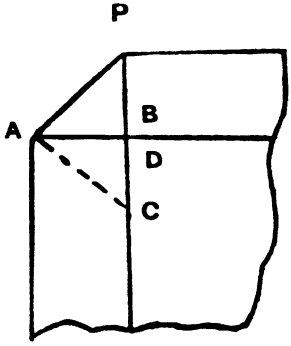


Fig. 102

binding and the back edge of the book, if possible, or between the cover of the book and the outside sheet. The book may now be closed and is well protected.

27. **A Purse.** Take a rectangular sheet of paper **ABCD** (fig. 103). Fold from the corners diagonally to meet along the middle

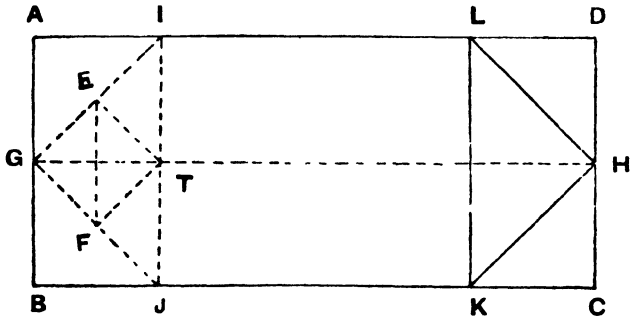


Fig 103

line **GH**. Next fold the corner **G** along the line **EF**, so that **G** meets the line **IJ** at **T**. Next fold to bring **EF** to meet the shorter middle line at **PQ** (fig. 104). Fold similarly from the other side so that the

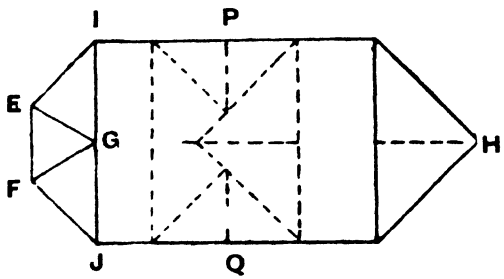


Fig. 104

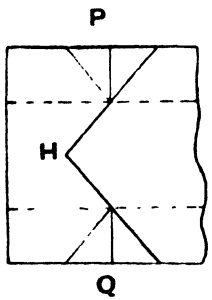


Fig. 105

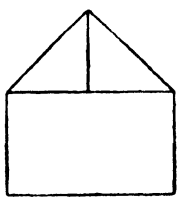


Fig. 106

corner **H** lies over **PQ** and a little beyond it on the opposite side (fig. 105). Turn over and fold along the dotted lines. Next fold along **PQ**, and a purse with two pockets will result (fig. 106).

28. **A Bag.** Take a rectangular sheet of stiff paper, 8 ins. by 14 ins. and make a fold, about 2 inches in width, from one of the shorter

sides. Turn over (fig. 107) and fold the paper lengthwise into three equal parts, so that the three folds A, B, C lie over one another (fig. 108). Insert the two-inch wide folded margin of C into that of A. This

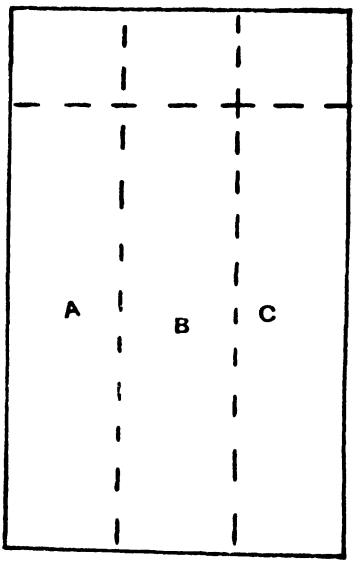


Fig. 107

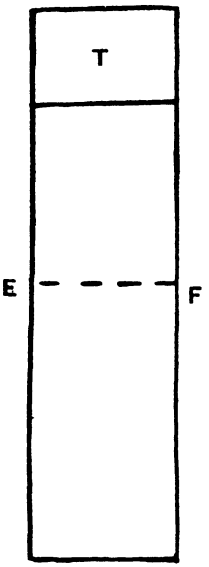


Fig. 108

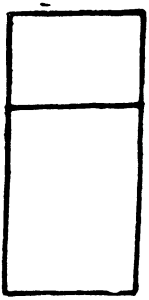


Fig. 109

fixes the top T of the intended bag. Next fold about the middle EF and insert the bottom end inside the flap at the top (fig. 109). The finished product will be a useful bag.

29. **A Cracker.** Take a rectangular sheet of paper A B C D, about 9 ins. to 16 ins. (fig. 110), and fold lengthwise to obtain the middle

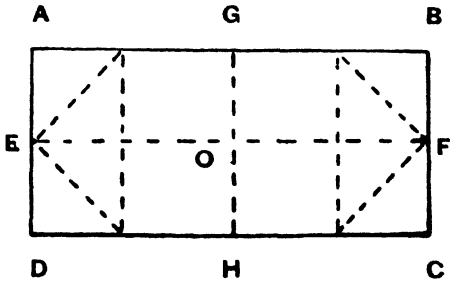


Fig. 110

line EF. Open out and fold the four corners, to meet along the line

EF. Next fold along the shorter middle line GH, (fig. 111). Push the corners G and H, inside the two flaps symmetrically to obtain the

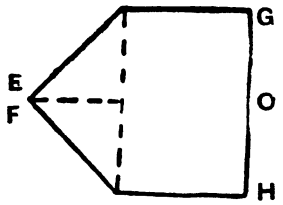


Fig. 111

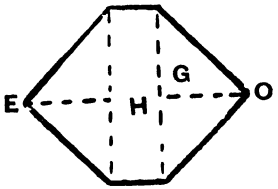


Fig. 112

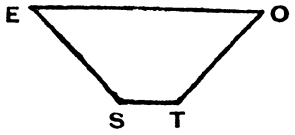


Fig. 113

shape illustrated in fig. 112. Now fold the paper along EO. The cracker ESTO is now formed (fig. 113). Hold the specimen vertically, at E, with the open sides, ES and TO, facing the ground. Now hurl

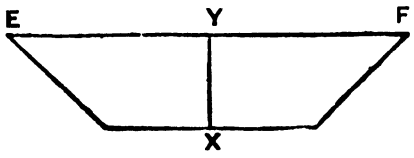


Fig. 114

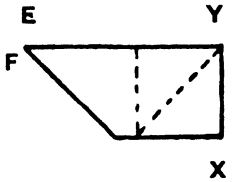


Fig. 115

it downwards, through the air with some force, when a loud crack will be heard. The two inserted portions, in opening out to form air pockets, produce the sound. In cracking it again, these air pockets have to be pushed inside.

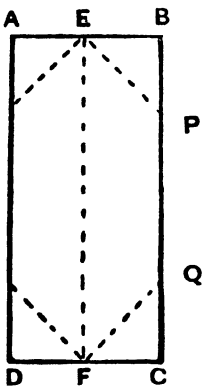


Fig 116

A variation consists of folding on EF, instead of along GH in figure 110 to obtain fig 114. Next fold is along the middle line XY, when fig. 115 is obtained. The corner X is pushed inside giving figure 113. The cracker is used in the same way, forming one but stronger air pocket, in this case.

30. **A Pair of Beaks.** Take a square sheet of paper, 8 ins. by 8 ins. Fold it in the middle, parallel to one of the sides to obtain ABCD (fig. 116), a rectangle with the two open sides meeting

along BC. Again fold along the middle line EF, and open out. Now fold the four corners at B and C on their respective surfaces along diagonal lines EP and FQ, through E and F. Next fold the corners A and D on opposite sides, similarly, on diagonal lines through E and F. Again fold back portions EPQF on EF, each on its respective side, to obtain the shape EFXY (fig. 117). Make a perpendicular incision RS through the middle of EF, about half an inch long. Now fold back the sides ER and FR of the triangles ERS and FRS

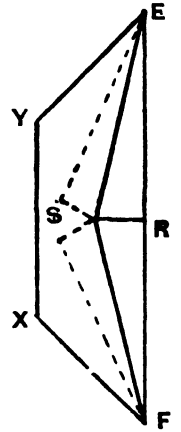


Fig. 117

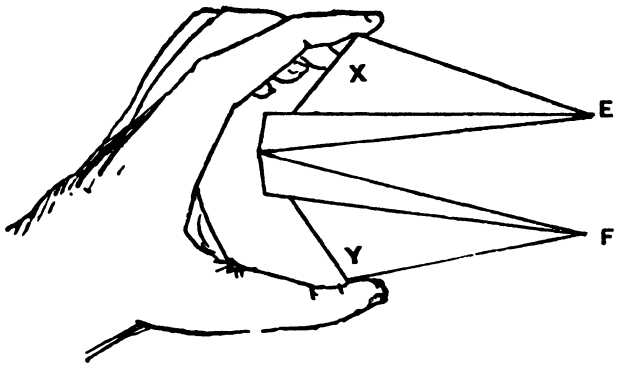


Fig. 118

on ES and FS respectively as shown by the dotted lines in the figure. Turn over and fold back similarly with the triangles on the other side. On pressing X and Y together, as shown in fig. 118, the slit between E

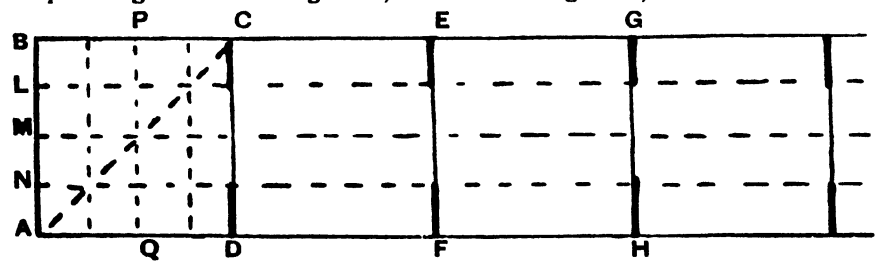


Fig. 119

and F will open out to show the shape of the beaks of a bird.

31. **The Fleet.** Take a long rectangular sheet of paper (fig. 119), and obtain the middle line by folding it lengthwise. Fold it again in the same way and open out, so that the paper is marked by three

lines through L, M, N into four equal divisions. Now fold diagonally along AC through one corner A. Fold again through C to obtain CD,

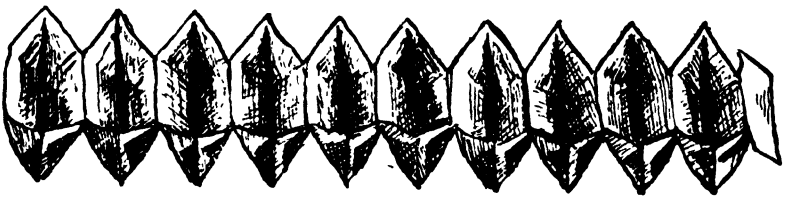


Fig. 120

so that ABCD is a square. Obtain similar equal squares by folding on EF, GH, &c. Now slit the paper crosswise, through C, E, G &c., and D, F, H, &c., up to the lines through L and N of the quarter divisions, as shown in the figure by thick lines. In the first square ABCD, fold along the middle line PQ, as shown. Open out and fold from two opposite sides, so that the edges AB and DC, meet on the middle line PQ. Follow the instructions given in section 11, to form a double boat. Proceed similarly with the other squares, each of which gives a pair of boats, the whole strip forming a fleet (Fig. 120).

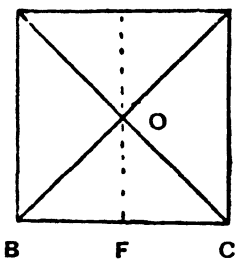


Fig. 121

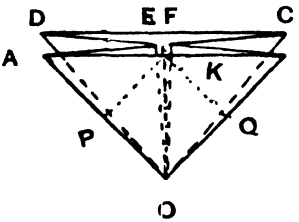


Fig. 122

32. **An Aeroplane.** Take a square sheet of paper, ABCD (fig. 121). Fold along the diagonals, AC and BD, and open out. Again fold it along the middle line EOF and open out. Holding the paper at E and F gather EO and FO, back to back to meet over O, and press to obtain a triangular shape (fig. 122). Now fold BKQ, the top flap, on QK, giving the triangle OKQ. Similarly obtain the triangle OKP. Next fold to bring QK on OK, at the same time pushing the portion between O and Q, inside the fold (fig. 123). Repeat the process on

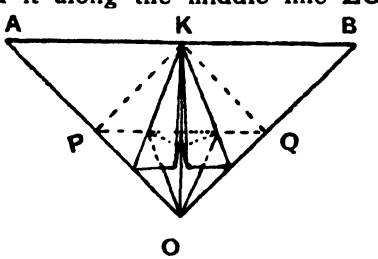


Fig. 123

the other side. Now take a narrow strip of paper, with its length, equal to the side of the square sheet, fold along the middle line, MN (fig. 124) and cut it with a taper, from one end, but leaving projections

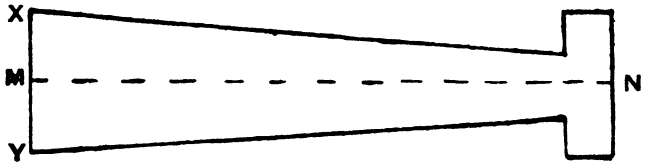


Fig. 124

at the other, as shown opened out in fig. 122. Insert the end **XY** (fig. 124) of this strip, into the triangle **AOB** (fig. 123), at **K**, so that the middle line **MN** coincides with **OK**. Turn over and fold from the

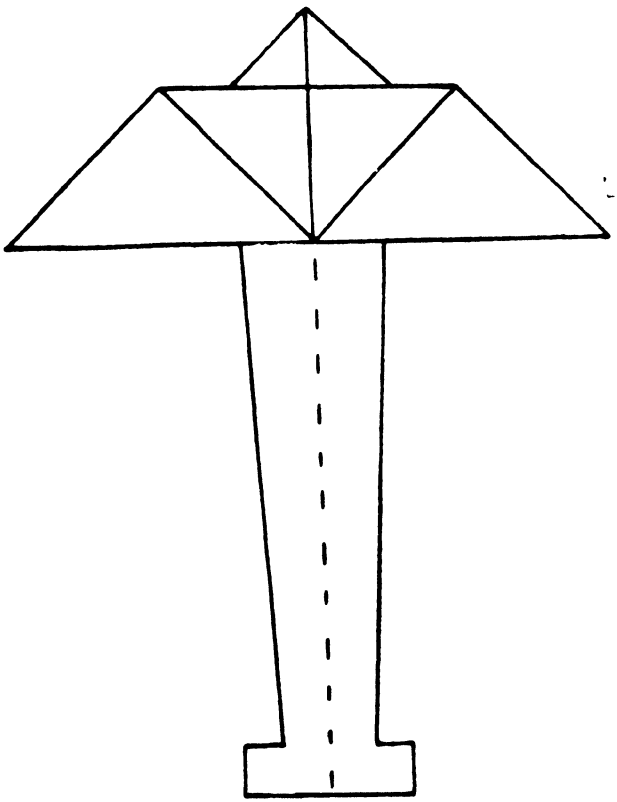


Fig. 125

tip **O**, to obtain the aeroplane (fig. 125) Before throwing the

model up into the air, bend the wings and the tail, a little, upwards, along the middle line.

33. **A Helmet.** Take a square sheet of paper **A B C D** (fig. 126). Fold along the diagonal **AC** to obtain the triangle **ACD**

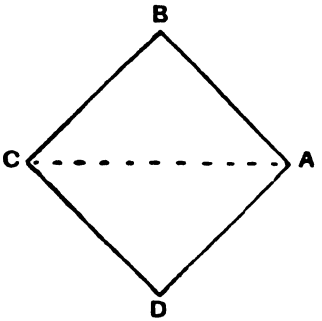


Fig. 126

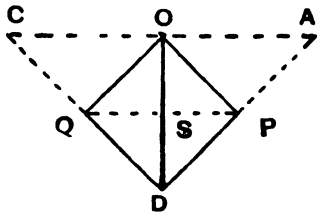


Fig. 127

(fig. 127). Let **O** be the foot of the perpendicular from D on **AC**. Next fold to make **AO** and **CO** meet on **OD**. We obtain the square **POQD** with a slit along **OD**. Fold back the two points at **D**, on half diagonals **PS** and **QS** to meet at **O**, so that **SD** coincides with **SO**. Again fold, so that these points may coincide with **P** and **Q** respectively (fig. 128) forming two triangles. Fold these two triangular flaps, back on themselves so as to obtain the triangles **P'GS** and **Q'HS**.

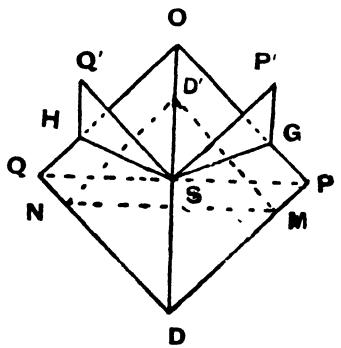


Fig. 128

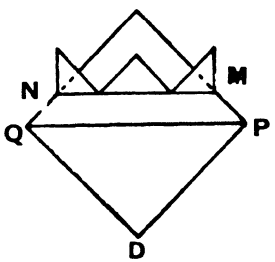


Fig. 129

Now fold back the top flap at **D** in the lower half of the square on a line **MN**, as shown, so that the three points **P'**, **D'**, **Q'**, in the upper half of the square are almost in a straight line. Next fold the portion **PNMQ**, on **PQ** to obtain fig. 129. Turn over and fold the remaining

flap at D on the line XY (fig. 130), corresponding to MN (fig. 128), on the top flap. Now fold the corners P and Q from the two sides on the

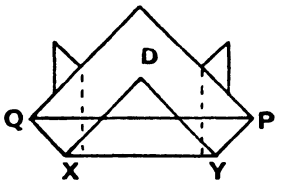


Fig. 130

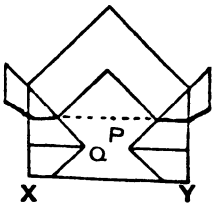


Fig. 131

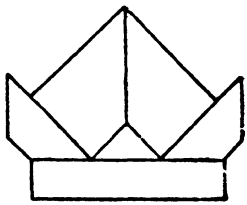


Fig. 132

dotted lines shown in fig. 130, to obtain fig. 131. Fold back the flap XY over the line PQ. Turn over and open out the inside of the helmet (fig. 132), which is now ready for use.

34. **A Crane.** Take a square sheet of paper, ABCD (fig. 133). Fold along the diagonal AC. Again fold along DO, where DO is perpendicular to AC, to obtain the triangle AOD, in figure 134, in which A and C are two flaps at one of the corners. Bring OC to

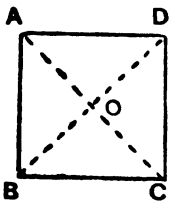


Fig. 133

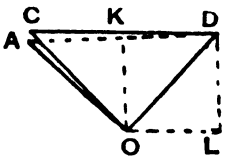


Fig. 134

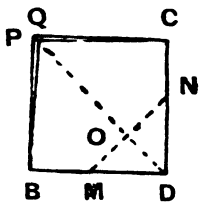


Fig. 135

coincide with OD, and open out the fold formed inside, to get the square LOKD. Repeat the process with the flap A on the other side. The paper assumes the shape of a square, QBDC (fig. 135), with one closed corner D. The four corners of the original square sheet of paper meet at another corner, opposite to D, P and Q being the two corners on the outside flaps. Fold QB and QC to coincide on the diagonal QD, marking their length QO along the diagonal QD. Repeat this process on the reverse side and crease. Now fold the corner D, through O, on a line MN perpendicular to QD, and crease. Open out these folds. Lift the corner Q, turn back the flap on the line MN and press it down, folding its two sides to meet in the middle along the

straight line **PQ** (fig. 136) in the middle. Turn over and repeat the same process on the other side. The paper assumes an elongated diamond shape (fig. 137), with a slit half way, along the longer of the two diagonals. Fold in the sides, from the slit half only, so that their

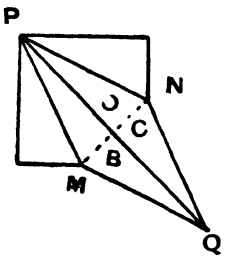


Fig. 136

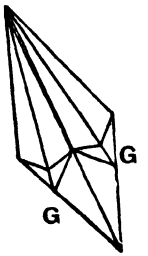


Fig. 137

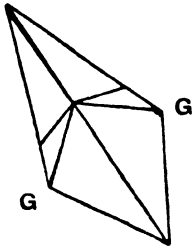


Fig. 138

edges meet one another, over the slit. Turn over and repeat the process on the other side. The paper assumes the form shown in figure 138. Close in from the sides, so as to make points **GG**, meet.

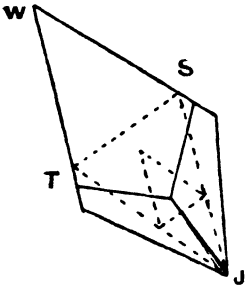


Fig. 139

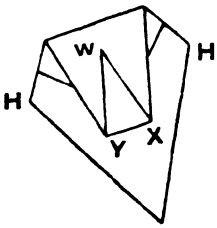


Fig. 140

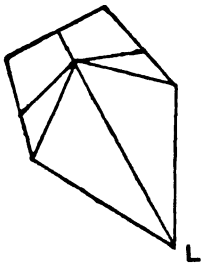


Fig. 141

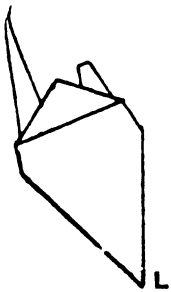


Fig. 142

Repeat this process on the reverse. Figure 139, as shown in full lines, is obtained. Double back the points **W** on either side, to the slit end **J**, as shown by the dotted triangle **TJS**. Now fold only one of the two points from **J**, back, to about a 3rd of the way, forming the small triangle on the top, in the middle **XYW** (fig. 140). Now close in from the sides as before, making the points **HH** meet one another, closing the front and the back, to obtain fig. 141. Fold the points at **L**, right back on either side (fig. 142). Draw out the paper sideways by holding the points at **L**, and blow

into the hole underneath. The body will then fill out. The beak and the tail can be properly shaped and aligned by gentle pressure, to give the form of a crane (fig. 143).

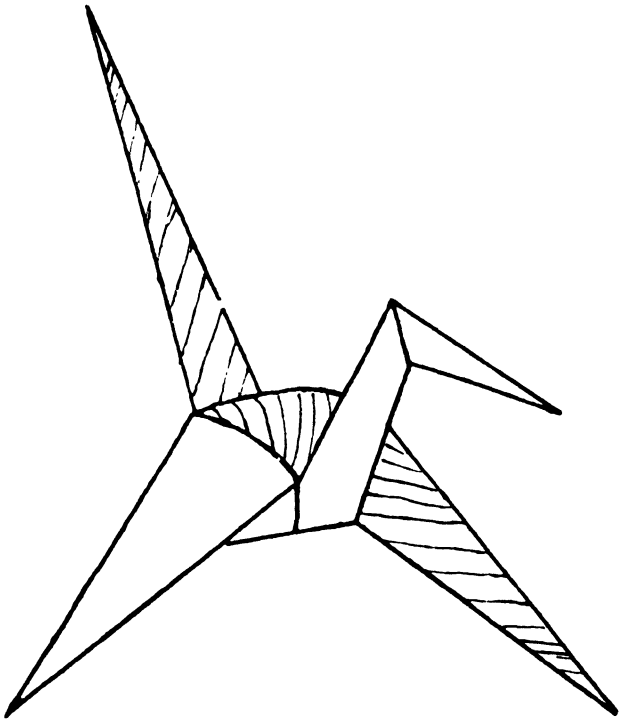


Fig. 143

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PAPER-WORK.

STAGE II. PAPER CUTTING.

1. Paper Cutting. Additional implements required in this stage are only a sharp knife, a sheet of glass or slate to support the paper when cutting, and a pair of scissors. It is desirable to draw the figure first with pencil on the paper. The use of the knife to cut against a straight edge, or otherwise, and the use of the scissors will suggest themselves. The specimens described in this stage, some of which illustrate the principles of Geometry or forms of common objects, may be used as decoration or parts of decoration. Geometrical methods of construction of rectilinear figures will be found in Plane Practical Geometry, by Mr. A. N. Sen.

2. A Four Pointed Star. Take a square sheet of paper **ABCD** and fold it diagonally on **BD** (fig. 1). A right angled isosceles triangle

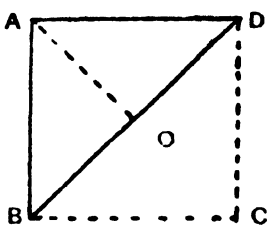


Fig. 1

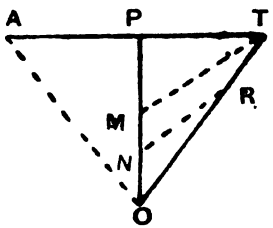


Fig. 2

ABD will be formed. Fold again from the vertex **A**, along the perpendicular **AO**, on the diagonal **BD**. Triangle **AOT** (fig. 2) is formed. Repeat the process, folding on **OP**, where **P** is the middle

point of **AT**. Now cut along **MT**, where **M** is a point on **OP**, and throw away the portion **PMT**. Open out. A four pointed star (fig. 3), will be obtained.

It will be observed that the position of **M** determines the shape of the body of the star. By making a second incision **NR** (fig. 2) where

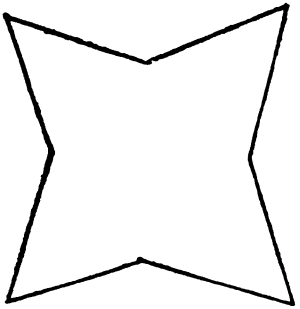


Fig. 3

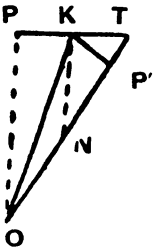


Fig. 4

N is a point on **OM** and **R** on **OT**, slightly below **T**, a four pointed star will be obtained by opening the portion **ONR**, and a hollow star by opening **NMTR**.

3. **Eight Pointed Star.** Proceed as in the last example, until the triangle **POT** (fig. 4), is obtained. Fold on **OK** where **K** is about the middle point of **PT**. **OP** now lies on **OT**, as **OP′**. Cut along **NK**, properly choosing a point **N**, on **OP′** (determining the shape of the body of the star). On opening out, we get an eight pointed star (fig. 5)

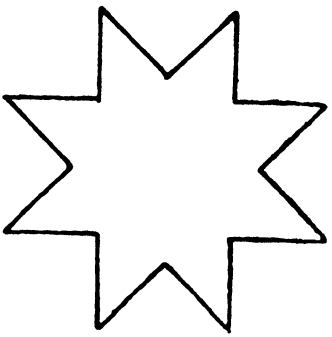


Fig. 5

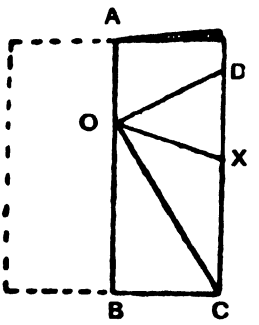


Fig. 6

4. **Five Pointed Star.** Take a square sheet of paper, of 4 ins. sides. Double on **AB**, obtaining the rectangle **AC**, as shown (fig. 6),

and mark a point O on BA, at $2\frac{3}{4}$ ins. from B. Mark OC by folding and creasing. Angle BOC is a fifth of two right angles. Open out. Now bring AO to coincide with CO, by folding on some line, OD. Press flat to obtain the edge DO. Double again through O, on some line OX, to make OD coincide with OC. Next fold OBC on OC and

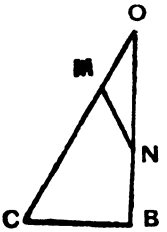


Fig. 7

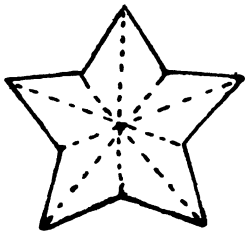


Fig. 8

press flat. A compact triangle of five leaves with OC (fig. 7) as a side is obtained. Take a suitable point M on OC, and cut through MN, where N is a suitable point on OB, to obtain a scalene triangle OMN. Open out. A five pointed star (fig. 8) is obtained.

Note. The points **M** and **N** should be so chosen that all the five leaves are cut at each of the extremities **M** and **N**, of the incision

The folding may also be done by trial, OC (fig 6) being found, so that the angle BOC is equal to $\frac{1}{5}$ of the angle AOC, obtained by doubling the angle AOC twice, for division into four equal parts. Bigger sizes of the five pointed star can be obtained by placing the small model on a big sheet of paper and marking the radial lines (fig. 8) through the points of the star, and cutting the star out in the desired size.

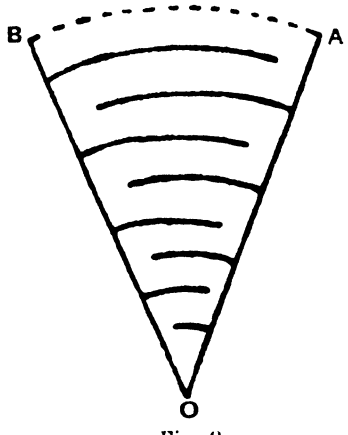


Fig. 9

5. **A Suspender.** Fold a piece of paper, 1 foot square, as in fig. 2, sec. 2, above, and cut from P, in the form of an arc towards the side containing the three flaps, to form a sector AOB (fig. 9). Leaving a space of about half an inch from the apex O, cut by the scissors in an arc with

centre O, from the side OA towards OB, to about a quarter of an inch from OB. Next cut from a point on OB, about an inch from O towards OA, up to about a quarter of an inch from OA. Proceed thus, cutting alternately from OA and OB, and obtain a full incision towards the end AB, as shown dotted. Open out. Now suspend all the loops at the brim AB (fig. 10) from a hook and pull down O gently by placing a small stone, on the support at O.

Fig. 10

6. **A Square Mat.** Proceed as in sec. 2 (fig 2), and cut out portions of any design (a simple one is shown shaded), from the sides OA and OB (fig. 11).

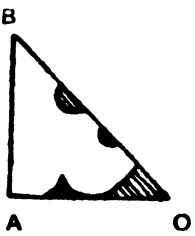


Fig. 11

Now open out (fig. 12) and spread on a coloured ground, when the design will show off. A circular mat will be obtained by cutting the base AO (fig 11), in the form of an arc with centre O. Further work on similar lines and numerous examples are given at the end of this stage.

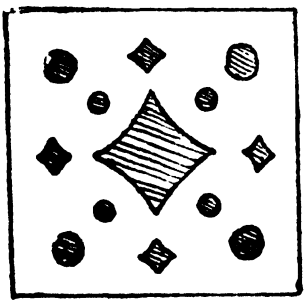


Fig. 12

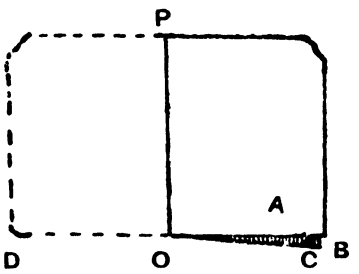


Fig. 13

7. **An Equilateral Triangle.** Obtain a piece of paper, with a straight edge DB (fig. 13) and fold on OP, so that the edge doubles on

itself along **OB**. Crease. Make a short incision with the scissors, near the open ends **A** and **C** on the two leaves of this edge. Now open out (fig. 14) and fold diagonally through **A**, so that **C** may fall on the line **OP**. Mark this point **M**, where **C** lies on **OP**. Open out. Now fold along **AM** and **CM**. Crease and cut through. An equilateral tringle is obtained.

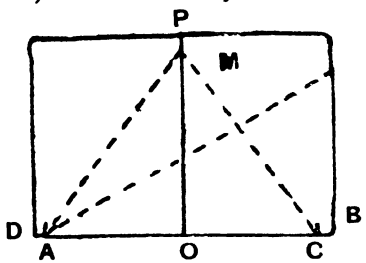


Fig. 14

Note. While folded in figure 13, **AM** was coincident with **CM**, which shows their equivalence ; and either of them is equal to **AC**, shown in figure 14. This shows the triangle to be equilateral

N. B. The square and the rectangle have already been dealt with in sections 4 and 5, in stage 1.

8. A Regular Hexagon. Fold a rectangular sheet of paper (fig. 15) in the middle **AOB**. Fold again through **O**, along **OP** and **OQ**, as shown in the figure, so that **OAP** and **OBQ** overlap one another and **OB** falls along **OP**, and **OA** along **OQ**. Three folds are

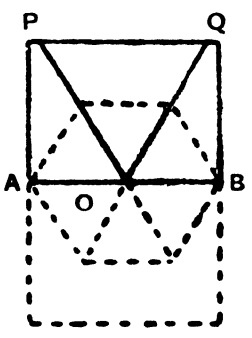


Fig. 15

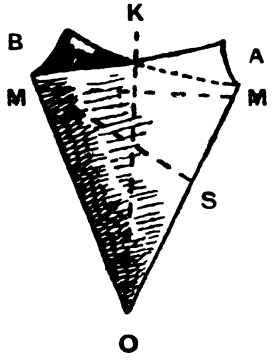


Fig. 16

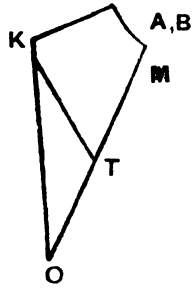


Fig 17

thus obtained with a common angle at **O** (fig. 16). Then fold to double evenly on **OK**. (fig 17). Mark by an incision **M**, near **A** or **B**, open out to obtain figure 16, again, and fold along **MM**. Cut through the fold. A regular hexagon will result on opening out the folded paper, as shown in figure 15, by the dotted lines.

Note. Four right angles at the centre **O**, have been divided into six equal parts, in the fold of figure 16. Each of these angles is therefore 60 degrees. Also, the sides subtending them, are equal by coincidence. Hence the figure is a regular hexagon.

9. A Three Pointed Star. Obtain an equilateral triangle as in section 2 above, and fold through the angles to mark the medians.

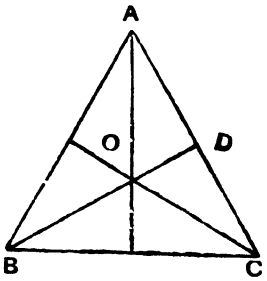


Fig 18

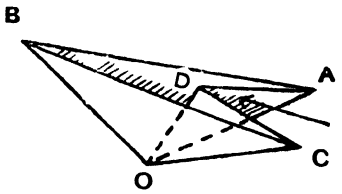


Fig. 19

Let **O** be the point of the intersection of the medians. (fig. 18). Fold on **BD**, so that **BA** coincides with **BC**. Now holding at **B**, separate **A** and **C**, and push **OD** (fig. 19) inside the faces **AOB** and **COB**. Press flat

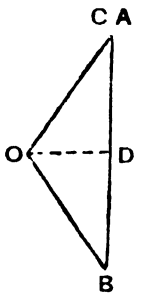


Fig 20

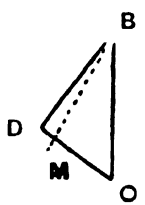


Fig 21

to obtain figure 20. Fold on **DO**, and obtain figure 21. Now choose a point **M** on **OD** (the position of the point **M** determines the shape of the body of the star) and cut through **MB**.

Alternatively, proceed to obtain figure 16, and cut along **SM**, where **S** is a point about the middle of **OA**.

A three pointed star will be obtained on opening out.

10. A Six Pointed Star. Proceed as in section 8 above. After the last fold on **OK** (fig. 17), choose a point **T**, about the middle of **OA**, and instead of the incision at **M**, cut through **TK**. A six pointed star will be obtained on opening out.

11. A Circle. Fold a sheet of paper in the middle and double the folded edge AOB, (fig. 22) through O. Make a small incision at P

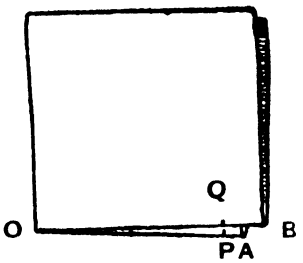


Fig 22

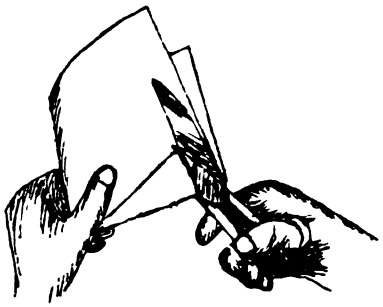


Fig. 23

and Q, on OA and OB, near A and B. Hold the paper (see also fig. 23) with the left hand at O, between the thumb and the pointer, and slide with the thumb, the edge BO, about the point O, gradually away from OA. As more and more of the bottom sheet is exposed, follow Q on the top sheet with the scissors, cutting the bottom sheet from P, bit by bit. When a quadrant has been cut, replace BO on AO and press the paper flat. Now turn over and cut the remaining quadrants, against the previous cut through P. A circle will be obtained with centre O.

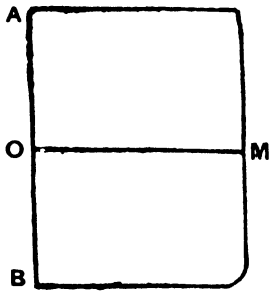


Fig. 24

12. A Set Square with 45 degrees angles. Select a stout and polished piece of cardboard (as is to be obtained in the presentation card almanacks of certain Insurance and other companies), so that the article may be used for a considerable length of time. First cut a thin piece of paper of a size equal to that of the piece of cardboard and making one edge AOB (fig. 24). straight, fold to double it, through OM, to obtain fig 25. Then fold diagonally on OK, so that OM falls on OA. Mark near AB or M, by an incision through all the sheets. Open out, obtaining figure 25, again. Fold through the incisions at

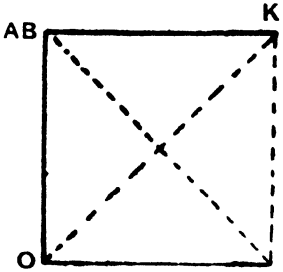


Fig. 25

A and M, cut through the fold and open out. Now place this pattern on the cardboard held on a thick sheet of glass. Placing a straight edge along the sides of the pattern, score by the sharp point of a knife, on the board, until it is cut through. Unless the knife is sharp, the job will be a tedious one. Care should be taken that the straight edge is not cut by careless handling. The completed Set Square AOB is shown in figure 26.

Note. The angle at O, (fig. 25 and 26) is a right angle. OA is equal to OB. Therefore the angles at A and B fig. 26, are equal to one another, each being 45 degrees.

13. A Set Square with 30 and 60 degrees angles. Obtain an equilateral triangle as in section 7, of proper size and fold it on a median. Cut through the fold. Use this half triangle, as a pattern on cardboard, and proceed exactly as in the last example. The completed specimen is shown in fig. 27.

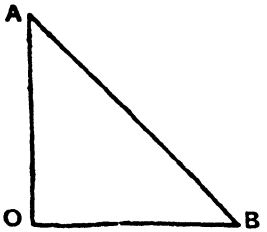


Fig. 26


Fig. 27

14. The *Ellipse*, the *Hyperbola*, and the *Parabola*. The use of a pair of compasses to the extent of drawing circles will be necessary in these exercises.

"On a piece of thin paper or tracing cloth, draw a circle (fig. 28) and take any point P within the circle Fold the paper so that the point P falls somewhere on the circumference of the circle, and crease it down hard. Open up the paper and in the same manner fold it again and again so that the point P falls successively on a number of points completely around the circumference. It will be found that the successive creases on the paper have traced out an ellipse, as shown by the dotted lines in fig. 28. The transverse axis of this ellipse is equal to the radius of the given circle, and the focii are the point P and the centre C of the circle.

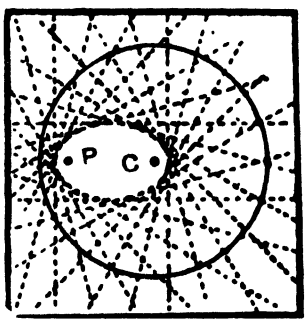


Fig. 28

If we prepare several pieces of paper with the point **P** taken successively nearer the centre **C** of the circle, the resulting ellipses will be found to have successively less eccentricity and to approach a circle in shape, until finally when the point **P** coincides with the centre of the circle, as in fig. 29, the curve traced by the creases is a circle.

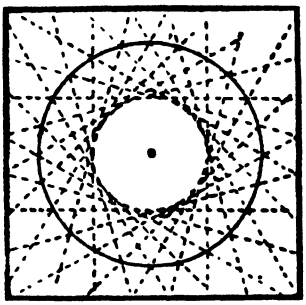


Fig. 29

If now, we consider the point **P** as moving further from the centre of the circle, the resulting ellipses with transverse axes always equal to the radius of the given circle —become flatter, until, when the point **P** is actually on the circumference of the circle, the ellipse degenerates into *a straight line.*

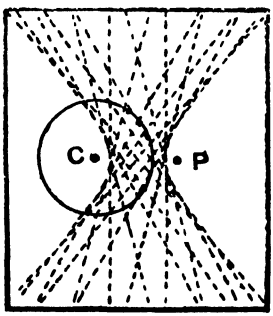


Fig. 30

As soon as the point **P** crosses the circumference and is outside of the circle, the creases in the paper trace an *hyperbola.* As in the ellipse, the transverse axis of the hyperbola is equal to the radius of the circle and the focii are the point **P** and the centre **C** of the circle (fig. 30).

When the given circle is considered to increase indefinitely in size until the comparatively small portion of its circumference that can be shown on a sheet of paper is practically a straight line, the curve traced by the creases resulting from folding the point **P** on successive points along this straight line is a parabola. The point **P** is the focus of the parabola, and the straight line, its directrix (fig. 31).

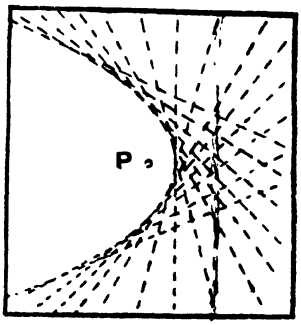


Fig. 31

That these curves are true "conic-sections" and not haphazard shapes may be proved by any one familiar with the methods of analytical geometry—the equation of any one of the creases, referred

to rectangular co-ordinates, may be thrown into a form recognizable as the equation to a tangent to the particular curve under investigation."

Francis M. Weston., Jr., in the Scientific American, Aug. 13, 1921.

Much of the above, will be understood only by the teacher, but the full extract has been quoted.

15. Models illustrating geometrical propositions. (a) That the angles of a triangle are together equal to two right angles, can be easily shown by cutting any triangle **ABC** (fig. 32), and folding the vertices A,B,C, on the lines shown dotted **PQ, QR** and **RT** to meet at the point O, the foot of the perpendicular to the side **AB** from the opposite angular point **C**.

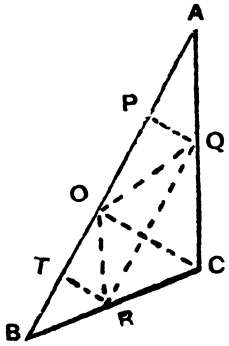


Fig. 32

(b) That the area of a triangle is equal to the rectangle, contained by the base and half the altitude of the triangle, can be easily shown by taking any triangle **ABC** (fig. 33), cutting it by a line **MN**, parallel to the base **BC**, at half its altitude **OD**. Triangles **AOM** and **AON** formed, may be cut out. These pieces fit together with the figure **MBCN** to form a rectangle, as shown in the figure.

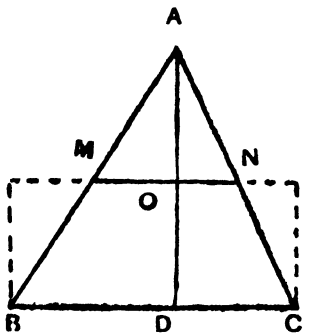


Fig. 33

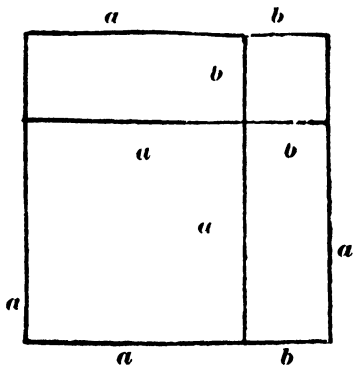


Fig. 34

(c) To verify: $(a+b)^2 = a^2 + b^2 + 2ab$. Prepare a square sheet of paper of sides equal to $a+b$ (fig. 34). Mark lengths a and b, on the

sides as shown, and fold to crease. On opening out, the above relationship is easily proved.

(d) The square on the hypotenuse in a right angled triangle, is equal to the sum of the squares on the sides. Squares are shown drawn on the two sides **AC** and **BC** and on **A′ B′** equal to the third side **AB** of the right angled triangle **ABC** in figure 35. It will be found that the four triangles formed, as shown, are equal in area. These may be cut and their equality verified. The proof of the above statement follows easily.

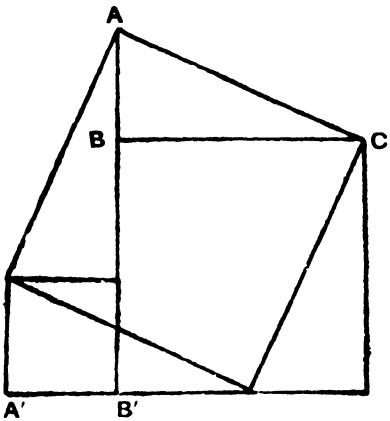


Fig. 35

(e) Many propositions of Euclid Book II, may be verified and algebraic expressions proved as in (c), above.

16. Symmetrical Objects. (a) The Vase. Take a rectangular piece of paper and fold it along **AB** in the middle (fig. 36), and cut with the scissors to the shape of half a vase. Previous drawing will be of great help. Trials will however show that a half view sometimes does

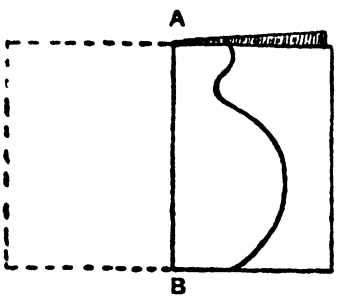


Fig. 36

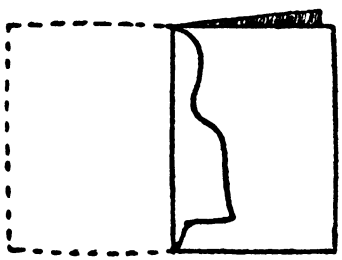


Fig. 37

not give a correct idea as to how the whole will look like, as regards the proportions of the dimensions of the model.

(b) **The Bell.** Fold a rectangular piece of paper in the middle, parallel to its shorter sides (fig. 37) and draw one half of the bell as

shown. Cut out the outline thus drawn, with the sharp point of a knife, after placing it on the glass plate. Spread out the folded paper, when the appearance of a bell will be obtained.

(c) **A Leaf.** Proceed as in the above example, but to show the complete effect, spread it on a coloured ground (fig. 38).

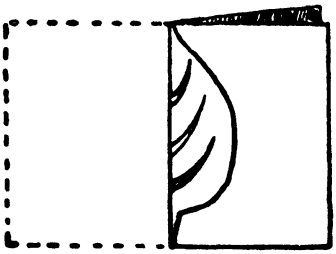


Fig. 38

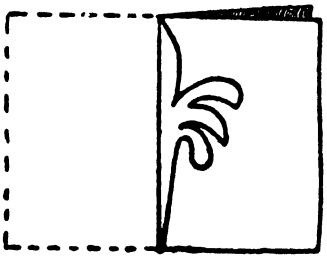


Fig. 39

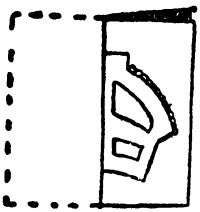


Fig. 40

(d) **A Flower** (fig. 39), **a Crown** (fig. 40). Proceed as above. Pen and ink lines in the interior, will improve the effect.

(e) Examples of an **Anchor** (fig. 41), **a Basket** (fig. 42), **a**

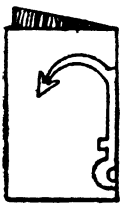


Fig. 41

Fig. 42

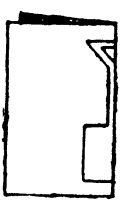


Fig. 43

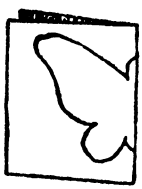


Fig. 44

Shovel (fig. 43) and **a Butterfly** (fig. 44) are also shown. Further work on similar lines is given in § 22 under friezes.

17. **Unsymmetrical Objects.** (a) **A Bud.** (fig. 45). This

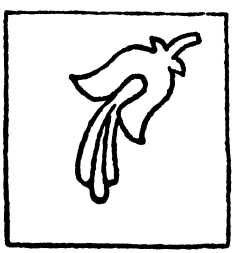


Fig. 45

should be first drawn on paper and placing the design on the glass plate,

the sharp point of the knife is to be used to cut the outline. Hold the paper with the left hand and use the knife with the other. For further instructions in cutting, see Stage V.

(b) **A Jug with handle** (fig. 46). The symmetrical portion may be first cut after folding, leaving the portions, where the handle is

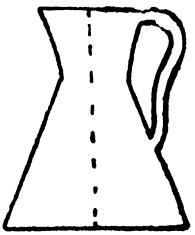


Fig. 46

Fig. 47

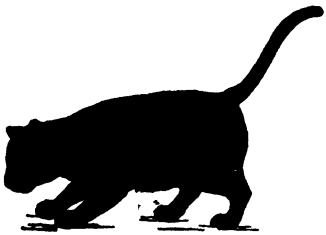


Fig. 50

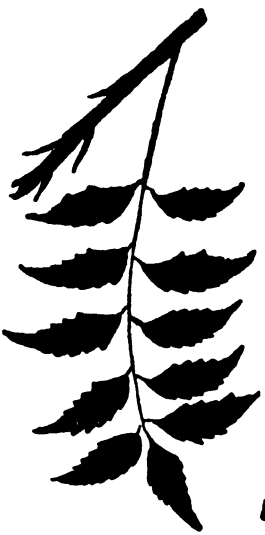


Fig. 48

Fig. 49

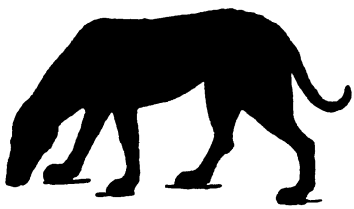


Fig. 51

Fig. 52

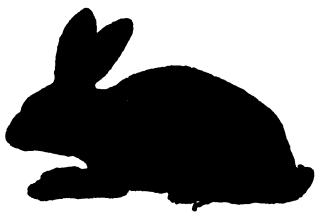


Fig. 53

attached, intact. The handle is to be cut out from one side after opening out the specimen and by laying it on the glass plate.

(c) **A Pointer** (fig. 47); a Branch (fig. 48); a Bird (fig. 49); a Cat (fig. 50); a Dog (fig. 51); a Rat (fig. 52); a Hare (fig. 53)

are illustrated. These forms though familiar to the child cannot be readily reproduced in drawing. It will be an interesting and useful exercise to attempt tracing and cutting out of a form before a faithful

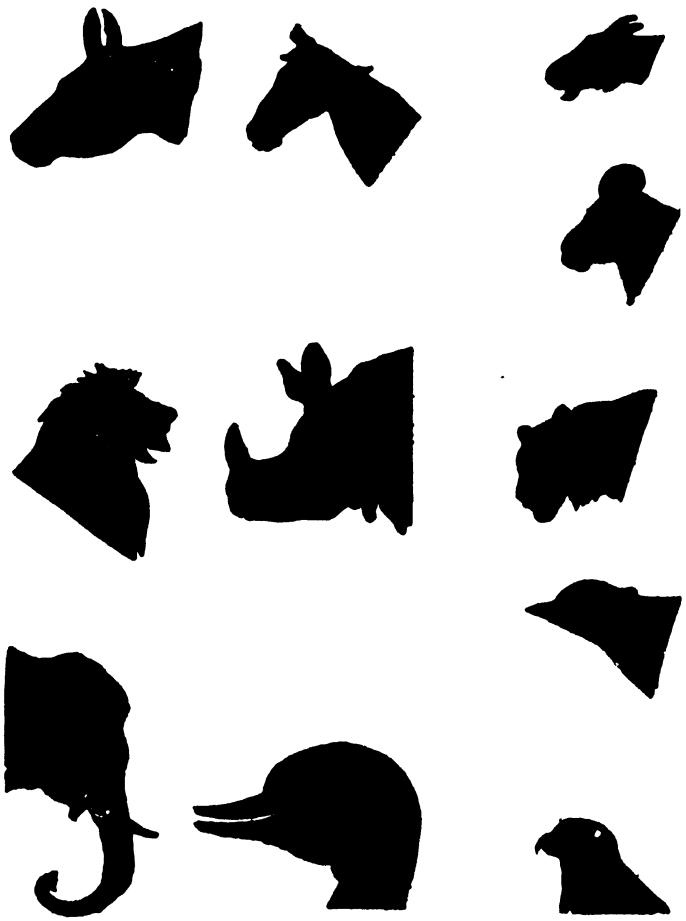


Fig. 54

copy of it is obtained. In trying to draw a specimen attention is directed to the details usually overlooked. Other examples say, heads of animals and of birds are shown in fig. 54.

These would also be of great interest to the child. Common fruits and flowers (fig. 55) may be tried similarly.

Beginners in this work may experience some difficulty in the drawing out of the outlines, in which case the illustrations given in the book, may

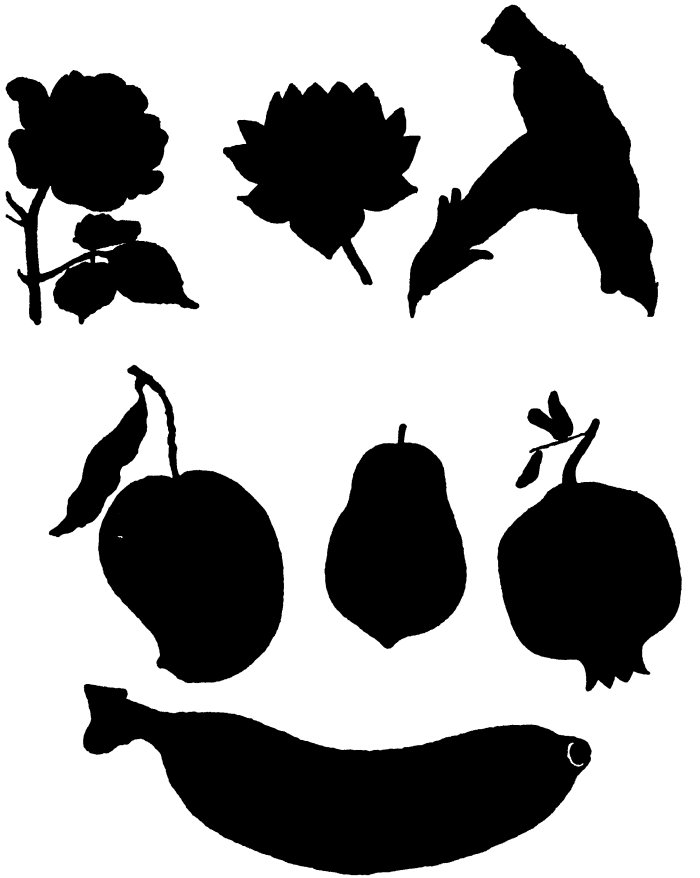


Fig. 55

be traced out. Directions for copying, enlarging or reducing, directly or proportionately distorting any given figure, will be found in App. III.

18. Letters of the Alphabet. Examples may be taken from the displayed advertisements in newspapers. The sheet to be cut is placed below the original and cut out by the knife following the outline of the

pattern. The cut specimens may then be pasted with proper alignment on a thick sheet of paper of a different colour for better effect. If the letters are to be used in decorations, then they should be cut out from

Fig. 56

thick paper. The sizes of the letters to be chosen, will depend on the general make up. An example is shown in figure 56.

Note. Full instructions for cutting, as suggested above, by the knife on a hard plate, is given later, under stencil cutting in Stage V, where similar work has to be very carefully done. Full instructions in the art of lettering is also given in Appendix I., should the student prefer to make his own designs.

18-19. A Box. Take a square sheet of paper **ABCD.** (fig. 57). Fold it along a diagonal **BD.** Fold again on a line **LM,** so as to bring the corner **A** to the centre, **O.** Now fold so as to bring **LM** to coincide with **BD.** Crease and open out. Repeat the process starting

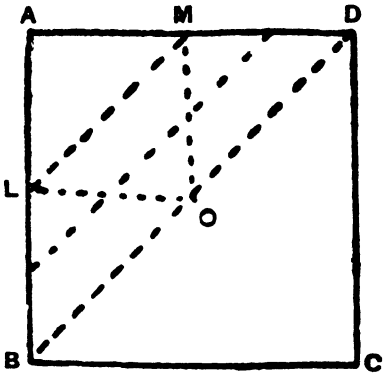


Fig. 57

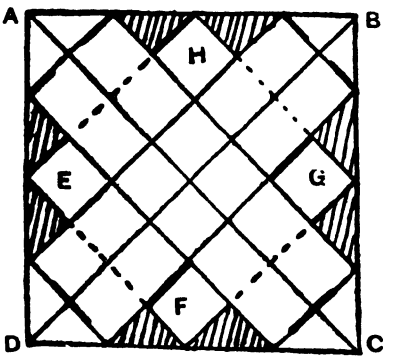


Fig. 58

with the other diagonal **AC.** The paper is now divided into a number of squares and half squares, as shown in figure 58. Now cut out the shaded portions with a pair of scissors, and make incisions as shown in the figure, along the thick lines. The incisions near the corners **A** and **B,** should be about two-thirds the side of a small square, from the outside. The incisions at the corners **C** and **D** should be of the same length, but are situated in the central positions. The latter may be

done with a knife over a hard surface. Now keeping the square portion **EFGH**, flat, bend in the paper from the sides, at right angles to the square. Bend again at right angles along the dotted lines, putting the small squares, projecting from the corners at **E, F, G, H**, inside the box now formed. The corner at **A** is now made three-fold, pushed inside the slit at **C**, and straightened out. Similarly the corner **B** is fixed inside the slit at **D**. The box is now complete (fig. 59.)

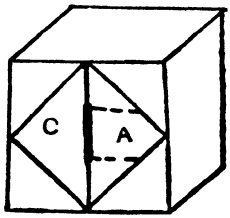


Fig. 59

20. A Confectioner's Box. Another form of cardboard box, largely used by confectioners is made of cardboard blanks, as shown in

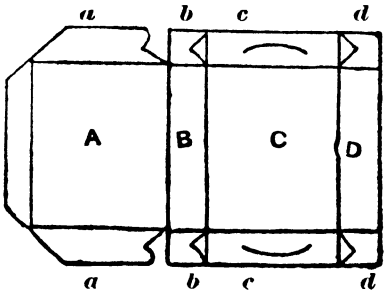


Fig. 60

fig. 60. The part **A** forms the top, **B** and **D**, the sides, and **C**, the bottom of the box, when ultimately formed. The projections *c, c*, on the sides of **C**, with circular incisions and the sides **B, D** are turned up.

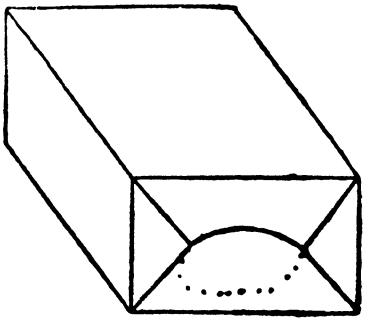


Fig. 61

The lugs *bb*, *dd* and *aa* are inserted in the slits *cc*, from the outside, and *p* pushed inside **D**. A substantial box (fig. 61) is formed.

21. A Cubical Box. A strong box of a small size in the form of a cube can be prepared out of stiff cardboard (fig 62). The paper is to

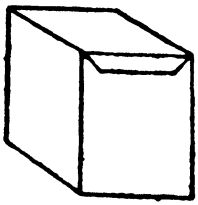


Fig. 62

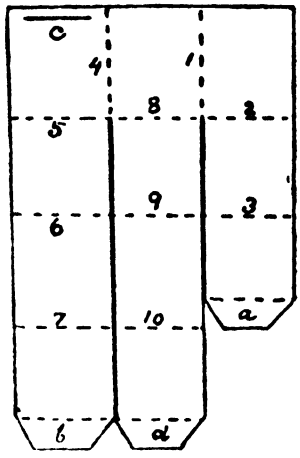


Fig. 63

be cut in the shape shown in fig 63. The thick lines indicate the cuts, and the dotted lines the creases. Folding may be proceeded with in the serial order shown by the numbers in the figure. The tongues *a* and *b* should be inserted in the slit *c*. Finally the tongue *d* closes the box. It will be noticed that the three quadrilaterals in the first and third rows determine the size of the sides of the box, which they form. The three quadrilaterals in the second line form the bottom of the box, while the quadrilaterals of the fourth row form the lid.

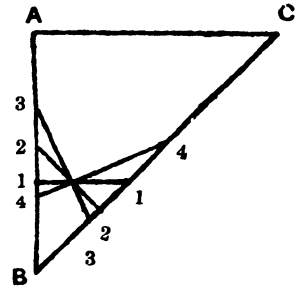


Fig. 64

22. Examples of mats and Decorations. Many interesting and instructive work, based on the principles of symmetry are possible, and numerous examples, taken from the Teachers' World, are given below. An idea of this work has already been given in sections 2 and 6. As in fig. 2, a right angled triangle, obtained by folding a square sheet of paper, three times, is first formed in each case. By single cuts on such a triangle (fig. 64), (1) perpendicularly to the side AB, (2) perpendicularly to the hypotenuse BC, (3) and (4) slantingly to the side and the hypotenuse, the stars shown below with corresponding

numbers, are formed. These pasted on coloured backgrounds make good decorations. On the other hand, the paper, when spread out, and pasted similarly on a differently coloured ground, shows off these forms to a great advantage.

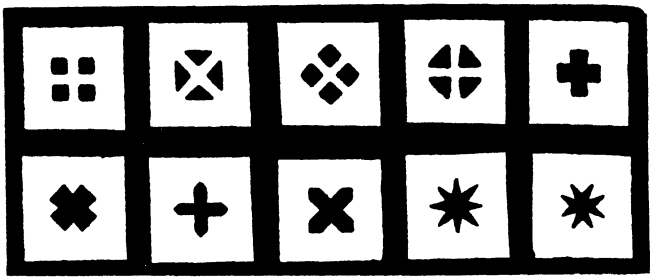


Fig. 65

By further extending the work to two cuts, in different ways, each cut being perpendicular or parallel to the hypotenuse or to the side, the examples shown in fig. 65, have been obtained. They may be used in either of the two ways, mentioned in the above paragraph.

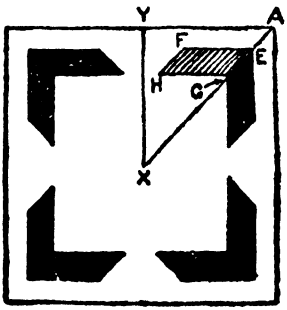


Fig. 66

To determine the number and direction of cuts required to produce any given figure (based on a square folded thrice to form a triangle) draw in the triangle XYA fig. 66, on the actual pattern. A simple one is illustrated here. The cuts to be made by the figure **EFHG** in the example shown, may then be seen at a glance.

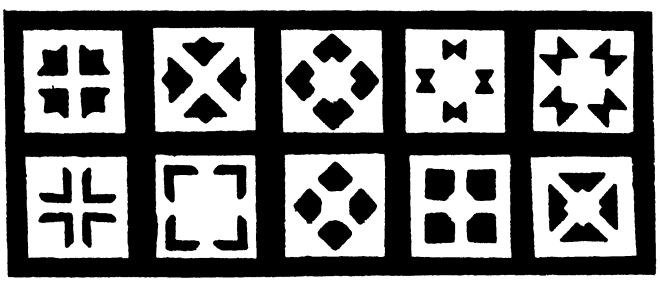


Fig. 67

Examples of three cuts, with centre retained, are shown in fig 67.

Examples of three cuts, with centre removed, are shown in fig. 68. Further examples of interesting but more complicated figures, including

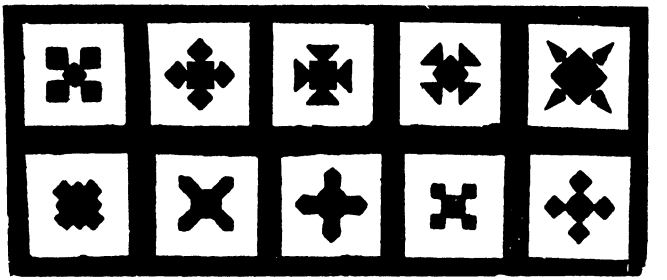


Fig. 68

those of mice, cats, dogs, ducks, swans, dancing girls etc., are shown in fig. 69.

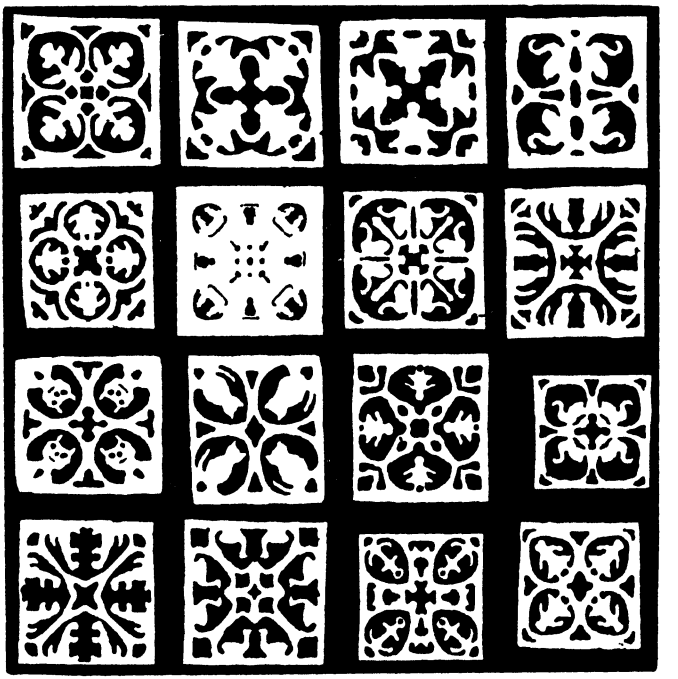


Fig. 69

22. **Friezes.** A different class of work, based on similar principles,

is the cutting of *friezes*. See also sec. 16 in this connection. A rectangular sheet of paper is to be folded alternately from one edge on the dotted parallel lines to the size shown black (fig. 70) and cut according

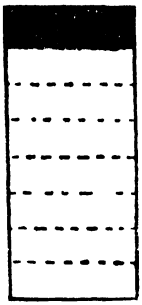


Fig. 70

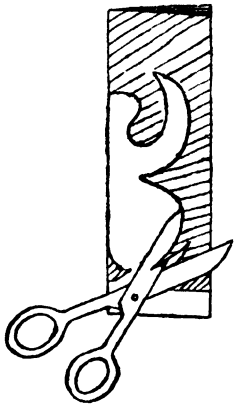
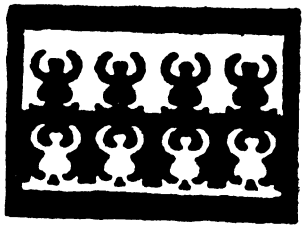


Fig. 71



Fig, 72

to some pattern, as shown enlarged in fig. 71. Both the blank and the design cut on paper, can be effectively mounted together, as shown in fig. 72. It is evident that the paper which has been cut out can also

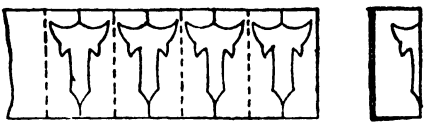


Fig. 73

Fig. 74

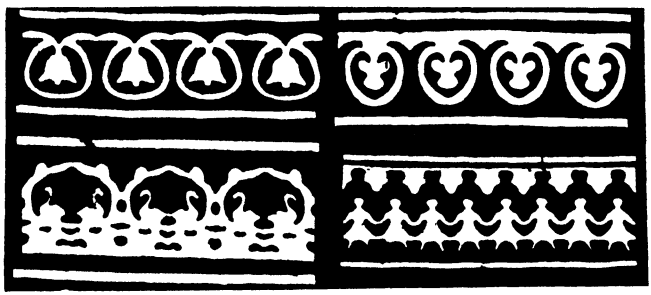


Fig. 75

be used as stencils, which class of work is described in Stage V. Some more examples of this kind of work are shown in figs. 73, 74 and 75.

PAPER-WORK.

STAGE III. PAPER ARTICLES.

1. Introductory. Some adhesive will be required here for the first time. Thick flour paste is a good material and the simple method of preparation is also widely known. A dilute solution of flour in water in a brass, bronze or even an earthen vessel is placed on a small fire and stirred vigorously, when thickening begins. The addition of a little copper sulphate or alum improves the paste.

Some of the following specimens serve only as decorations. A few are toys for children to play with. Some of them are useful articles.

2. The Chain. (a) This is largely used as decoration on festive occasions. It can be made from strips of paper varying in size from $\frac{1}{2}$ in. by 3 ins. to 2 ins. by 10 ins. The chain is usually coloured differently in alternate links. Thick paper is generally not rich in colouring and is difficult to join, but a chain made of thick paper would be much more lasting than one made of thin coloured paper.

The full sheet of paper is evenly folded, and cut across the fold in two equal halves. This process is repeated until strips of small size, as desired, are obtained. It is not necessary to have these strips cut to any exact measurement, which would involve useless work and waste of material. It is sufficient to have them all of the same size. The strips should first be collected, and arranged evenly in a pile, one on

top of the other. The pile is held by both hands (fig. 1) from the sides, the edges being gently tapped vertically on the table in turn to settle the heap evenly. If thin, the sheets have to be alternately bent and unbent diagonally over the grips of the two hands along the dotted lines shown in figure 1, while the thumbs gently pull the sheets downwards. A little overlap is produced at the top of the pack, which helps in the gathering which is effected by holding the pile vertically and knocking it gently on the table. When the paper is very thin or the size is big, a gentle pull with the nail of the right thumb diagonally from the top corners of the pile would help in making the overlap. This is a most useful practice with the Duftries. A deft hand appears to do marvels in this way. Incidentally the process described above is the only method of doing this job satisfactorily.

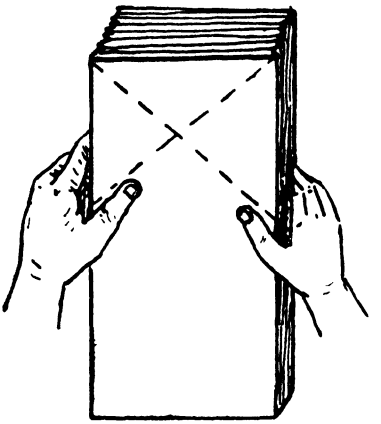


Fig. 1

Finally, an overlap of about a quarter of an inch between successive sheets is given to one of the shorter edges and the pack thus formed is placed on the table. Adhesive is now applied to these overlapping portions of the sheets. One sheet is lifted at a time, bent round (fig. 2) and the dry end evenly placed over the gummed quarter of an inch at the other end. The overlapping portion is then pressed to form a link and set apart to dry. When a number of links thus made is dry, a fresh strip is taken and looped through a pair of these links, and the ends are joined in the same way. This process is continued until a desired length of the chain is obtained (fig. 3). It will be more effective to have the alternate links of the same tint.

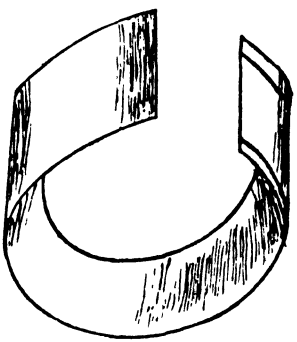


Fig. 2

Fig. 3

If a variety of tints be available, it is desirable to follow a certain regular order in the arrangement of the tints throughout the chain.

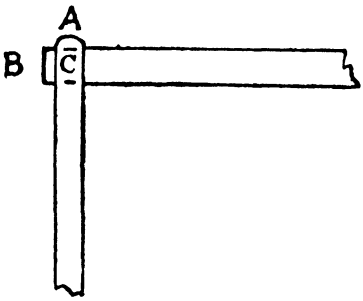


Fig. 4

(b) A simpler paper chain could be made by taking two long narrow strips of paper. Place one extremity of the strip **A** (fig. 4) on one of the extremities of the strip **B**, the latter being arranged perpendicularly to the former, the strips overlapping on the square portion **C**. Fold the strip **B** and **A** alternately over the square **C**. Ultimately a chain is formed when the specimen is stretched out. A portion of the chain shown in fig. 5.


Fig. 5

If a head and a tail of a toy snake be gummed at the two extremities of the chain, and the two strips of paper are chosen of different colours, a paper snake is formed for little children to play with.

(c) Another simple chain, made from paper is indicated in fig. 6. A

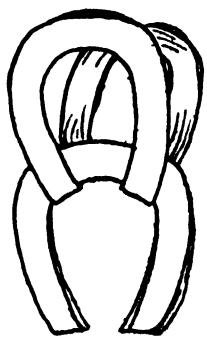


Fig. 6

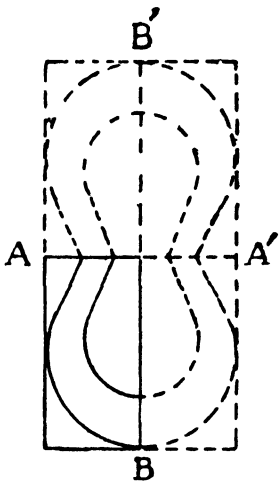


Fig. 7

rectangular sheet of paper is folded twice, on the short **AA′**, and on the long **BB′**—middle lines successively, and cut along the thick curved lines (fig. 7), inside the rectangular portion **AB**. On opening out, one link

is formed. On arranging a large number of such links, in the way as shown in fig. 6, a long chain is obtained.

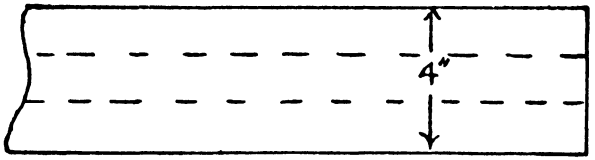


Fig. 8

(d) Another kind of chain, or paper lace is prepared as follows: Take some strips of paper, four inches wide (fig. 8). Fold them lengthwise into three equal leaves and crease (fig. 9). Make incisions with scissors alternately from the two sides, about a $\frac{1}{4}$ in. apart as shown enlarged in fig. 10. The lace

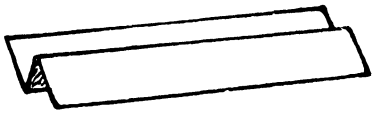


Fig. 9

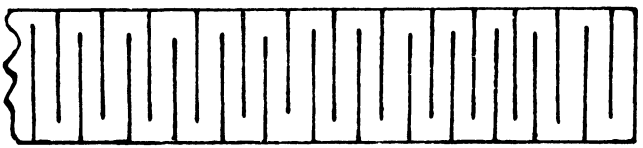


Fig. 10

is finally formed by opening and then stretching the paper out (fig. 11). The folding might also be done into four equal leaves instead (fig. 12),

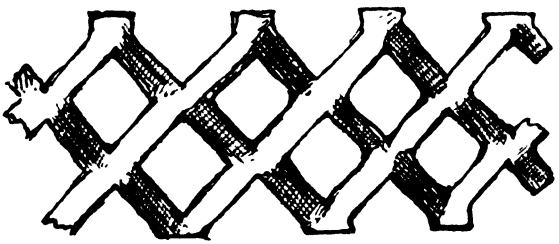


Fig. 11

Fig. 12

when a broader pattern will result. The paper lace is formed by attaching a number of such pieces together by paste, end to end.

3. **The Windmill.** This toy is largely sold at fairs and can also be easily made. Take a piece of stiff coloured paper about 5 or 6

inches square, fold and cut along the diagonals (fig. 13) from the corners down to about one inch from the centre, leaving a small square

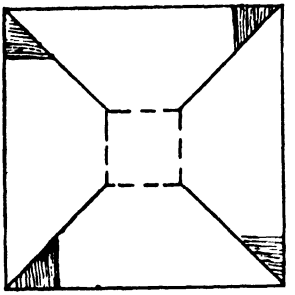


Fig. 13

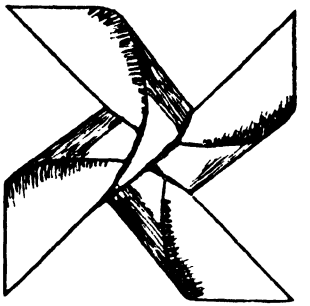


Fig. 14

area shown bounded by dotted lines. Now gum the alternate halves of the corners as shown shaded, and loop round (fig. 14) each corner to the opposite corner of the small square. Press the corners to fix on the square, but do not press the loops flat. Strengthen the centre by gumming square pieces of stiff paper of the size of the small square at the centre (fig 15) from opposite sides. Take a bamboo stick one foot in length and the width of which is about the thickness of an

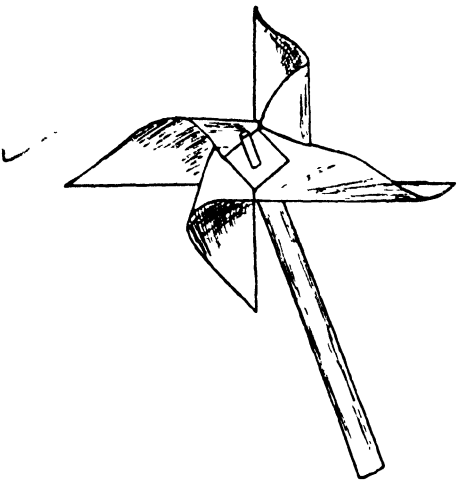


Fig. 15

Fig 16

ordinary pencil. Smooth down the rough surface and narrow a length of about an inch from one end (fig. 16) to half the width of the strip,

and give it a smooth round shape. Next bore a hole through the centre of the paper windmill and mount it on the narrowed portion of the stick with the face containing the loops away from the stem. Tie a piece of string tightly on the projecting portion of the stick to prevent the

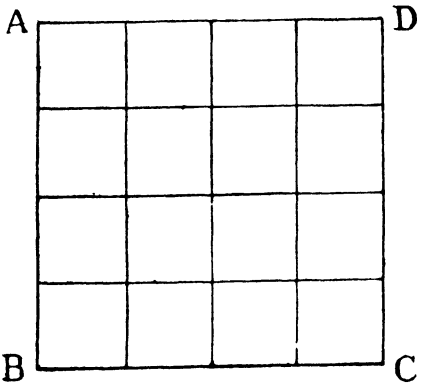


Fig. 17

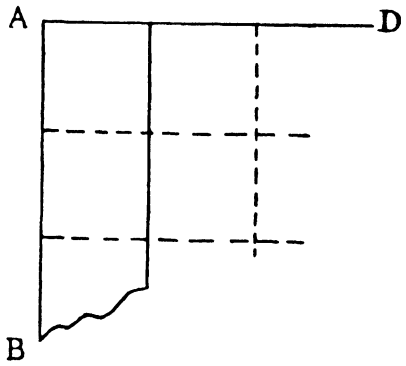


Fig. 18

model from coming out. When directed against the wind, the mill (fig. 15) will revolve very easily. If the projecting corners be coloured or covered with thin coloured paper or tinsel paper, the effect will be much improved.

The sails of the windmill could also be constructed in a simpler manner as follows :

Take a square sheet of paper **ABCD** (fig. 17) and divide it into sixteen smaller squares by folding. Turn down the first row of squares from the side **AB** (fig. 18). Then turn down the row of squares along **AD**, and pull out the corner at **A**, into a triangular projection as shown in fig. 19. Proceed similarly with the two other rows of squares along **DC** and **CB** (fig. 17), and arrange each of the other corners in order, like the corner at **A** (fig. 19).

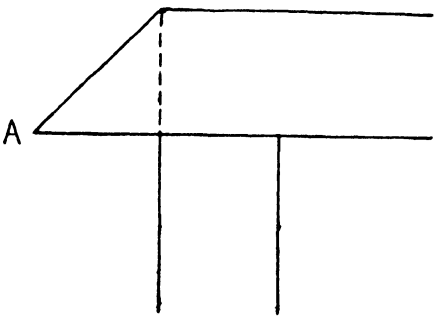


Fig. 19

The specimen as formed (fig. 20) can be mounted on the bamboo stick as described in the foregoing example.

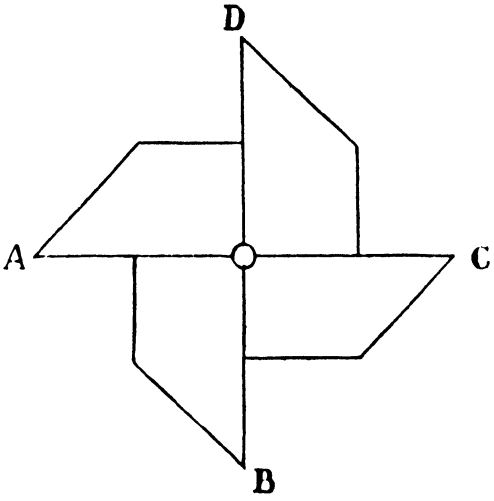


Fig. 20

4. Paper Bags. These in various sizes are largely used by shopkeepers in dealing out their wares.

The material required is simply waste paper or old newspaper. A pack of paper, cut to a suitable size, is gathered together, folded in the middle, opened out, overlapped, and gummed in the overlapping portion (fig. 21.) A sheet is taken from the ungummed side and is folded with its edge on the middle line. The gummed side is next carefully lifted up, brought to the middle, and placed on the ungummed edge. It is then fixed by pressing and allowed to dry. All the sheets are prepared in this way.

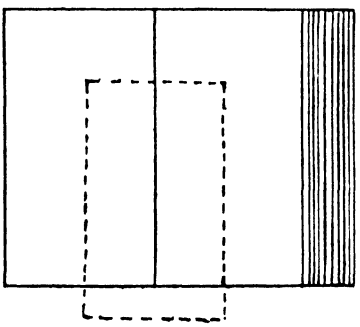


Fig. 21

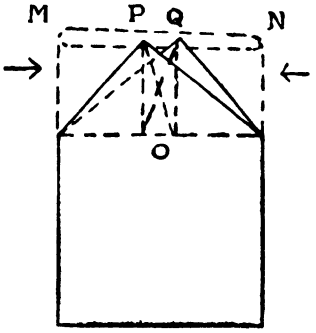


Fig 22

These are then taken one by one and the two points **M** and **N** at the extremities of the two edges are pushed inside (fig. 22) to meet in the middle at **O**, leaving two corners **P** and **Q** standing out. One corner **P** is now turned outwards, and pressed down to the form as

shown in figure 23. Gum a small piece of paper **X** over the middle portion of the slit **PQ**. The two corners **P** and **Q** are then folded on the dotted lines **AA′** and **BB′**, and fixed one on the other by gumming (fig. 24).

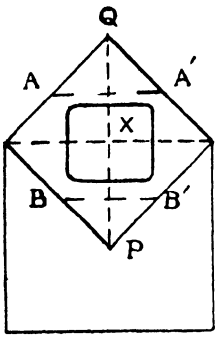


Fig. 23

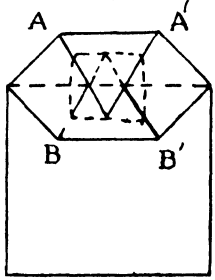


Fig. 24

This completes the paper bag. The use of a wooden former, approximately of the size **AA′ B′B** (fig. 23) for its section, simplifies the work.

By placing the former in the position as shown by the dotted lines in fig. 21 on the pack of paper, all the processes described above can be gone through very rapidly.

5. **Envelopes.** Take an old envelope which has not been torn in any way, and moistening it at the joints, open out. Place it on a sheet of stiff paper, draw the outline, and cut along the outline thus drawn, with the sharp point of a knife, or if possible, with a pair of scissors. This will serve as a pattern for making envelopes of the

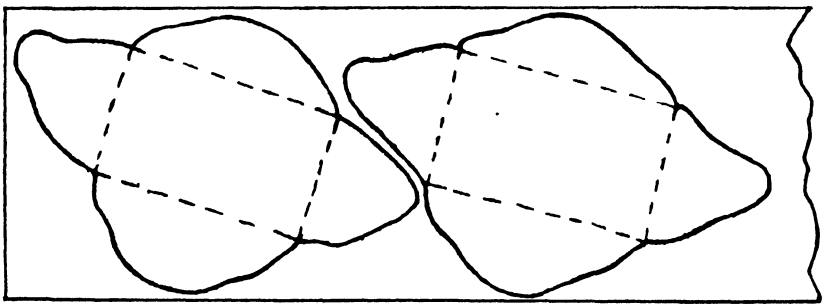


Fig. 25

size chosen. Placing the pattern over several sheets of paper taken in a pack, cut them out along the outline of the pattern. The pattern should be so arranged (fig. 25) on the paper that little material is wasted.

Now fold several at a time along the lines shown dotted (fig. 26) to allow easy folding of single envelopes later on. Gather the cut sheets and working as suggested in section 2 with the hands, produce an overlap of about a quarter of an inch at the right side of the sheets as well as at the bottom, and apply paste on the overlapping portions. Fold the left ungummed side first, and then the right gummed side over it, and lastly the gummed bottom side over both. Press to fix, and put the specimen aside to dry. Proceed in the same way with the other sheets.

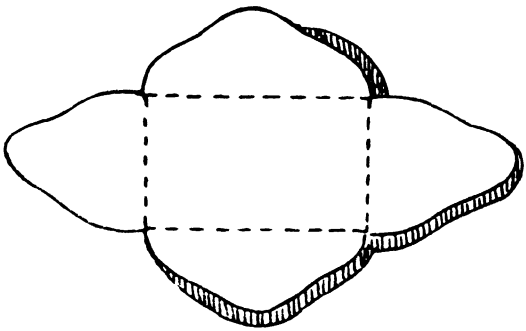


Fig. 26

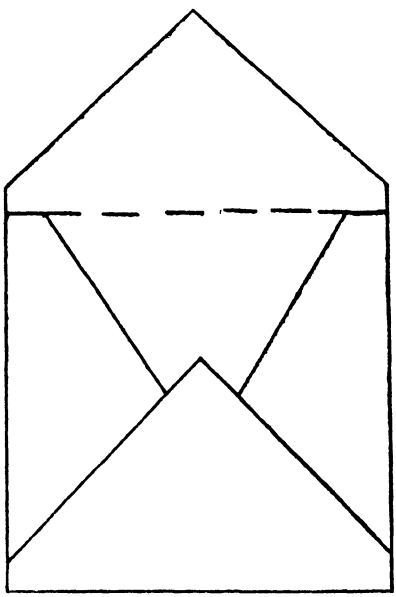


Fig. 27

The top flaps should be gummed later on in the same way by producing an overlap, and should not be folded but allowed to dry in an open position. The flour paste is of no use for the top flaps but a gum solution should be applied which will stick whenever moistened.

As exercise,* a small rectangular envelope of thin paper, a square envelope of thicker paper of the size sold at the post offices, an envelope of a decent quality of paper of the usual office size [foolscap folded four times] and a big envelope of thick brown paper, which is often very useful as a bag, are suggested.

Two other forms of envelopes are indicated in figs. 27

*When the envelopes are prepared on a big business scale, oblong sheets of paper are obtained from the mills and used instead of the usual rectangular sheets of paper. These, however, may not be ordinarily available.

and 28. For the former, take a square sheet of paper and obtain the centre by folding along the diagonals. Fold each corner a little way

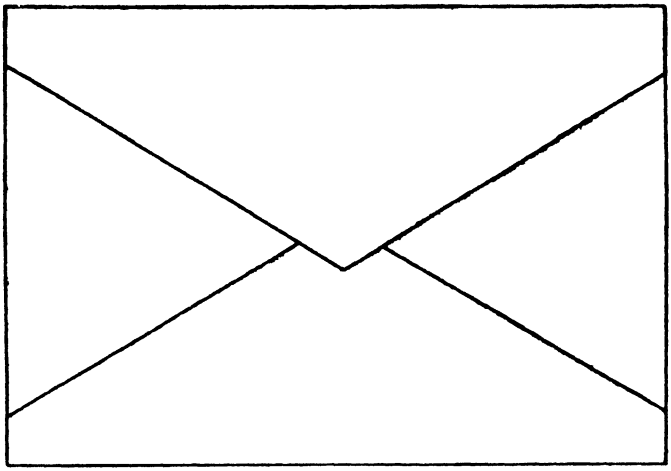


Fig. 28

beyond the centre in turn and cut off the triangles, shown shaded in fig. 29 and fix up as already indicated.

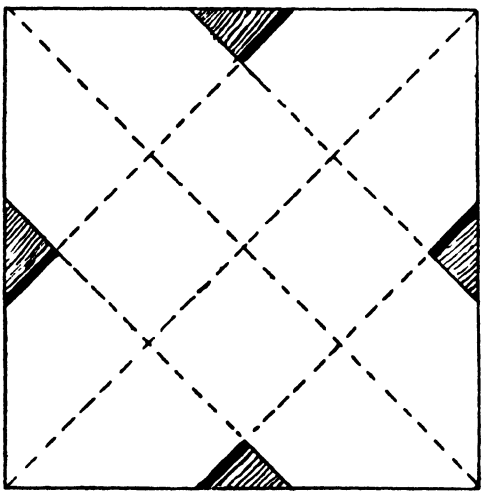


Fig. 29

For the second one, take a rectangular sheet of paper and divide

all the sides into four equal parts and fold on the broken lines as shown (fig. 30). Crease along the broken lines and cut along the full lines as indicated in the figure. Gum and fix.

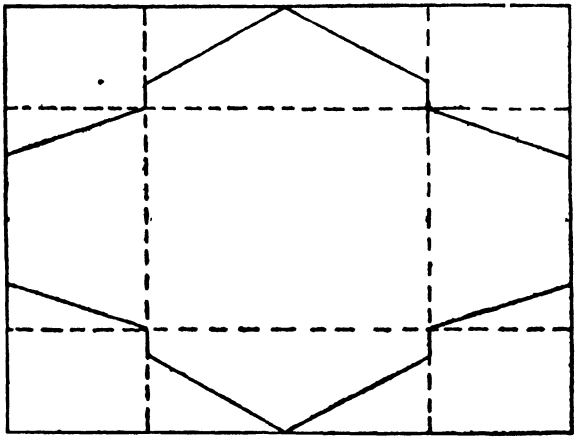


Fig. 30

In these two examples there are no curved sides to be cut out; they are therefore easy to prepare.

6. Letterettes. (a) Take a sheet of paper **ABCD** (fig. 31) decent enough for letter writing, 8 ins. by 7 ins. and fold it at $1\frac{1}{2}$ ins. and again at $5\frac{1}{2}$ inches from one corner **A** of the bottom edge **AB**, perpendicular to **AB**. Similarly fold at 3 and 6 inches from **A** parallel to the bottom edge. Cut and throw away the portions shown hatched. Gum on the dotted portion of the projection at the top, taking several at the same time, as indicated in section 2, and leave them to dry. The whole portion 7 ins. by 6 ins. below the projection can be used for writing a letter. The sides are then folded in and the bottom doubled

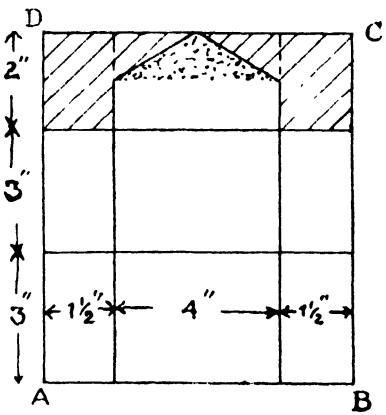


Fig. 31

over (fig. 32). The flap is next moistened, bent down and fixed to close the paper. The address is written on the back. The use of separate envelopes is thus done away with.

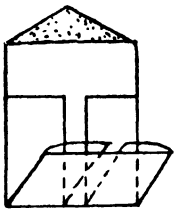


Fig. 32

(b) Take a sheet of writing paper $10\frac{1}{2}$ ins. by $6\frac{1}{2}$ ins. Fold at about $\frac{1}{2}$ in. from the top and also from the left side, as shown dotted and hatched in fig. 33. Leaving out the $\frac{1}{2}$ in. margin marked in the figure, fold the sheet in the middle along the dotted lines and cut out the hatched portions. Now cut out with a knife, a rectangle 3 ins. by 1 in., as shown crossed near the left top by incisions, leaving a margin of 1 in. on the top and at the left. Place a piece of tissue paper, a little bigger than the rectangle over it, and fix the overlapping portions of the tissue paper on all the four sides with paste. Gum the dotted portions after overlapping several such sheets gathered together as in section 2, and leave to dry. The name of the addressee

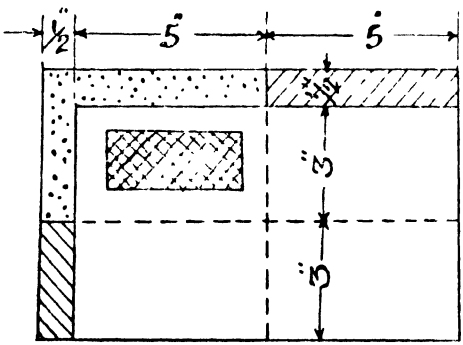


Fig. 33

and address of despatch should be written at the right top corresponding to the opening at the left top. The writing is to be done on the right half of the paper below the address and may be extended to the left half at the bottom. Folding is to be done vertically first and then horizontally upwards. The gummed portions may now be moistened and fixed by turning down. The name and the address which need not be written again, will show through the tissue paper from outside.

(c) Another form of a letterette can be prepared with a rectangular sheet of paper, cut out to the measurement and the shape

as shown in fig. 34. The curved portion at the top should be gummed and dried. The rest of the paper can be used for writing. The written sheet should be folded first from the two sides along the dotted lines

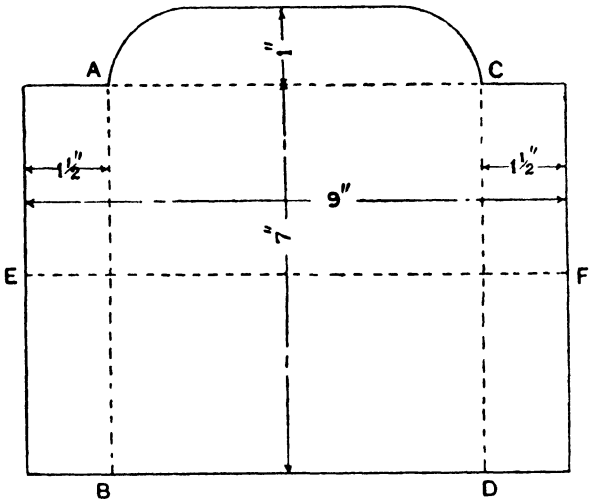


Fig. 34

AB and CD ; then doubled across the middle line EF in a direction perpendicularly to the side folds. The top flap may now be moistened and fixed to close the letterette.

(d) Take a rectangular sheet of stiff paper (fig. 35) 14 inches by 6 inches, and divide it into four equal parts A, B, C, D. Cut out a strip of about half an inch width from D as shown shaded. Make two incisions, one a straight line at T, and another at S of a V shape in sections D and B respectively, according to the measurements given in the figure. The entire space on one surface, as well as on the backs of A and B can be used for writing. Folding is to be done from A, so that A falls on B, and then both fall on C. D is to be folded next on these from the other end, and the V shaped tongue S should be

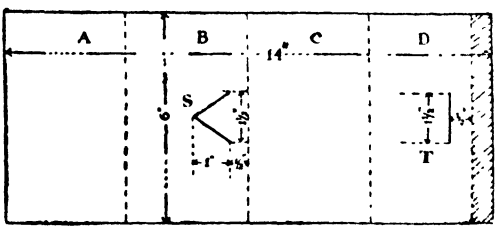


Fig. 35

inserted into the straight incision **T** to close the letterette. Another way of closing a similar form of letterette is to have two dovetailed tongues formed at the two corners of the cover by single cuts from the sides slantwise. On the leaf under the cover are also made two corresponding incisions, in which the tongues are inserted for closing the letterette.

It should be noted that these letterettes are open to inspection.

7. A Fool's Cap. Take a piece of stiff paper, draw and cut out

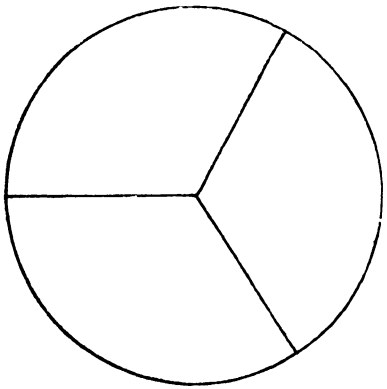


Fig. 36

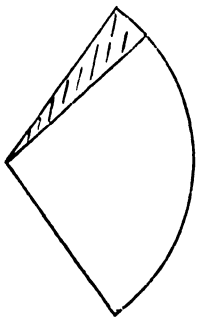


Fig. 37

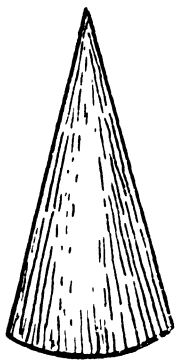


Fig. 38

a circle of about 9 ins. radius. Divide the circumference into three equal parts (fig. 36) and cut the specimen along the three radii to form three equal sectors. Take one of these sectors, and apply paste on a narrow strip, as shown shaded in fig. 37. Now stick the gummed strip on the other straight edge, to make the *fool's cap* (fig. 38).

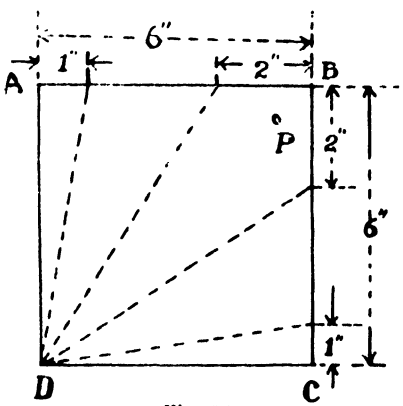


Fig. 39

8. Pockets. (a) *A Triangular Pocket.* Take a stiff sheet of paper **ABCD** (fig. 39) 6 inches square, and mark on the sides **AB** and **CB** at 1 inch from the corners **A** and **C** respectively, and also at 2 ins. from corner **B** along **BA** and **BC**, and fold along the dotted lines as shown. Apply paste on the narrow marginal triangular strips along **DA**,

and on the reverse side of the other one along DC. Close up the paper, so that the gummed strips overlap by 2 inches at the top (fig. 40), and press the strips together. The dotted lines along the marginal strips coincide in the overlap.

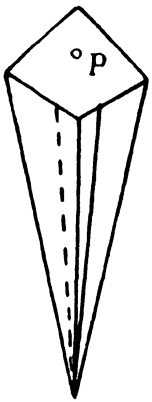


Fig. 40

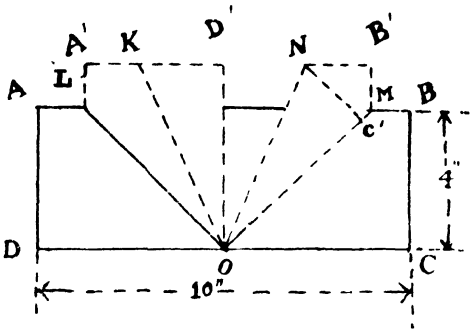


Fig. 41

Now nail it on the wall at the point P as shown in the figure. This forms a very useful receptacle for pens, pencils, brushes, scissors &c.

(b) *A Semicircular Pocket.* Take a sheet of stiff paper ABCD (fig. 41) about 10 ins. by 4 ins. and turn over corners D and C diagonally through the centre O of the bottom side CD, along OL and OM respectively. One of the corners D is shown in the figure in its new position D′. Then fold back D′O on OK so that D′O falls on LO. Proceed similarly with the other corner C, which takes the position C′ on folding. Press and open out. We have now marked angles of $22\frac{1}{2}°$ at O (fig. 42). Draw an arc PQ between LO and MO with centre O and touching AB. Then draw straight lines PK and QN as shown, and cut out the shaded portions. Now apply paste on the triangle KOD and fix it on the under surface of the triangle NOC. Press the doubled triangular part flat, and bend the circular part to the form of an arc. The pocket can be nailed (fig. 43) on the wall as in the previous example, and will serve useful purposes.

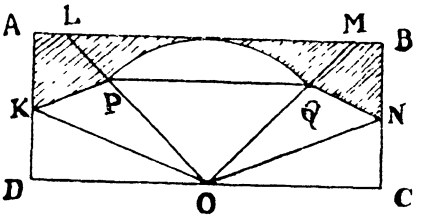


Fig. 42

Fig. 43

(c) *An Open Pocket.* Fold a stiff piece of paper 8 ins. square as in fig. 44, and divide it into 1 inch square areas by folding, Mark the square ABCD and the lines as shown. Cut along A1′, B2′, C3′ and D4′. Fold along the sides AB, BC, CD and DA. Gum the triangular portions 1A1′, 2B2′, 3C3′ and 4D4′ on their under surfaces. Gather and fix these portions, each on the adjoining flap, press and leave to dry. Bore holes at the points P, Q, R, S, shown, and suspend by a piece of thread. This will serve as a useful receptacle for small articles (fig. 45).

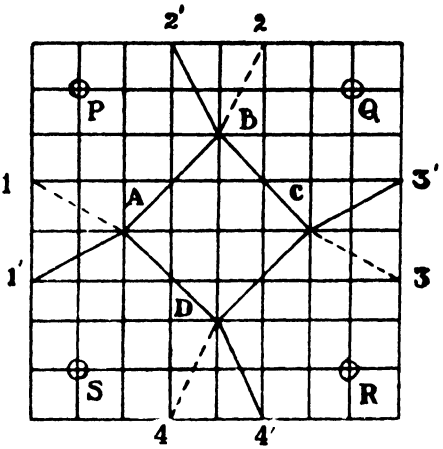


Fig. 44

9. **A Cylindrical Tube.** Cut strips of paper with parallel sides of a width equal to the length of the tube required. The paper should be thick and stiff depending on the thickness and the strength of the required article. Bevel off the short edges of the strip with a file or a

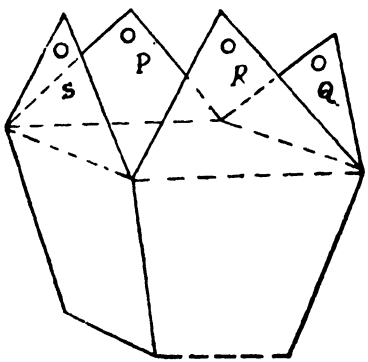


Fig. 45

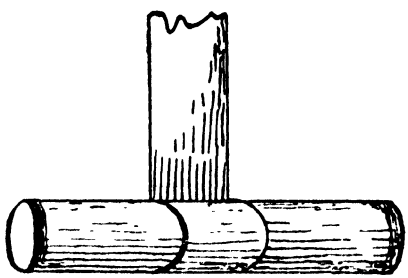


Fig. 46

knife, or even sand paper. Secure a wooden roller of a diameter equal to the inside diameter of the cylinder required, varnish it and have it dried. Start wrapping the paper on it as follows (fig. 46): Spread out the strip from one of the bevelled edges. Mark out a length on the strip

from the bevelled edge, equal to the circumference of the roller. Leaving it dry, gum the rest of the strip. Place the wooden roller across the strip on the ungummed edge and holding the strip tight to prevent creases roll on the strip, new strips being used as required as the rolling proceeds, until the necessary number of strips has been wrapped round. Be careful that the rolling is even. Continue rolling to obtain tight folds. Next take a strip of thin glazed or fancy paper about an inch wider than the original strip and of a length equal to one turn round the cylinder, and a little over. Proceed wrapping with it in exactly the same way. Take out the mandril (wooden roller) and allow the paper cylinder to dry. Turn round at the edges the projecting portion of the fancy paper inside the cylinder. Press with the fingers all round and leave it to dry.

The size of the inside diameter of the required cylinder, should be identical in size with the outside diameter of the roller (*mandril* or *former*). A thin former can be made stouter, if required, by a packing of old newspapers, wrapped tightly without paste and secured only at the extremeties by gum. As the actual sizes of cylinders vary very widely, the *former* may be as narrow as a pencil or as wide as a tin canister. The material should be properly chosen to suit the size of the cylinders. Thick brown paper may be used for large tubes and ordinary writing paper for small ones. The quality of paper should be good so that there may be no unequal expansion with crinkles or blisters, when wet. The grain of the paper, if any, should be made to run in the same way to prevent such expansion. Home made stiff flour paste free from lumps or grits will be the most satisfactory adhesive. For better work, a tube of two turns of paper only will first be made and dried before it is wrapped further to greater thicknesses. For really good work, overlapping at joints should be avoided, the edges of strips being simply folded and torn at the folds, leaving a ragged edge, which joins better than evenly cut edges. For long tubes, the application of a little French Chalk on the former will ensure easy removal of the tube after its construction. Drying is best done slowly in the air. Attempts to accelerate drying by heat would result in warping. The finishing touches such as trimming, staining, varnishing &c., will depend on individual tastes.

When the diameter is chosen to be about 1½ inch, and the length 2 ins. a serviette ring (fig. 47) is formed. In making a cylindrical box, three such rings (fig. 48) are required. Two are of the same diameter, one long (*a*) and one short (*b*). The third one (*c*) should be of a slightly smaller diameter, so as to fit tightly into the other two. To the longer of these (*a*) is fixed by adhesive, the narrow tube (*c*), half projecting out. Two discs (*d*) of thick cardboard are fitted inside the wider tubes (*a*) and (*b*) tightly, to close up the ends. With these in position (fig. 49) wrap a covering of thin fancy gummed paper

Fig. 47

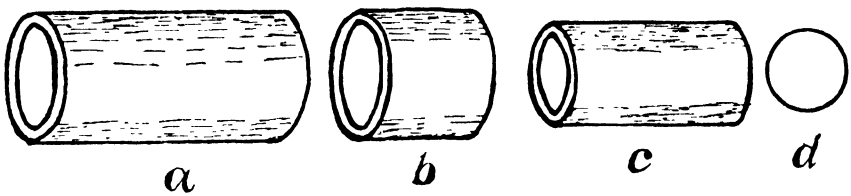


Fig. 48

(*e*) projecting out a little at the ends. Make radial slits in the projecting portions. The flaps are then turned over the discs. Discs of thin paper

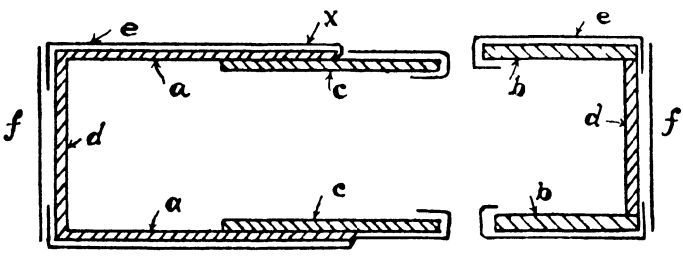


Fig 49

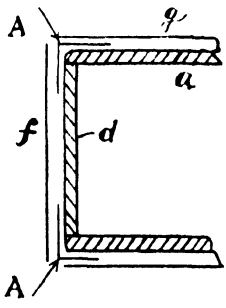


Fig. 50

(*f*) are finally pasted over the ends to hide the flaps. Strips of cloth for strength, or of thin coloured paper for show (see Section 11, for full details), or both, might be first fixed over the edges (shown at **A** in fig. 50) where the cardboard disc joins the cylinder. Then it remains to wrap the sides with fancy paper (*g*) almost to the edge instead of projecting it beyond the tube for binding. Cover the disc in the same way with fancy paper, (*f*) of a slightly smaller diameter. This improves

the appearance greatly, by showing a coloured edge of a different hue. The other end of the tube is also done in a similar manner.

Pill-boxes or cases for shaving stick, &c., are easily made in the same way. As described in the last para, the application of coloured marble paper at the edges, which are to be almost covered up by cleanly cut strips wrapped on the side and also by discs at the top and bottom, may be tried with great effect.

Tubes for big telescopes, instrument cases, coils for wireless apparatus which are largely used nowadays, are also prepared similarly.

10. Lamp-Shades. (a) *A Simple Shade.* Cut a circle (fig. 51) of about 10 ins. diameter from thick paste board, e.g., from blue covers of paper reams. Cut out a sector **AOB** of the circle and also a small circle at the centre as shown shaded to suit the size of the chimney. Mark by folding, a strip of about half an inch width as shown dotted from one of the radial side **AO** and apply paste on it. Fix this under the other side **OB**, press and leave to dry.

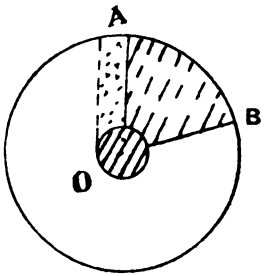


Fig. 51

If a better finish is desired, glazed or fancy paper should first be glued on the top and thin glazed green paper on the under surface of the thick "cover" paper. For a still better effect, a narrow strip of coloured marble paper may also be hemmed over the brim before applying the glazed and the green papers.

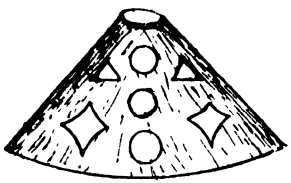


Fig. 52

Any design, even circles or triangles (fig. 52) may be cut out symmetrically on the shade and suitably coloured tracing paper or cloth, of slightly bigger sizes than the cuts is placed and fixed between the green paper and the cover paper by gumming the overlapping portions of the tracing paper or cloth. A careful selection of designs may be successfully made from newspapers and magazines. The designs should be cut and taken out and pasted on the shade before it is finally shaped. When dry, the outline of these designs may

be cut out. In the selection of designs it is necessary to choose forms suitable for festive occasions, which contrast effectively when placed in juxtaposition, and are intelligible at the same time.

(b) *A Pentagonal Shade.* Cut a circle (fig. 53) of about 5 ins. radius and inscribe a regular hexagon in it. Draw radial lines to the angular points of the hexagon. Let **ODC** be one of the six equilateral triangles formed. Draw a line **AB** parallel to the radial side **OC** about $\frac{1}{2}$ an inch away from **OC**. Cut out the shaded figure **DAB** and also cut out a small circle at the centre to suit the size of the chimney. Now fold along the radial lines, one at a time, on the same side. Apply paste on the $\frac{1}{2}$ inch strip **ABOC**, and fix it under the open radial side **OD** of the adjoining triangle.

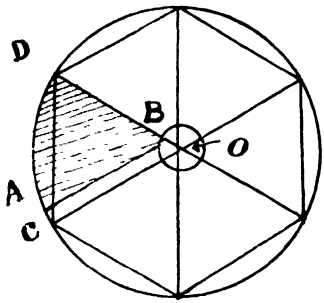


Fig. 53

Variations as suggested in (a), may be tried to produce a better effect. Similar shades having a larger number of sides than five can be made, but unless 2 or 3 triangles are cut out, the final shape would be rather flat.

(c) *A Combination Shade.* Cut out a circle **ABC** (fig. 54) of $5\frac{1}{2}$ ins. radius on stiff cover paper and draw a circle **A′B′C′** of $4\frac{1}{2}$ ins. radius with the same centre **O**. Inscribe a regular hexagon **ABCDEF** in the outer circle to obtain the six angular points **ABC** etc., and draw radial lines **OA, OB** etc. Cut out a central hole *h* to fit the chimney. Make incisions **AA′**, **BB′** etc., of an inch in length along each of the radii, from the outside. Mark 1, 1′; 2, 2′ etc. on the outer circumference at a distance of an inch on either side of each radius, and fold the triangular portions **AA′1**, **AA′1′** etc., upwards. Cut out a portion as shown shaded, about a triangle **ODE**,

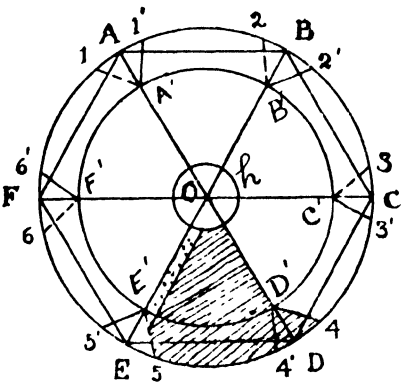


Fig. 54

leaving a radial strip of about 1 inch wide along **OE′** as shown dotted. Fold at the circumference arcs, **A′ B′**, etc. of the inner circle upwards (taking small lengths at a time and working with the fingers). Now apply paste on the radial strip along **OE′**, and also on the triangular strips, **1AA′**, **1′AA′**; **2BB′**, **2′BB′** etc., alternately on the upper and lower surfaces. Gather adjacent triangles **1AA′**, **1′AA′** etc., together and fix one pair at a time. The appearance (fig. 55) may be improved, as in (a), by decorating the shade with fancy paper, or by cutting out designs on the shade, and covering the cut out portions with thin tissue paper or coloured tracing cloth.

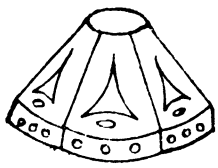


Fig. 55

(d) *A Geometrical Shade.* Draw a regular pentagon **ABCDE** (fig. 56) of 3 ins. sides and equilateral triangles **ABM** and **DCN** on two of its sides **AB, CD**, which are not adjacent. Draw lines *ab, bc, cd*, parallel to, and on the outside about $\frac{1}{2}$ an inch apart from, **MB, BC, CN**. Now cut out the outline of the figure drawn as shown by the thick lines.

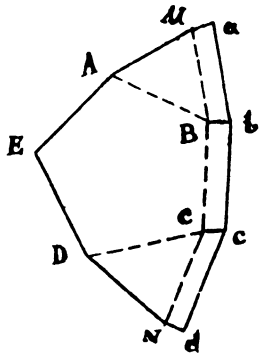


Fig. 56

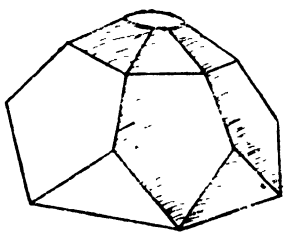


Fig. 57

Make two short incisions *b***B**, *c***C**, as shown. Prepare 5 such pieces. Fold upwards, along all the dotted lines. Apply paste on the strips **M***b*, **B***c*, **C***d* and fix them to the sides of another piece corresponding to **MA, AE, ED.** Proceed in this way to join all the five pieces. When dry, cut out a hole at the top with scissors to fit the chimney. The appearance (fig. 57) can be improved as in (a) by applying fancy paper or by cutting out designs and covering the openings with fancy or

coloured tracing paper. The edges can be strengthened by superposing a strip of strong paper or linen and fixing by doubling inside and outside the edges. If desired, the joints may also be similarly strengthened.

(e) *A Japanese Shade.* Take a sheet of stiff paper 11 inches by 4 inches (fig. 58) and fold along the middle line **MN**. At about $\frac{1}{2}$ inch from the open side, make another fold lengthwise, and open this fold

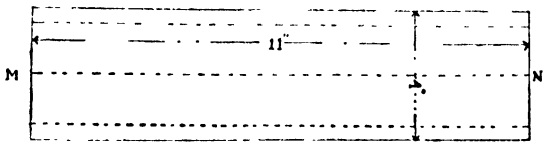


Fig. 58

out. Next make parallel incisions $\frac{1}{2}$" apart in the folded paper from the closed side **M N** (fig. 59). Now open out and applying paste on the

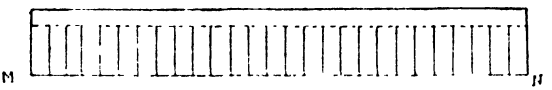


Fig. 59

extremities at the short sides close up in the form of a cylinder. On pressing the bands at the top and bottom a balloon shaped shade

Fig. 60

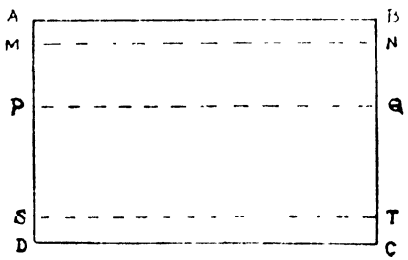


Fig. 61

will be formed (fig. 60). A cardboard disc at the bottom and a holding string at the top, complete the work.

A more complex shade can be prepared by taking a sheet of paper **ABCD**, of about 12 ins. by 12 ins. (fig. 61). Fold at half an inch as shown by dotted lines **MN** and **ST** from the top and bottom and open out. Next mark a line **PQ** at 4 ins. from the top and fold, so as to

bring **AB** and **DC** on **PQ** (fig. 62). Make incisions as in the last example up to the dotted lines **MN** and **ST.** Open out. Proceed as

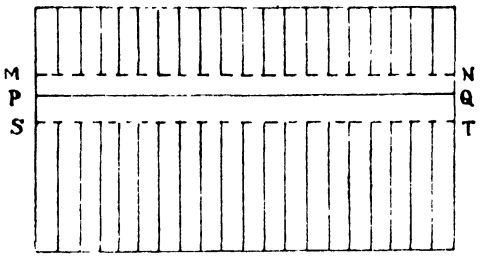


Fig. 62

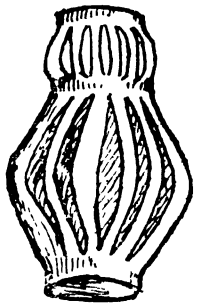


Fig. 63

above to obtain the final shape as illustrated in fig. 63.

11. A Fruit Basket. Take a square sheet of paper (fig. 64). Divide each of the sides into three equal parts at points *a* and *b*. Fold

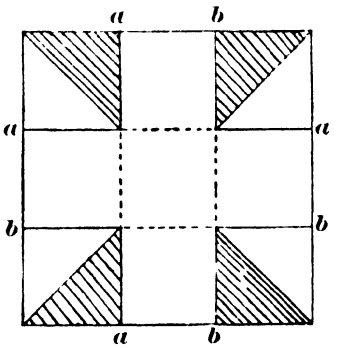


Fig. 64

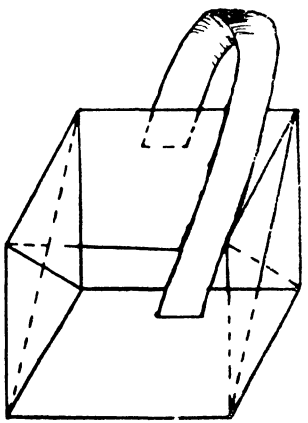


Fig 65

and crease on dotted lines shown and make incisions along the thicker lines. Apply paste on the right angled triangles shown shaded, and attach them to the adjoining sides (fig. 65, shown enlarged). A holder is also attached as shown.

In another form of the fruit basket, and rectangular sheet of paper with sides, of lengths in the ratio of 3 : 4, is taken and the adjacent sides are divided into 3 and 4 equal parts respectively. Each of the

squares obtained by joining points of divisions should be equal to one

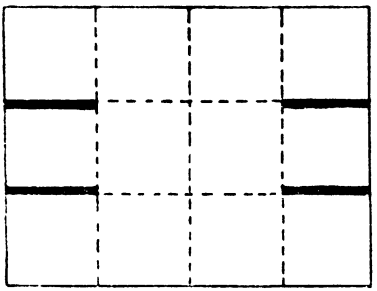


Fig. 66

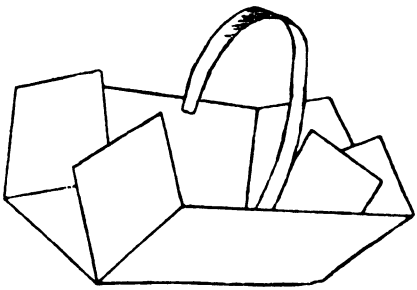


Fig 67

another (fig. 66). The paper is folded along the dotted lines and incisions

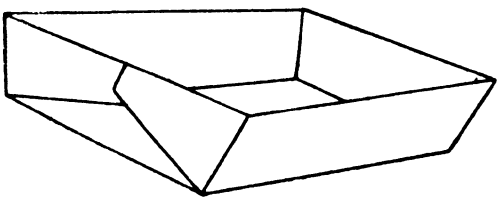


Fig. 68

made along the thick lines. The sides are then fixed as shown (fig. 67). An oblong tray results (fig. 68) if straight cuts are made from corner to corner.

12. Pocket Cases. (a) *A Photo Case.* Cut out a piece of thin stiff cardboard (fig. 69) of the shape and size shown. Fold through **P** and **Q** and along **R** and **S** on the dotted parallel lines. Apply paste on the back of the outside strips **AA** on the two sides. Double over and fix the lower portion **B** on them. Tuck in the small squares at **T** neatly inside. A book of suitable size pushed in from the open side will be of help in shaping the case.

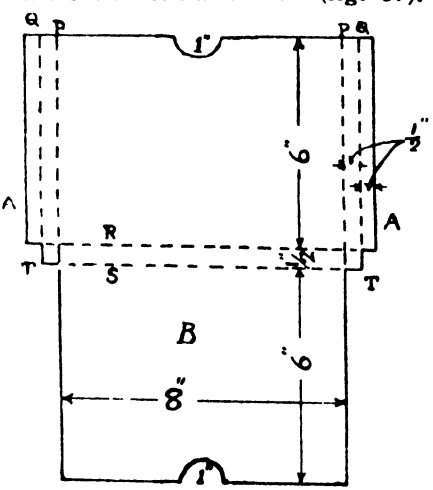


Fig. 69

The semicircular cuts on the open side enable handling of the photos inside the case (fig. 70) with ease.

(b) *A Comb Case.* Take a piece of stiff cardboard (fig. 71) about 1 inch longer than the length *t*, of the comb, and about $2\frac{1}{4}$ times its

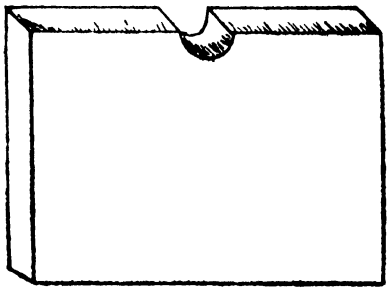


Fig. 70

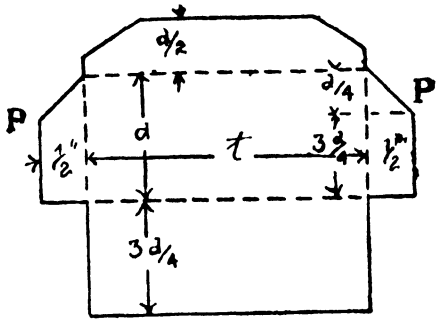


Fig. 71

width *d*. Cut out the outline as shown. Fold along the dotted lines and applying paste under the projections **P**, **P** at the sides, fix up the whole as shown in fig. 72. The comb will be well enclosed in this case.

(c) *A Pocket Book.* Cut out a piece of stout cover paper (fig. 73), 6 ins. by 13 ins., of the shape as shown, and fold along the dotted lines. Covering the material with fancy paper will improve the appearance. Make incisions at the thick lines shown at **A**. Apply paste

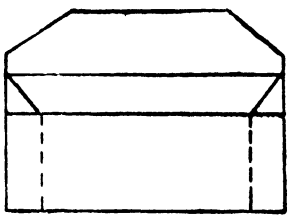


Fig. 72

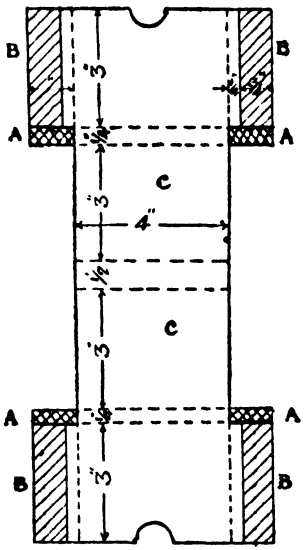


Fig. 73

under the strips at **A** shown by crossed lines and at **B** shown hatched, and bend them upwards. Fix **B** on the inside of **C** in both halves, **A**

being also properly bent and fixed on the inside (fig. 74). Get about 20 sheets of writing paper, 3½ by 6 inches and sew in the middle

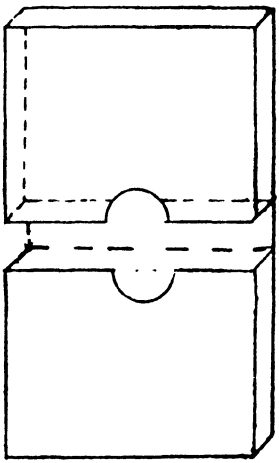


Fig. 74

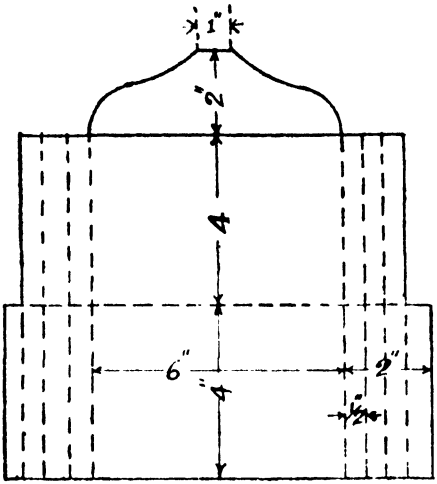


Fig. 75

with a piece of thread. It makes a useful pocket note book. Cut out a thick strip of strong paper 2 ins. wide and 8 ins. long, and join the short ends by paste, with about 1 inch overlapping. This ring slipped on the case, forms a useful binder, and prevents thecase from opening out.

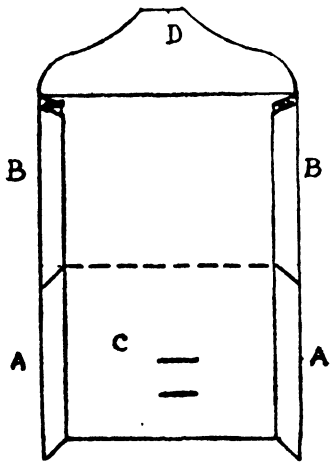


Fig. 76

(d) *A Pocket Case.* Cut out a piece of thin stiff cardboard of the shape shown in fig. 75 and fold vertically along the dotted parallel lines into ½ inch wide spaces. The folding is to be done alternately upwards and downwards as in a palm leaf fan (fig. 76). Cut two slits at **C** as indicated by thick lines, about 1 inch in length. Apply paste on the outer ½ inch flaps **A** and folding from below on the dotted line in the middle, fix on flaps **B**. Cut a strip of

stiff paper nearly an inch wide and two inches long and fix one end by paste under the protruding tongue at **D** at the top. When the case is closed the other end can be pushed inside the slits at **C** (fig. 77).

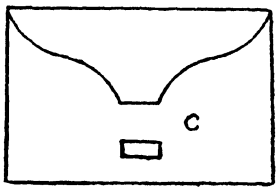


Fig. 77

(e) *An Extensible Pocket Case.* A different kind of folding, as is used in the construction of a camera, is shown here. Cut the pieces of cardboard covered with fancy paper, of the dimensions given in figs. 78 and 79. Crease along **AA** and **BB** and pierce holes **P** and **Q** at the points marked. Now take a piece of thin but strong flexible paper, 15 by 3 inches (fig. 80) and draw parallel horizontal lines $\frac{1}{2}$ inch apart. Draw also two pairs of parallel lines $\frac{1}{2}$ inch apart crosswise, i.e., vertically at distances of $3\frac{1}{2}$ ins. from the sides and draw

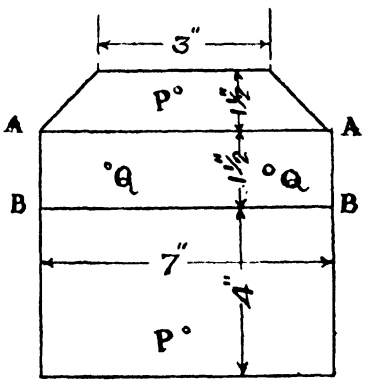


Fig. 78

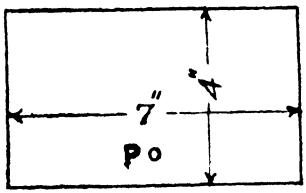


Fig. 79

the diagonal lines in the small squares shown. Fold the paper along the horizontal parallel lines, alternately on opposite sides as in

Fig. 80

a palmyra fan and press flat. Then open it and fold again on the verticalal lines. While doing this, pinch the diagonals adjacent

to the cross lines, one by one, to give a proper shape to the corners (fig. 81) forming sides like those of the bellows. Now apply paste to the flat sides T at the top and at the bottom, and placing it at the bottom of the bigger board (fig. 78), cover it with the smaller

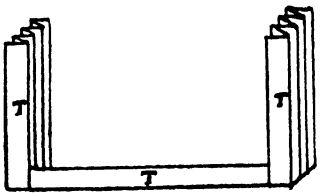


Fig. 81

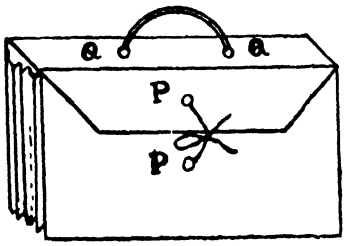


Fig. 82

(fig. 79) and allow it to dry under pressure. When dry, two small pieces of ribbon are tied to the two holes PP and used as shown in fig. 82 to close the case and to bind it. A piece of cord can be taken round the holes QQ to form a loop as shown, to carry the case. Any size may be chosen as desired. Instead of creasing at the top between AA and BB (fig. 78 the use of stiffened cloth between the back piece and the top flap will serve as a better hinge and will be a great improvement. Instructions for using cloth hinges will be found later.

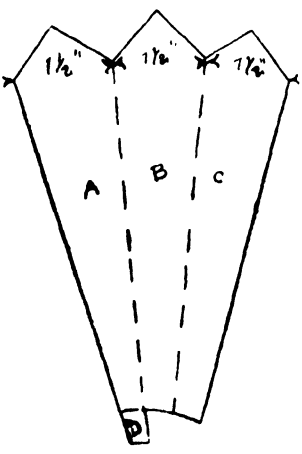


Fig. 83

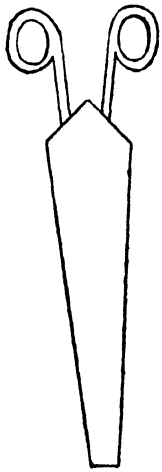


Fig. 84

13. A Scissors Case. Cut a piece of stiff paper of the shape shown in fig. 83, the actual size depending on the size of the pair of scissors to be encased. For an ordinary size, each of the three leaves may be $1\frac{1}{2}$ ins. wide at the top and $\frac{1}{2}$ inch wide at the bottom. Crease along the dotted lines, and applying paste on one leaf C, double A on B and then C on A, the projection D at the bottom being previously folded in. The completed case is shown in fig. 84.

14. Boxes. The general principle of making boxes is the same. A rectangular sheet of thick paper (fig. 85) is divided into 9 smaller rectangles and squares, the central figure determining the size of the area of the box, and the width of the other figures determining the height of the box. Four squares shown hatched at the corners are cut off. The material is placed on a hard surface and is creased along the dotted lines* by a blunt point of polished steel against a straight edge pressed hard on the lines. This allows folding to form the sides perpendicularly to the base. In smaller sizes where thin cardboard is used, a binding strip of stiff paper or linen at the edges, or even of thin fancy

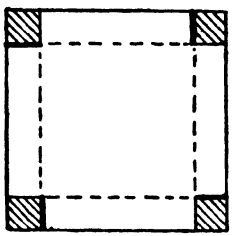


Fig. 85

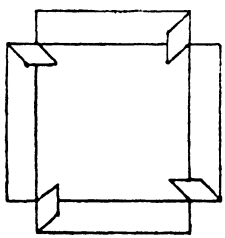


Fig. 86

or glazed paper for a better finish, is sufficient for holding the sides together. In bigger sizes thicker cardboard is used. If it is desired to give greater strength at the corners, the smaller squares are slit (shown by thick lines in fig. 85) on one side only and bent (fig. 86) to be glued or tacked to the next side, before the cover, if any, of fancy paper is applied.

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* Creasing of cardboard :—The simple method of creasing, as suggested, will do well for thin material. But for thicker sheets, a wooden board with a groove $\frac{1}{8}$th inch deep and $\frac{1}{4}$th inch wide, if available, will give a satisfactory folding without injuring the material at the creases. The creasing tool may be only a piece of hard wood such as mahagony, shaped at one end as shown in fig. 87—front view in (a) and side view in (b). The pointed end should be carefully made smooth with fine sand-paper For creasing, the marked cardboard is placed on the grooved board, with the line of the intended crease along the groove Whilst firmly holding the card, glide backwards and forwards the point of the creasing tool along the line with sufficient pressure to make a crease on the card, but without breaking its under surface. Other creases are to be made in the same manner. It may be pointed out that all materials do not crease equally well. The material found by trial to crease satisfactorily, is only to be secured.

Fig. 87

Two such parts are made for the complete box, and the part meant for the bottom half is usually of a greater height than that of the other.

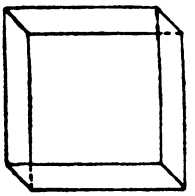


Fig. 88

Another strip of cardboard equal in length to about twice the length, plus twice the breadth of the box, is bent four times at right angles to its length, at proper distances (fig. 88) and put tightly inside the bottom half of the box with adhesive, projecting out a little. The upper half easily fits over this.

A simple covering of glazed paper is a good enough finish, but fancy paper or coloured edges improve the appearance. A strip **A** (fig. 89) is cut wider by about 1 inch than the height of the sides of the box. This is laid down flat and paste is applied on it. The sides of the box are next rolled on the strip and the two projecting portions *p*, *p*, on the sides turned over and pressed by the fingers. Sheets **S**, (fig. 90) of the size of the bottom or of the top of the box are now fixed by paste to cover the turned down flaps. To apply a border at the edges, a narrow coloured strip *m* (fig. 91) is first applied along the edges and turned down the sides. A plain sheet **N** at the top or bottom is fixed extending almost to the edge and leaving just a line of the coloured paper uncovered as shown at **A**.

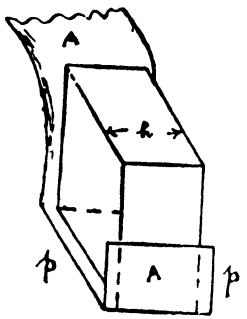


Fig. 89

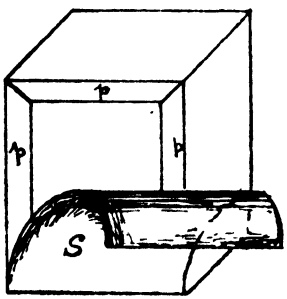


Fig. 90

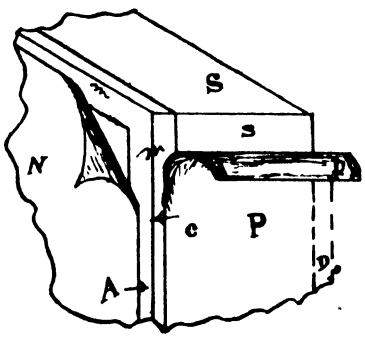


Fig. 91

Similarly, the strip **P** to cover the sides **S**, leaves a line of the coloured paper uncovered on the side **C**, but projects on the other side **D**,

which projection is afterwards turned down. Light fancy or tissue paper or lace can be gummed inside the box with a narrow portion projecting out, as can be seen in some soap or scent boxes.

Small boxes of various sizes are used in large quantities for packing buttons. Bigger boxes are used for packing cakes of soap, scent bottles and various other articles. Those used for pills, patent medicine, powder, etc., are made exactly in the same way. The outside is made over a wooden former, in the form of a square, circular or rectangular prism, the joints being made by overlapping, to give additional strength to the case. The outer cover of glazed or fancy paper is pasted on the case in the usual way and the projecting portions turned down. Boxes for packing bottles etc., needing no separate cover may be shaped on a wooden former. But following the usual way, the material may be cut (fig. 92) on full lines and creased on the dotted lines, as shown, and the case is prepared by folding from the sides. After the bottle is placed inside the case, the top and the bottom flaps are turned in and the whole is rolled on gummed sheets, which project at the two ends. The projections are then symmetrically folded from the sides. The two corners formed are next folded in. The folding at one end is shown in fig. 93. All these articles are very largely used, and if decently made are sure to command a sale.

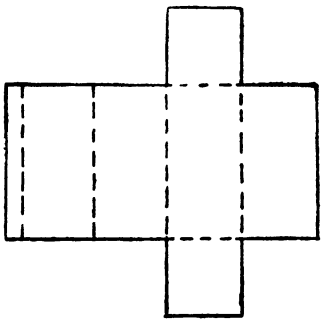


Fig. 92

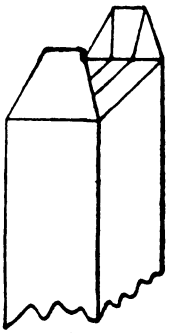


Fig. 93

15. The Writing Pad. Cut a piece of cardboard 18½ by 15 ins. and also two square pieces of good strong cloth or leather each of 3 ins. sides. Cut these square pieces diagonally to form triangles and trim them at the sides to have smooth edges. Now attach with paste on one side of the board a lining of white paper, bigger than the board by half an inch on every side. To avoid creases, first begin on the edge nearest to you, placing the paper in its proper position

on the board. Then holding the two upper corners of the paper, gently and uniformly place the whole sheet, avoiding air bubbles. With a piece of clean rag or soft paper rub gently away from you. Now turn over and turn down the projections and press to fix on the opposite side. Place the triangles at the four corners on the covered side of the board. One of these corners is shown in position in fig. 94. After applying paste

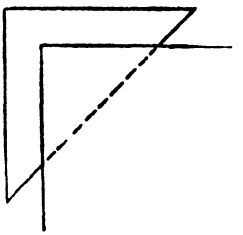


Fig. 94

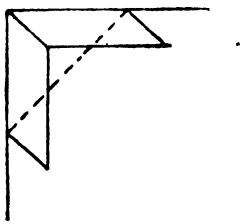


Fig. 95

on the projected portions, turn down and fix (fig. 95). The overlapping joint at the corner formed, will appear uneven and should be smoothed down. Now apply a piece of strong brown paper over the back of the whole board and leave it to dry. Sheets of blotting paper of the proper size (obtained by simple folding and cutting) are placed on the upper surface of the board (fig. 96) being held at the corners by the triangular leather or cloth pockets.

16. The Writing Case. Cut out three pieces of cardboard A, B, C, as shown in fig. 97, all 12 ins. long, but two of them 10 ins. and one 5 inches wide. Cut out two corners of the smallest one C, as shown in the figure.

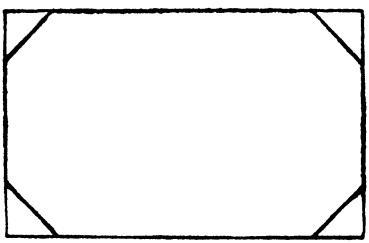


Fig. 96

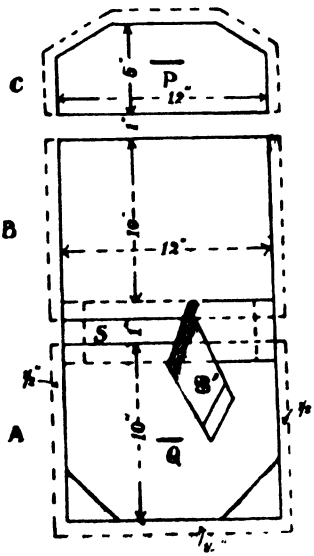


Fig. 97

(1) Take four strips of cloth or thin leather, 3 ins. wide and 14 ins. long. Double 1 inch of each strip on itself at the shorter ends. Apply paste and fix Place the pieces of cardboard A and B with the longer sides parallel to each other, leaving a space of one inch in width between them. Then applying paste on one of the prepared 3 ins. strips S, place it to join A and B. Turn over. The strip is now seen at S in the figure. Apply a second strip S′ on the side now on top in the same way. This process is shown in the figure. Similarly placing C on the other side of B, join B and C by the two other strips. This is not shown.

(2) Cut out a piece of fancy paper 13 ins. by $10\frac{1}{2}$ ins. and apply on A by paste, so that it may project equally by $\frac{1}{2}$ an inch on three sides, as shown by dotted outlines. This covers part of S′, in pasted position. Cut another piece 13 ins. by 10 ins. and apply on B by paste, two sides only projecting out in this case. Cut out a third piece 13 ins. by $5\frac{1}{2}$ ins. and cut out the corners and apply on C so that

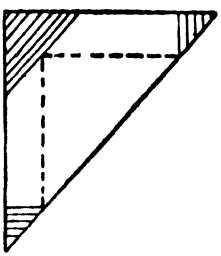


Fig. 98

it may project from the sides by half an inch. Turn over the whole piece and double back to fix the projections by paste from all the sides.

(3) Cut two slits about an inch wide at the centres of A and C as shown at P and Q. Take two pieces of strong tape, each about 6 ins. long, and insert about an inch from one end of each through the slit from below and fix by applying paste.

(4) Now line the inside with pieces of glazed paper, cut exactly to the size of the three cardboard pieces.

(5) Next cut out four triangular pieces of cloth as shown in fig. 98, and trim the corners as shown hatched. Fold along the dotted

lines and apply paste on the doubled portions. Fix them on the four corners of A to hold blotting paper as in the last example. Two only are shown in the figure.

(6) Cut out a piece of fine stiff paper 15 ins. by 12 ins. (fig. 99). Fold back one inch from one of the long sides, apply paste and fix as shown at *ss*. Next take each of the three other sides in turn and fold alternately to right and left into $\frac{1}{2}$ inch strips along the dotted lines shown. Cut out the two corners shown hatched and make two incisions *f* as shown thick, each $\frac{1}{2}$ inch in length. Now fold on the lines *pp* from the two sides inwards. Applying paste on the square portions *aa*, as shown dotted, fold from the bottom on the line *qq* and press down. Next fold back the lower flap on the line *rr* and then the sides outwards on *qq*. The lower portions *bb* have to be lifted over the bottom flap in the process. Lift portions *bb* and apply paste on both sides. Fold the bottom slip *tt* upwards and press. Apply paste at the corners of *tt* and fold from the sides inwards. Then apply paste on the $\frac{1}{2}$ inch top edges formed on the three sides, turn over the specimen and fix it over the middle board B, to form a pocket like camera bellows opening upwards.

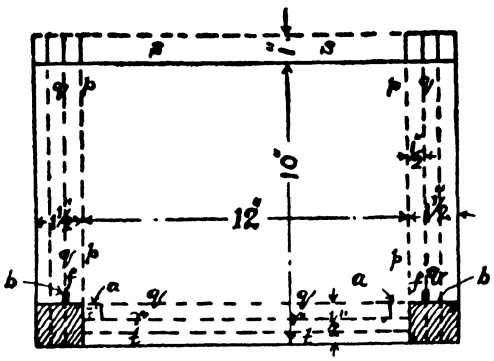


Fig. 99

(7) Next take a strip of cloth 3 inches by 2 inches and double about $\frac{1}{4}$ inch along the longer sides and fix the edges by applying paste. Place a pencil (fig. 100) in it and wrap round one turn as shown. The overlapping portions are then pasted together to form a flap. Attach this flap on the joint between B and C by paste. This forms a pencil holder. The writing case is now complete and can be folded and closed by tying the tapes.


Fig. 100

17. The Folding Chess-Board. Take two pieces of cardboard or pasteboard, 16 inches by 8 inches and hinge them in the manner as indicated in § 16, with strips of cloth about 2 inches wide as shown by dotted lines at **A** (fig. 101). The two cardboard pieces must be close together, so as to allow space for folding only. Cut two pieces of strong packing paper about 17 inches by $8\frac{1}{2}$ inches, one long edge being very carefully cut. Applying paste, fix them on the hinged boards, making them project out on three sides by about $\frac{1}{2}$ inch and leaving bare in the middle, a narrow strip of the joining cloth against the sharply cut edge. Turn over, trim the corners and fold back on all the four sides. Cut out neatly with scissors, strips of glazed coloured paper about an inch wide and leaving a narrow margin equally all round, fix with paste along the boundary as shown at **B**. Now cut out carefully, square pieces of white and black glazed paper of one and seven-eighth inch sides. Fix them with paste, arranged edge to edge in alternate colours, starting from the centre line after leaving a narrow strip uncovered along the hinge. Leave it to dry. The chess board is now complete.

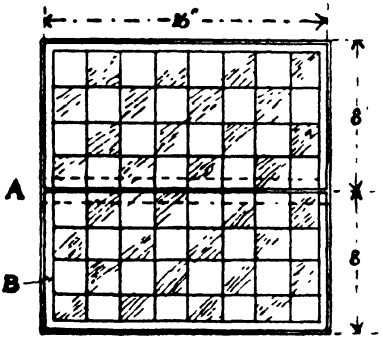


Fig. 101

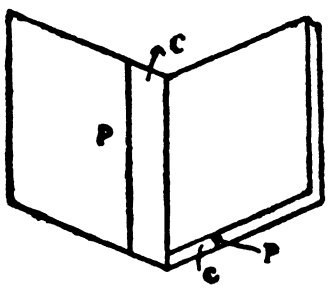


Fig. 102

18. A Blotter. Proceed exactly as in § 12 (c), with stout cover paper $18\frac{1}{2}$ ins. by 15 ins. In this case, however, there need not be any space ($\frac{1}{4}$ in. and $\frac{1}{2}$ in. spaces have been left in fig. 73) between the covers. Blotting paper, folded and cut to the above size, is stitched on a piece of stiff cardboard of the same size. The cardboard covers **C** are bent back and inserted in the pockets of the case **P** as prepared. The right side is shown so inserted. This makes a nice protected blotting pad (fig. 102).

19. A Drawing Portfolio. This will be a very important article for personal use. Cut a piece of cardboard A (fig. 103) ½ inch bigger on every side than the usual drawing sheets. Fix four leather corners on one surface as indicated in § 15. Take a sheet of thick brown paper, about 2 inches longer than the board in length and breadth. Fold one inch of the brown paper from one of the longer sides P shown dotted (fig. 104) and applying paste on the *inside*, press to fix.

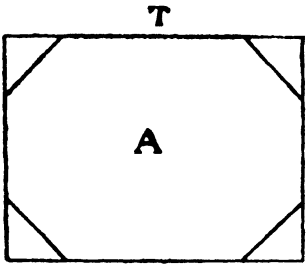


Fig. 103

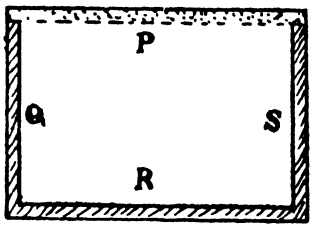


Fig. 104

Next fold 1 inch from the three other sides Q, R, S, and applying paste on the *outside* of the doubled strips shown hatched, place the whole evenly on the back of the board A (fig. 103) and press to fix. Drawings already done or paper for new drawings can be kept in the pocket formed at the back of the surface A (fig. 103). On the side, of A, sheets inserted under the triangles at the corners, are very conveniently held while actually drawing.

20. Khatas. The quarter size of a foolscap paper is convenient and common for ordinary purposes. Take a sheet of thick cover paper half foolscap size, and place on it sheets of writing paper of the same size. Big sheets are cut as follows : Open the gathered sheets on a hard plane surface and place a strong clean straight edge (a piece of strong straight hoop iron will do) along the middle line, obtained by folding a single sheet from the top and opening it out. Press the hoop iron with the left hand, as shown in fig. 105. The right hand, holding a moderate quantity of paper at a time,

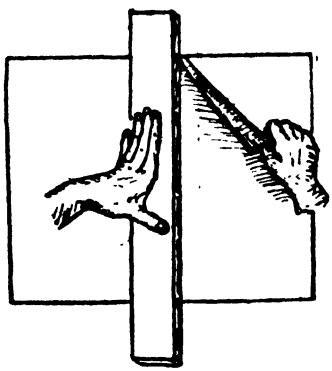


Fig. 105

from the right corner at the top, pulls and tears the paper along the edge. After one lot is torn, the straight edge is lifted, and the cut sheets on the right are placed on the left side, the sheets being turned round so that the torn edges of all the sheets are placed along one edge. All these sheets but one, are then doubled to the left. The sheet left, serves as a mark to place the straight edge, again to cut further sheets to the same measurement. Now place the necessary number of sheets inside the cover, and stitch with the help of a fine steel point or needle and thick cord along the middle line which is obtained by folding as indicated above. Apply paste to the sheets next to the covers and close the book, avoiding creases. Take also a half foolscap sheet of glazed or fancy paper and spreading out, apply paste on it. Place the khata on one half and turn over. Fix by slight pressure and gently rub with some soft dry paper from the line of stitches to the edges, so that there may be no creases (see § 15 in this connection . Leave the khata, placed on a board bigger than the size of the khata to dry under pressure, say under a number of books. When dry, trim* the sides with a heart shaped cutter with a long handle against a rectangular bar of wood, placed on the line to be cut near the edges.

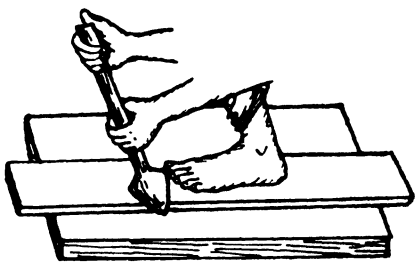


Fig. 106

The left foot is placed on the bar (fig. 106) and the cutter is pulled forward by the handle held by the right hand, while the left hand down below presses on it. A little practice is necessary, but the cutter should be sharp to avoid dragging of the paper. Also be careful that the wooden bar is not cut. The appearance may be greatly improved by cutting the book first and then applying by paste an outer cover of fancy paper, about $\frac{1}{2}$ inch bigger on every side. The portions projecting out are turned down inside the stiff cover paper

* The above method of cutting paper is ordinarily satisfactory, and though the finish is not of the best quality, it is good enough for most purposes. The heart shaped cutter is usually sharpened by rubbing it on a wooden board srinkled with sand. The process of cutting can be seen in Duftry shops.

and then the two adjacent sheets of the khata are pasted and fixed on them from the inside.

The use of a screw-press to act as a vice, makes the operation much easier. The following method of cutting has been suggested, having been found to work well. After sewing, the book or khata is put into a wooden press made of two boards, say 1 inch thick with $\frac{1}{2}$ an inch bolts at the extremeties. The exact line in which cutting should be done is placed in line with the edge of the press. Then the press is fixed in a vice or even to two uprights, so as to prevent any motion while the edges are filed off with an ordinary smooth file. It would be wise to put a handkerchief over the mouth and the nostrils to keep out filing dust. This simple method will do very well and does not call for anything besides bolts. The wooden boards may conveniently be somewhat long, to allow a rigid attachment. The same appliance may be used for rounding the back edge of the book afterwards, as described under bookbinding later on. U-shaped clawps instead of bolts are very successfully used at Bishnupur school.

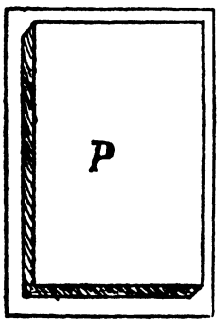


Fig. 107

21. A Jotter. An exact size for the jotter is immaterial. Obtain a suitable size from the paper available, by successive folding. Cut as indicated in § 20 to the size, as much paper as required. Take a thin cardboard also of the same size and place the sheets on it. Gather them together and make the two edges, the top and left, even. Now take a sheet of ordinary paper T (fig. 107) slightly bigger than the intended jotter and apply paste on it. Place the pack P on this with the cardboard first. The pasted paper projecting at the top and at the left, is doubled over the sides to the front (fig. 108) and pressed down. The sides are further rubbed by a piece of rag or soft paper to ensure evenness. When dry, the whole is placed on the wooden board and cut at the bottom and at the right hand sides as indicated in § 20. The

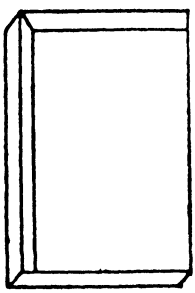


Fig 108

top sheet forms the cover and is thrown away. The paper in single sheets can be pulled out by holding at the right bottom corner. A better appearance may be given by having a cover (fig. 109 formed of two beards CC slightly bigger than the paper. Attach them by a piece of cloth A, of suitable width as a hinge (see § 16) binding C and C. Cover the boards with fancy paper B from the outside, leaving bare the hinge, and double over the three other sides. Hatched portions and dotted lines indicate this. Next cover the turned down flaps with glazed paper X, from the inside, and finally, attach the pack as above prepared but without the bottom board, by simply applying paste to the top edge of the pack, which is placed on A and fixed.

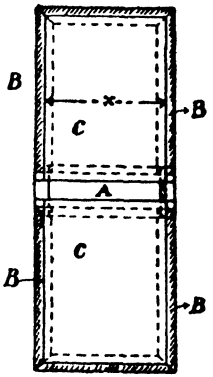


Fig. 109

The preparation of the above case for covers is very important and we shall again refer to it under bookbinding. For the jotter, the simple attachment by adhesive is sufficient. But much stronger methods of attachment are generally necessary.

22. **A Novel and Handy Photographic Album.** This is a type of photographic album that can be made for a few annas. It is of the *loose leaf* variety, so that fresh leaves can be added to it. It can be made of any size and demands no special tools.

The album consists of three parts, namely, covers, leaves and binder.

For the leaves, take some thick stiff uncreased paper. Wrapping paper should do excellently. A good dark shade is preferable. Discard all papers of a spongy texture. In fig. 110, the diagrams A and B represent pieces of this paper. When the size of the page has been determined, cut out the piece B, which is double the size of the page

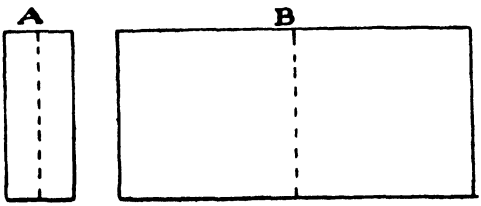


Fig. 110

required, bend and fold over along the dotted line, which divides it into two parts. Then take another piece A of a length equal to the width of the page, but only about $1\frac{1}{2}$ inch in width. Bend and crease this along the dotted central line. Take a piece C (fig. 111) of stiff cloth, of the same width as A, but of length about 1 in. greater. Half inch from each of the short sides is folded, pasted and doubled back. It is next covered with adhesive on both sides and placed in position as shown (fig. 112) leaving no more than $\frac{1}{32}$ in. between the edges of A and B. Press to fix the whole together, thus forming a leaf of double paper, the cloth acting as a hinge. It is desirable that these should be dried under pressure, so that no cockles ensue. If a press be available, that undoubtedly is best for the purpose; but three or four large books can be made to answer just as well, specially if well weighted at the top.

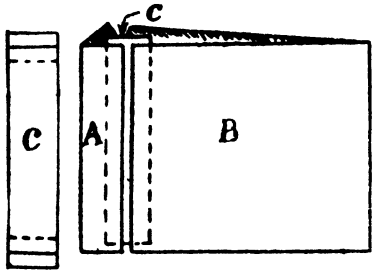


Fig. 111 Fig. 112

When dry, the specimen thus prepared forms one leaf. As many more exactly like it as desired can be made, or they can be added afterwards as occasion demands.

The paper hinge portion of the leaf A is then perforated by a few holes, properly spaced. This is best done with a punch (available for a few annas), as a clean cut hole is desirable. The first leaf can be used as a template.

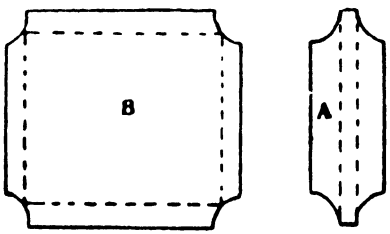


Fig. 113

Two covers are now required. Take four thin but stiff pieces of cardboard; two of the size of the page, and two of the size of the hinge as seen in the dotted portions of B and A (fig. 113). Each of these is then covered with cloth or stiff paper of a colour and texture deemed suitable for a cover. The usual method of book covering is adopted. In fig. 113, the outer lines represent the covering cloth. The

corners are cut as shown. Cover with adhesive one side of the cardboard and also the inner surface of the covering paper and lay the board in position on the covering paper and smooth the latter down. Four flaps are then left over. These are covered with adhesive and folded over on to the cardboard, making the corners as neat as possible. Each pair **A** and **B** is then hinged together with strips of cloth as in the case of the leaves. Stiff pieces of paper of the size of **A** and **B** together, are used to hold the whole in position, and to hide the hinges and the folded down flaps of the covering paper by pasting them over the inside. It is desirable that these also be dried under considerable pressure.

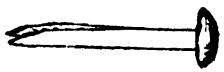


Fig. 114

The hinged portion of each cover is then pierced exactly in the same manner and position as the leaves, so that the alignment of the leaves on assembling is correct.

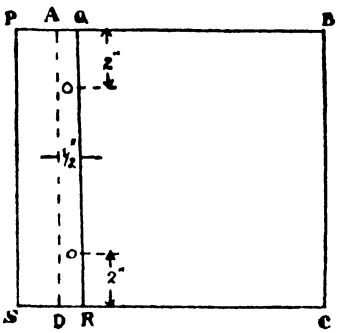


Fig. 115

To assemble, the leaves and covers are placed together and held in position by threading through the holes a piece of cord, or silk, or otherwise.

Photographs or postcards may be pasted in, in the usual manner, or the corners inserted in diagonal cuts made in the paper, as is usual in many postcard albums. These cuts can easily be made by slipping a piece of glass between the two papers forming each leaf, using this as a cutting surface and making the cuts with a sharp pointed penknife. If an adept with pen or brush, a suitable inscription combined with some amount of ornament may be put on the cover.

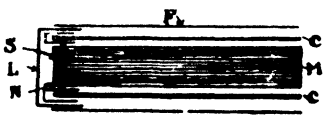


Fig. 116

23. Magazine Binding. Procure some linen, cardboard, and some brass fasteners (fig. 114). Cut two strips of the linen $1\frac{1}{4}$ ins. wide. Place the books or papers **ABCD** shown in fig. 115 (or **M** shown in fig. 116) in serial order, face upon the table and punch two holes

almost on the binding edge, at a distance of about 2 ins. from the top and the bottom. Lay one of the linen strips **PQRS**, with one of its edges only half an inch over the margin, and push two paper fasteners (one shown at **P** in fig. 116) through each hole. Turn over the pack and place the other strip of linen in like fashion and fasten down. Place two folded sheets of blank paper (shown in section at **N** in fig. 116) of the size of the books on the top and the bottom of the pack. Fix them to the linen by paste, evenly on the pack. From the cardboard, cut two pieces of the same size as that of the books. Place these **C, C**, on the faces of the book and pasting the linens **S** well, bring them over the edge to the top of the cardboard. While still wet, paste another strip of linen **L**, wide enough to go round the back and half an inch on each cover. Then for further security and neatness, paste brown paper or strong fancy paper **F**, on the top and bottom and trim to the size of the cardboard. Alternately, the edges of the fancy paper may be turned down, in which case, the cardboards, should be slightly bigger than the book and the fancy paper still bigger, so as to allow folding over the cardboard. Finally, paste one fold of the blank sheets on the inside of each cover.

24. A Gramophone Record Album. The principle on which a gramophone record album is made is, to provide sufficient thickness of paper at the binding edge, to balance the thickness of envelopes containing records. These envelopes are to be individually and suitably hinged to the thick paper at the binding edge. This is done by what is known as the *jointed guard* method. The records being very thick and heavy, the guards (i.e., the thick binding strips) require to be thick also and are made of mill-board. Cut as many pieces of guards as required, 12½ ins. by 1 in., and for every guard cut piece of good strong linen 12½ ins. by 4 ins.

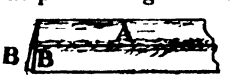


Fig. 117

Bevel the inside edges of the mill-board, apply paste on both sides and finally cover it up (**A**, fig. 117) with the piece of linen, leaving 1 in. **B, B**, loose on both sides for attaching the envelopes. The envelopes should be made of good strong paper, lined with cloth if possible, and

should consist of two separate parts. Fig. 118 shows one piece to be cut, 15½ ins. by 14 ins., with angles cut out at the corners. The paper should be folded along the dotted lines and the folded parts pasted evenly all over. Fig. 119 shows the other part to be placed evenly on the

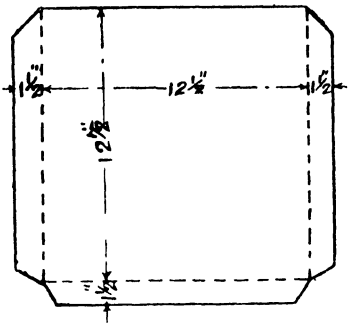


Fig. 118

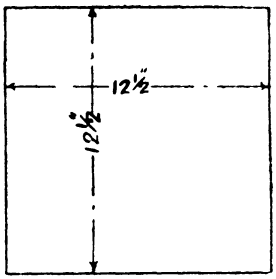


Fig. 119

top of the first, with its edges in line with the folding. The pasted edges are rubbed down and pressed to stick. Fig. 120 shows the finished article with the thumb and title holes (**S** and **T** respectively) cut out. The envelopes can now be attached to the guards by pasting the loose parts of the linen and inserting the left side **L** of the envelope between the two pieces of linen, leaving about ½ an inch joint between the envelope and the guard. When the required number is made up in this way, place all the guards together. Cut two pieces of cloth 12½ ins. by 4 ins. and insert 1 in. from one of the longer sides of each piece between the two top and the two bottom guards respectively, leaving about 3 ins. free, which are pulled over the top and bottom guards, forming the joints for attaching the boards. Drive three nails through from the top, turn over and do the same at the back. The nail should be shorter than the thickness of the book and the front and the back nails placed alternately. Alternatively as in § 22, 3 or 4 holes may be made with a punch for binding all the guards together with a piece of ribbon. Now prepare a cover, as described in § 21, of proper size and

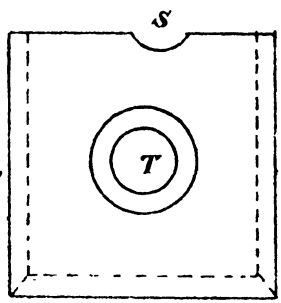


Fig. 120

attach on the book. Up to 20 records should be put in one book, as anything heavier, cannot be handled with ease. Attachment of a strap and buckle to the fore-edge of the boards will provide a handle for carrying purposes. Maps, big pictures, tables etc., which have to be folded to suitable sizes, can be kept in similar books. Fold them to suitable size, and attach a strip of strong paper to one side, half projecting out. This is to be attached between the linens of a guard of proper thickness.

25. Bookbinding. The pages of the book will be in sections which have to be sewn together. The sections are arranged in a pack with strong folded lining paper at the top and at the bottom.

Take two pieces of tape about an inch wide and sew on the first section as shown in fig. 121. A wooden vice would be very useful in making 4 saw-cuts at the edges of sections gathered together before sewing, to help in working the needle. Place the second section on the first and passing the needle in the same way back, tie with the free end of the thread at the beginning. Proceed in this way with the other sections but remember to pass the needle through the loop of the previous sections at each end. Paste the tape on the back of lining paper. Apply a piece of linen L at the back (fig. 122) covering the tapes. Cut the book at this stage from the three sides. If the wooden vice be available the book might be held with all but the sewn edge within its grip and a round shape be given to the back of the book with a small hammer by gentle tapping. It may be given without a vice by the method explained in § 20. In the absence of these, careful hammering as shown in fig. 123, may also be made to give

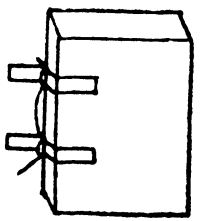


Fig. 121

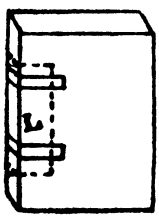


Fig. 122

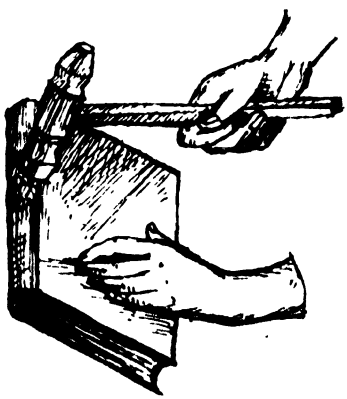


Fig. 123

a round shape. Now prepare the cover with paste-boards P, P (fig. 124) slightly bigger than the cut size of sections, joined by cloth or leather hinge H of proper width at the back. Triangular corners CC of cloth or leather, over clean cut fancy paper F on the boards would be an effective half-binding.

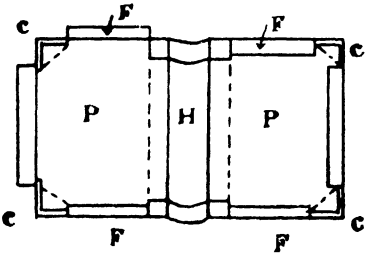


Fig 124

Alternatively, a whole piece of cloth or leather may be used to form the hinge at the back, and the covers on the boards. The manner of using them as in previous sections will be apparent by looking at fig. 124, or better at a book, so bound. The book after sewing, cutting, and rounding is pasted on the outside and place symmetrically on the inside of the pasted cover.

A little practice will be necessary but great pleasure will be derived if one can properly bind one's own book for personal use.

26. Paper Flowers. The kind of paper used for work of this nature is known as *Crepe Paper*, which is available in the market and is stocked by certain book sellers. This paper is crinkled finely and lends itself to stretching, when required to produce a definite shape. The paper is supplied in a variety of colours and shades, suited to the natural hues of the different flowers.

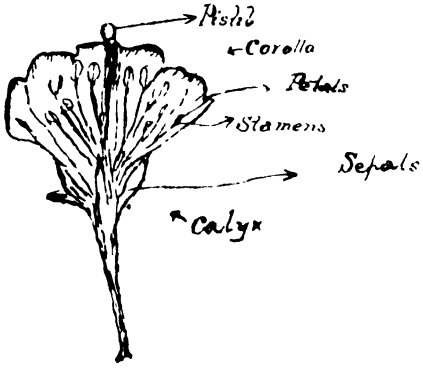


Fig. 125

After a flower is chosen, the leaves, sepals and the petals of the calyx and the corolla respectively, the stamens, and the pistil (fig. 125) are to be cut in outline, several at a time, from a folded sheet of paper, according to the sizes and outlines of these parts. They are then given their respective shapes, and assembled to form the flower on a wire stem, which is covered suitably with green crepe paper.

The outlines of the different parts of a flower have to be obtained first. This is best done by securing a good specimen of the flower and separating its component parts. Rough outlines are obtained by placing the severed parts on a piece of paper and cutting them out to form the pattern. For permanency and future use, the material used for the pattern may be cardboard instead of paper. Cut across the grains of the crepe paper through the entire thickness of the folded packet (fig. 126) so that the portion cut may be a little bigger than the pattern chosen. Stretch the paper slightly along the cut edge. Take from this pack, a thickness with about half a dozen sheets in it and placing the pattern on it lengthwise, along the grain, cut round the edges of the pattern (fig. 127). When a continuous strip is required, e.g., in cutting the calyx, or any

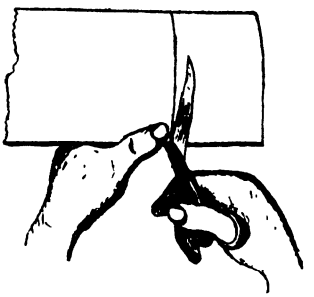


Fig. 126

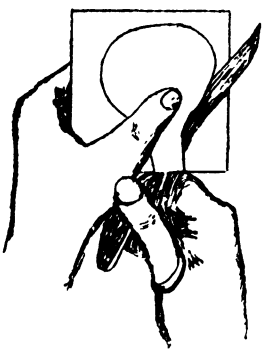


Fig. 127

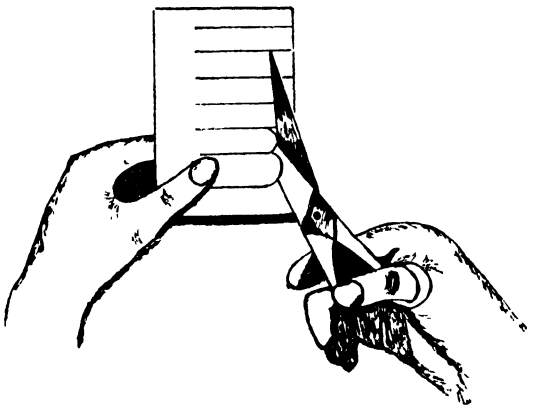


Fig. 128

corolla, where the petals are joined together at the base, make straight cuts, of depths and at distances as required, and shape up the edges as shown (fig. 128).

27. The cut strips can be shaped as required, in the following ways :—

(1) A ripple effect at the brim in certain petal tips, can be given by "fluting", which involves stretching the paper slightly across the grain. Hold firmly a pack of several sheets at the left extremity of the edge to be fluted, between the left thumb and forefinger. Similarly holding by the right hand, with the thumbs about an eighth

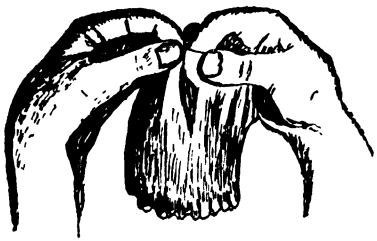


Fig. 129

Fig. 130

of an inch apart (fig. 129) pull the paper gently inwards, stretching the material. We obtain a trough and a crest of a wave at the brim of the paper. Shift the left hand on the adjoining curve for making the next wave in the same way. Repeat the process until the entire length of the brim has been fluted.

(2) Generally the petals have to be given a convex shape which process is known as "cupping". Take several petals and placing the two thumbs in the centre and the forefingers on the reverse side (fig. 130) near the brim, work them to the shape desired.

Fig. 131

(3) The petal tips have sometimes to be sllghtly bent, either inwards or outwards, as required. This process is known as "curling". To do this, hold the petal in the left hand and placing the brim of the petal between the thumb and a blunt edge, e.g., the back of the knife (fig. 131) draw the paper upwards with gentle pressure exerted by the thumb. Alternatively, a knitting needle can be used to roll the brim (fig. 132) of the petal. A crushed effect is

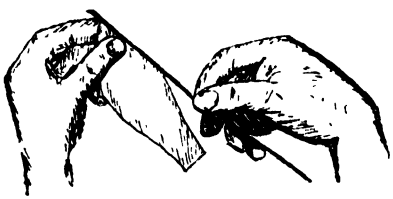


Fig 132

obtained if desired, by closely gathering the paper rolled on the needle (fig. 133).

(4) The bottom edge of the petals or leaves has to be gathered closely before fixing them in position. This is done by placing the

Fig. 133

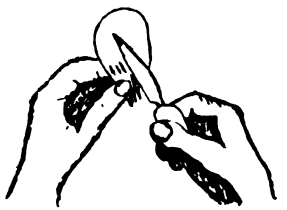


Fig. 134

left extremity of the edge between the left thumb and the forefinger and gathering the edge close together in a fine stroking by means of a penknife (fig. 134). After some practice, the use of a knife for the purpose of stroking can be avoided.

(5) For fringing the crepe paper, cuts are made, from one edge of the paper folded several times with the grains up to about half an inch from the opposite edge. The cuts for the fringe should be close together, and the paper is to be stretched more or less fully, according as the fringe is to be fine or coarse respectively. If the cuts are very close and deep in figure 128, we get the fringes.

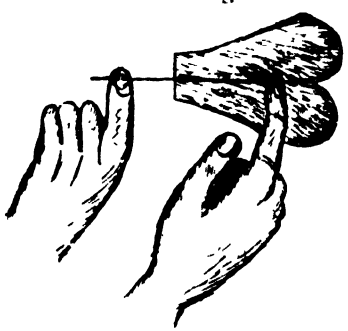


Fig. 135

(6) Wiring of petals or leaves is done by holding the ends of the wire on a flat board with the fingers, and brushing one side of the wire with paste. This is now placed along the middle of the petal or leaf (fig. 135) with the pasted side down and with an extra length of an inch projecting below the base. Press to dry. For a double leaf, paste is applied over the edges of the petal and on the wire, which has been fixed on one leaf as indicated above. The second leaf is then pressed on this evenly.

(7) The edge of a petal can be tinted differently from the body, if necessary, by soaking it in water first, to remove the colouring. Any desired tint may then be applied by a small fold of the white crepe paper dipped in the coloured liquid.

(8) Beads are prepared by taking a square piece of crepe paper and doubling along a diagonal to form a triangle ABC (fig. 136), where AC is the hypotenuse. Place the first finger of the left hand symmetrically on the paper, with its point against the middle point of AC. Bring the left corner A over to the right and round the finger, and then the right corner C over the left and round the outside (fig. 137), so as to obtain a conical shape. The base of the cone, however is closed up as shown in fig. 138. Round beads are easily prepared by first making a ball of crepe paper of suitable size and then wrapping it smoothly all over by crepe paper stretched and gathered underneath (fig. 139). The

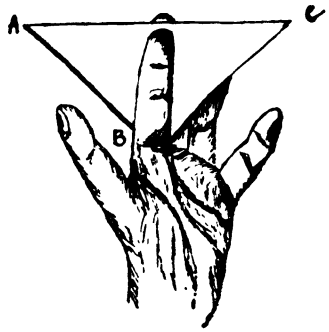


Fig. 136


Fig. 137


Fig. 138


Fig. 139


Fig. 140

centres of some flowers are flat. This is obtained by preparing a round ball as above and flattening it out by pressing it against a hard surface (fig. 140).

(9) The stamens are prepared with narrow (about $\frac{1}{8}$ inch wide) strips of crepe paper cut across the grain. Stretch fully and then fold one small side, about $\frac{1}{8}$ inch. Roll the strip diagonally downwards

on itself, so that a heavier top on a narrow filament is obtained (fig. 141). A piece of twine properly coloured may also be sometimes used for the purpose, supporting the top extremity which consists of a small piece of crepe paper thickened by twisting. The pistil is generally of a bigger size than the stamen, but is prepared in the same way.

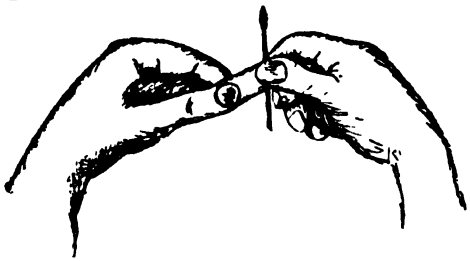


Fig 141

28. When assembling the various parts, the petals are first properly arranged round a prepared centre in the shape of the flower with one end of a wire strip, forming the stem inserted from below to the centre of the flower. The wire is then wound round twice or thrice to close up the bases of the petals, the rest of the wire strip forming

Fig. 142

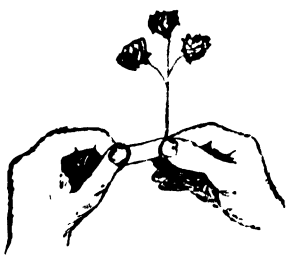


Fig. 143

the stem (fig. 142). Cut away the surplus paper below the wire fastening, leaving a margin for security. Attach the sepals over the wire knot with paste. Now begin wrapping the wire stem with a narrow strip of crepe paper cut across the grain. The strips should be $\frac{1}{2}$ inch wide for short thin stems up to 2 inches for long thick stems. If necessary the strip of paper may be doubled. The method of wrapping the stem is to attach an end of the strip to the calyx. Stretch the strip and wind round two or three times tightly and then in a slanting direction down the wire, which may be twirled in the right hand, while the left hand feeds the strip (fig. 143). When a leaf is to

be inserted, its base is closed up and placed on the wire and covered up (fig. 144) in the wrapping of the wire stem by the paper strip. Sometimes when the leaves are thin, long and pointed, like the grass blades, fringed paper can be wrapped round the wire stem with the uncut portion of the paper. At the end of the wire stem, a little paste is used and the strip is tightly wrapped round the wire twice or thrice as in the beginning. If the wire strip is to be lengthened, simply overlap a second wire strip by one or two inches on the first, instead of twisting the wires. For detailed description for making individual flowers, the Dennison's books, easily available from the book sellers, may be consulted. As a matter of fact Dennision's books have been followed in the writing of the above instructions. But the best plan would be to pick out two flowers, alike in appearance and size, and to seperate the parts of one flower, to serve as models in the preparation of the different parts of the paper flower. When the individual parts have been cut out and shaped properly, they would be finally arranged to form the specimen, with the other flower serving as a guide.

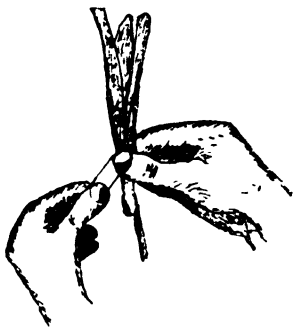


Fig. 144

29. Parallel Fold Models. A different class of work consists of models formed of somewhat thick paper with narrow parallel folds. The paper should be rather stiff and rectangular in shape. The folds must be alternately made in half an inch strips or less, in a zigzag fashion, like palmyra leaves, parallel to the short sides of the rectangle. The following models are suggested as illustrations :

Fig. 145

(1) *The Fan.* Take a rectangular sheet of stiff paper, 36 inches by 8 inches and make folds in it, as suggested above. Again fold in the middle. To stiffen the end strips on both sides (fig. 145), open out two or three extreme folds, and applying paste between the leaves, press down and leave them to dry. The zigzag free edges

may be given a diamond or a curved shape, by means of a sharp knife, or with a pair of scissors. A strip of linen about 3 inches in length should be securely attached by paste over the opposite edge as shown. The article may now be opened out and can be used as a fan (fig. 146).

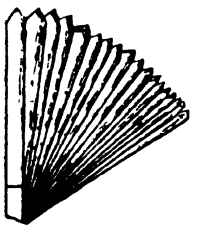


Fig. 146

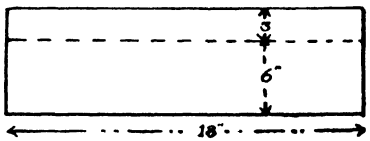


Fig. 147

(2) *A Chimney Shade.* Take a rectangular sheet of paper about 18 inches by 9 inches, and fold it lengthwise at about 3 inches from one side as shown by the dotted line (fig. 147). Now form the $\frac{1}{2}$ inch parallel folds in the paper and press down. Spread out slightly the zig-zag doubled edge **E** (fig. 148), while holding the folds collectively at the other edge **F**. The doubled portion is deftly pulled out about half an inch fold by fold. The specimen is then pressed tightly particularly at the zigzag edge. It now remains to apply paste on the surfaces of the angular outer strips, and opening out the specimen

Fig. 148

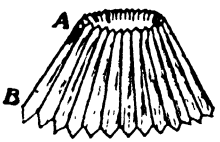


Fig. 149

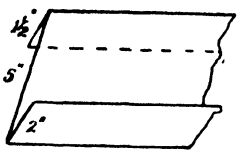


Fig. 150

in a circle, to fix them together at **AB** (fig. 149) keeping inwards the surface with the doubled portion. The specimen can be placed on the chimney of a lamp to serve the purpose of a useful shade.

(3) *A Top Hat.* Take a rectangular sheet of paper, about 3 feet in length, and 9 inches in width. Fold lengthwise 2 inches from the bottom, and $1\frac{1}{2}$ inch from the top on opposite surfaces (fig. 150). Now fold the paper into $\frac{1}{2}$ inch parallel strips as in previous examples.

Holding the specimen in the middle, spread out the edges, and pull out the doubled portions fold by fold (fig. 151) to positions perpendicular to the middle limb. Press the specimen tight, particularly at the corners. Apply paste on the surface of the end folds, open out and join

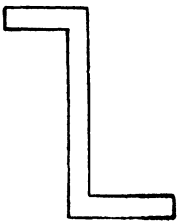


Fig. 151

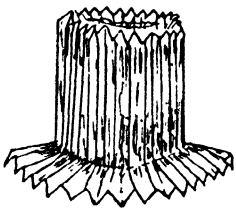


Fig 152

them together keeping the two inch perpendicular ledge on the outside. The specimen can now be fitted on the head, as a top hat, and can be used as a part of fancy costumes (fig. 152).

(4) *Paper Lantern.* Take a sheet of paper about 3 feet in length and 15 inches wide. Fold the paper lengthwise on opposite surfaces, at 3 and 6 inches from the edges. Obtain the $\frac{1}{2}$ inch parallel folds as in the previous examples, pulling out the folds of the smaller ledge at an inclination of 30 degrees, and the folds of the bigger ledge at right angles to the central limb (fig. 153). Now apply paste on the extreme folds at the top and bottom, open out and join them to form the lantern, keeping the smaller ledge on the outside (fig. 154). Attach a piece of wire to the base of the smaller ledge to form a handle

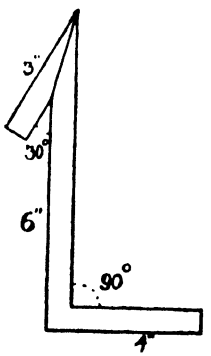


Fig. 153

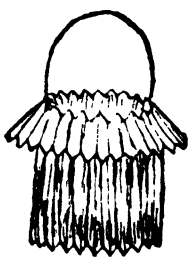


Fig. 154

as shown. At the bottom of the lantern and on the inside is stitched a disc made of cardboard on which the candle is fixed.

(5) *Paper Vase.* Take a rectangular sheet of paper, about 18 inches long and 15 inches wide, and make folds lengthwise as shown in fig. 155. Next fold into $\frac{1}{2}$ inch parallel strips as in previous examples. Then pull out the folded portions upto different angles, as shown in fig. 156, and finish the vase by opening out and joining the end strips with paste.

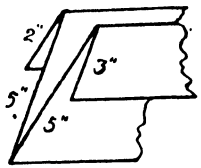


Fig. 155

30. It will be noticed in the previous examples that a definite procedure is followed in each of these models. By a combination of (a) the number of horizontal folds, (b) the widths between horizontal folds, (c) the nature of the folds (inside or outside), (d) the inclinations of the contiguous limbs to one another, (e) and the manner

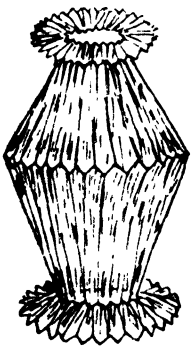


Fig. 156

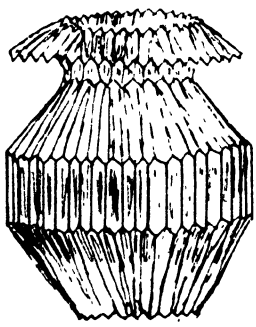


Fig. 157

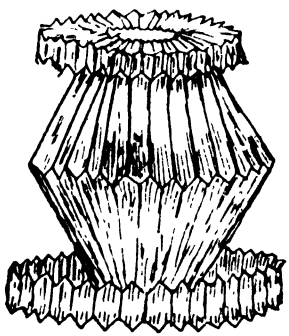


Fig. 158

of fixing with a particular surface inside or outside, a large variety of models can be prepared.

Two other examples are shown in figs. 157, 158, which can be easily followed.

31. Honeycomb Models. A class of models, made with fancy paper of different colours, having a honeycombed appearance, lends itself to a variety of pretty forms.

The specimen as prepared in its folded position is supported by two thin bamboo strips projecting out as handles. By manipulating these strips, the model assumes its primary and other forms. (Cut the sheets of thin fancy paper of different colours all to the same size, say about 9 inches by 16 inches. Arrange them in a pack forming groups

of several sheets (6 to 10) of same colour placed together. Groups of different colours however should be arranged in the same serial order. Place the pack on a wooden board (fig. 159) A, against a stop, *i.e.*, a fixed wooden strip B at the left side of the board. Fix the top edge of the pack of paper to the board by two or three small nails. Turn the whole pack over the line of nails as shown in the figure. Now turn down one sheet at a time on the board and apply paste in thin (one-sixteenth of an inch) parallel vertical lines about half an inch apart. This process is easily done by a pasting apparatus (fig. 160) consisting of a board which has parallel vertical ridges standing on one surface (shown) and a handle on the other.

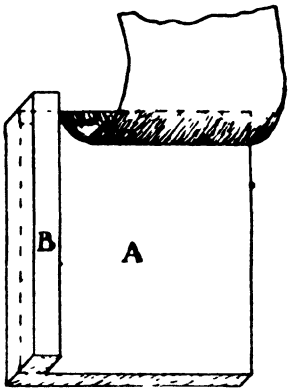


Fig. 159

The extreme ridges at the two sides C and D are situated at half an inch and a quarter of an inch respectively from the sides of the board. The pasting apparatus is dabbed on a pasting pad, where thin flower paste has been spread over an evenly stretched piece of cloth padded underneath. It is then applied on a sheet on the board A (fig. 159) with one of its edges (say that with $\frac{1}{4}$th inch margin) against the stop B, on the board. The next sheet of the fancy paper is turned down on the former sheet. Paste is applied on the pasting apparatus which is turned round and placed, so that the half inch margin is now placed against the stop

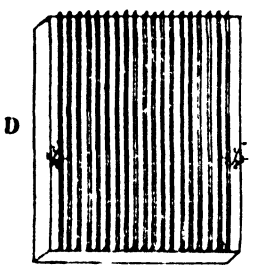


Fig. 160


Fig. 161

B on the board. In this way the lines of fixation between the successive sheets on A are displaced alternately by quarter of an inch. Proceed in this way until all the sheets (50 to 70) are joined to one another. Now take out the pack, and allow it to dry under pressure by placing it under a board with weights on it. When dry, cut out pieces from the pack in the shapes of crescents (fig. 161) by means of a pair of scissors, or better

still, by gouges. Take a piece of stiff paper and apply paste on it and fix a number of crescents (3 shown in fig. 162) according to a design on this pasted paper. Next apply another sheet of stiff paper by paste on the top of these crescents. Fix two bamboo strips parallel to one another, projecting downwards, on the outside of these stiff covering papers, and apply over them, two other smaller pieces of pasted stiff paper

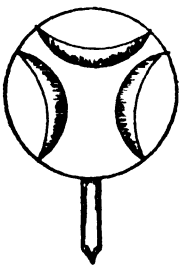


Fig. 162

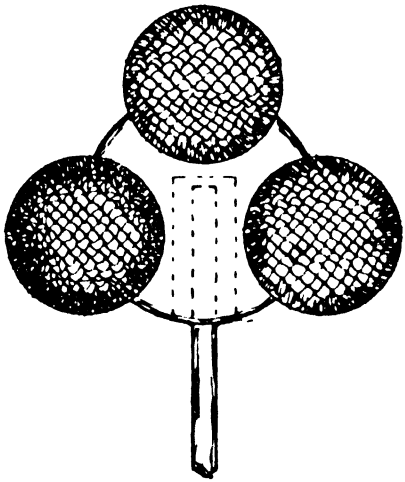


Fig. 163

to fix the bamboo strips firmly. Now cut the sheets of stiff paper in a circle, outside the crescents, almost touching the outlines of the crescents. Pull apart the projecting ends of the bamboo strips, and turn them

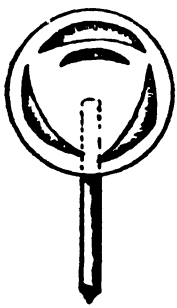


Fig. 164

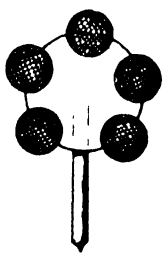


Fig. 165

about the other extremities until they coincide back to back, when the design will have taken its proper form (fig. 163). Two other examples with crescents are suggested in figures 164 and 165. An example with

triangles is shown in fig. 166. This specimen may be made to assume a

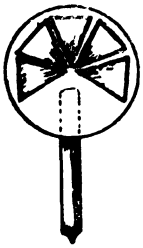


Fig. 166

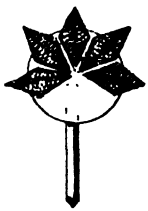


Fig. 167

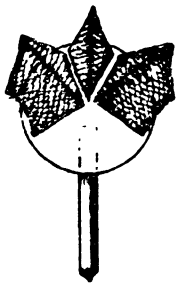


Fig. 168

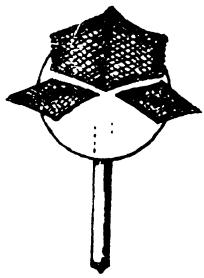


Fig. 169

variety of forms by the manipulation of the bamboo strips as shown in figs. 167, 168 and 169.

Other complicated designs can be cut out to produce more striking effects. A fan or models of a similar type can be prepared

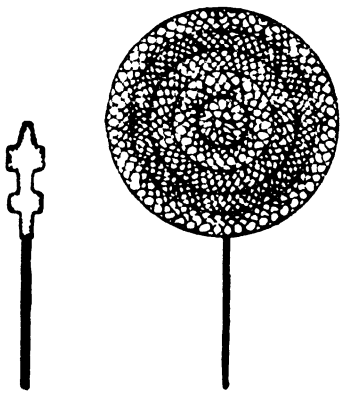


Fig 170

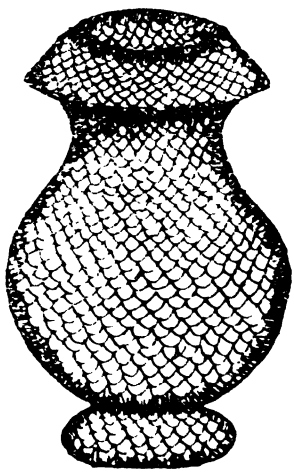


Fig. 171

by making straight cuts along the sides of the paper pack as shown in fig. 170 (left). The method of preparation is similar but the same piece of stiff paper strip is carried over the two surfaces to cover the prepared section from the back, and fixed on the bamboo strips after the style shown in fig. 146.

Fig. 171 shows a model of the shape of a jar. In this case, instead

of cutting the crescents, the outline of half of the jar in its vertical position is cut out from the prepared pack, and mounted as usual between the covers and the bamboo-strips or without them.

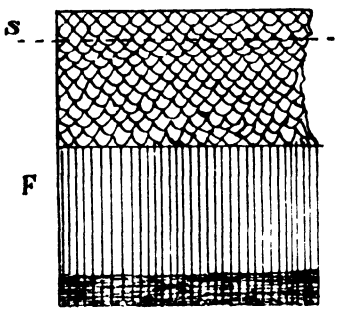


Fig. 172

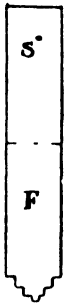


Fig. 173

Fig. 172 shows the example of a frieze, which produces a striking effect. In the process of pasting, a portion of the fancy paper sheet projects below the board **A** in fig. 160, and is therefore without any paste. Thus we get the loose hangings **F**, in the cut section in fig. 173. It is hung by a string through the top, if desired.

Fig. 174 shows a unit and a section of a wreath (fig. 174) prepared on the same principle. A round or oval or star shape makes excellent effect. So also, an X-shape can be prepared to produce a garland in small sizes or a wreath in bigger sizes. The use of a string is not essential.


Fig. 174

Fig. 175 shows a single unit of a bigger wreath made without the use of the pasting apparatus. One pair of two units are joined by gum at

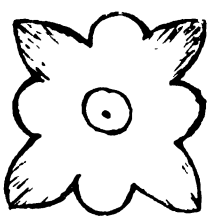


Fig. 175

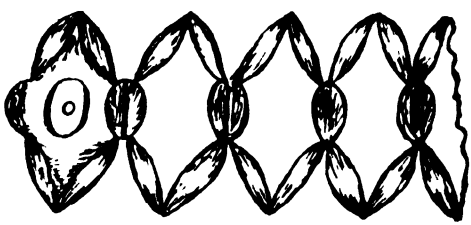


Fig. 176

the points of the leaves (shaded portions) while the next pair is joined at the centre and so on. The wreath when finished, looks like fig. 176.

In the latter models, the same piece cannot however be manipulated to take different forms.

32. Weaving with Paper Ropes and Paper Tapes. The crepe paper lends itself to the preparation of a variety of pretty ropes and tapes, which can be effectively used in the making of baskets, trays, handbags, blotters, lampshades etc. The following instructions will suffice for general purposes, but for greater details Dennison's books should be referred to. The rope is prepared by cutting out a strip crosswise with a pair of scissors from one extremity of the folded pack of crepe paper (see fig. 126). The width of the strip determines the thickness of the rope. Open out the strip and fixing one end conveniently, stretch out the paper by pulling it gently and twist it from the free end to form a rope. If desired, two or three or more of such

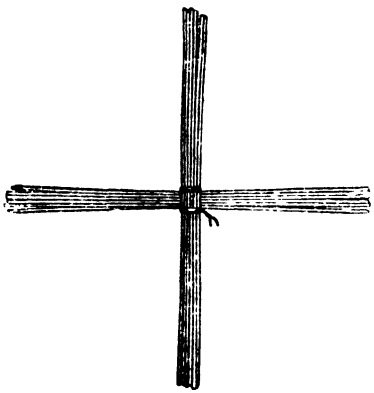


Fig. 177

ropes twisted in the same way are held together at one end and are twisted together in the opposite way from the other end. This makes the rope thicker and stronger. It also looks prettier if papers of different colours are used. In preparing baskets or other articles with paper rope, a frame work of wire is necessary, the centre of which forms the starting point of the base of the article. The wires are of iron and have to be wrapped first by strips of crepe paper about $\frac{3}{4}$th of an inch wide. The method of wrapping has been described under the section dealing with paper flowers. Two lots of such prepared wires, containing the same number in each, and spread out in the form of a sheet, are placed at right angles to each other and fixed as shown in fig. 177, by a piece of fine wire. Now divide the wires into

groups of two wires each, radiating like the spokes of a wheel from the centre (fig. 178). One such group of two wires should be separated into two single wires to make the number of the radiating spokes uneven. The rope should now be woven round continually over and under successive radiating wire spokes. It may be noticed that unless the number of the radiating wires is uneven, the rope will not be placed in consecutive turns over and under respectively of individual radiating spokes which may be further separated into single wires, any of which may be cut out when necessary. When woven in the way indicated, the round base is easily formed (fig. 179). For a square base the rope has to be looped round once or twice over each of the four

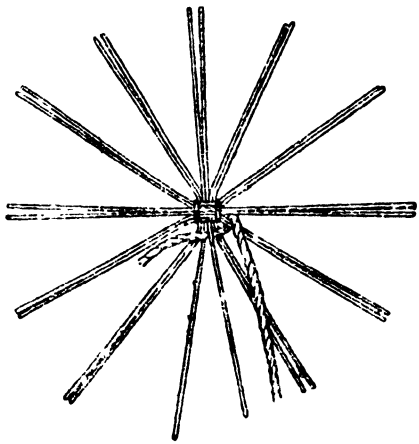


Fig. 178

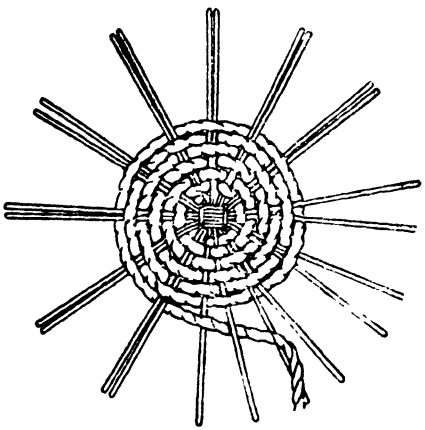


Fig. 179

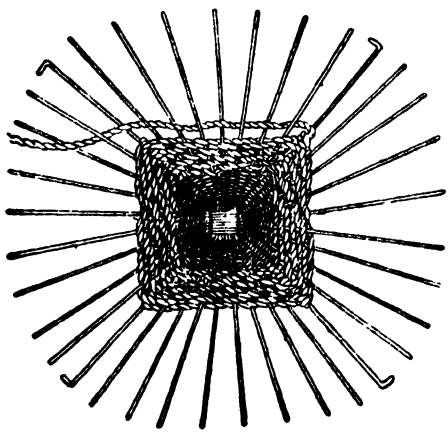


Fig. 180

wires which radiate at right angles to one another from the centre at the four corners of the required square base (fig. 180). A triangular base can be formed by looping similarly on three radiating wires equally inclined to one another. A heart shape can be given by taking

the rope over wires and retracing it at desired places as shown in fig. 181. For an oval shape one of the two sets of the original wires

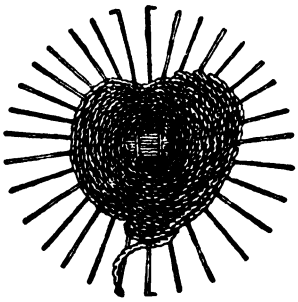


Fig. 181

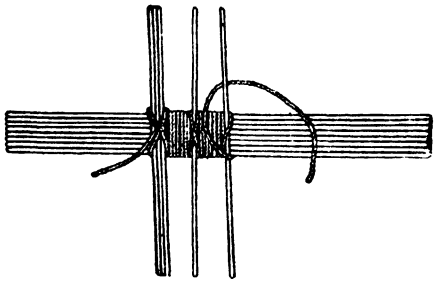


Fig 182

placed at right angles to one another, should be spread out (fig. 182) while being fixed on the other. The principle of working is the same for the different bases, but thicker wires may be used more conveniently, as the work proceeds, the lower end being tucked into the weaving. After the base is formed the radiating wires are bent at right angles to the base and then given any desired shape. The paper rope is carried round and round to fill up the spaces between the wires to form the sides of the basket (fig. 183). When the desired height is

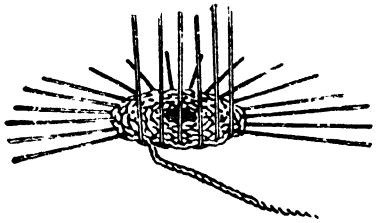


Fig. 183

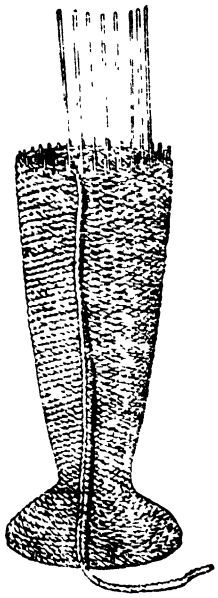


Fig. 184

obtained it remains to finish the edge. The wires are cut at about half an inch (fig. 184) standing above the weaving line. Additional wires are inserted in the junctions of successive wires and the weaving

rope for thickening the edge. The wires are bent back and the ropes are looped round to cover them along the edge until the whole of the edge is finished (fig. 185). When one rope is used up and another has

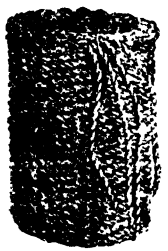


Fig. 185

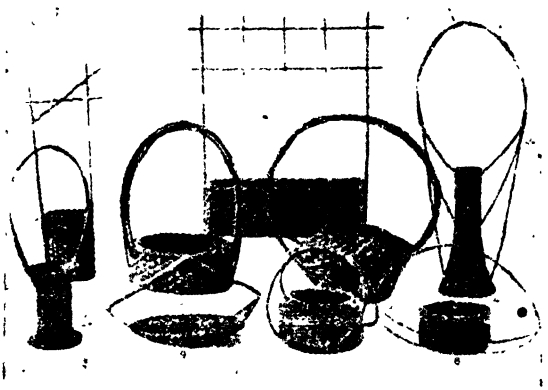


Fig. 186

to be joined, both should be thinned at the joint, and lapped together and twisted, until the joint becomes hardly discernible. A few examples (from Dennison) are shown in fig. 186.

33. Paper Tapes. These are prepared by cutting out strips of crepe paper across the grain with a width (fig. 187), three times that of the required tape. After the strips are stretched out they are folded together twice lengthwise, so as to form three equal leaves (fig. 188). This forms the tape which may be strengthened if desired by putting inside, a strip of stiff paper of an equal width. Lengths are next cut to suit the length and breadth of the surface of the article

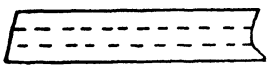


Fig. 187

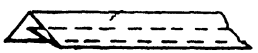


Fig. 188

to be prepared. For weaving, a number is spread out parallel to and against one another. Crossed strips are next placed over and under these strips alternately and beaten up to close all empty spaces. Tapes of different tints can be combined to produce excellent effects. After

weaving in this simple manner (fig. 189), the material can be used as cover of different articles, the edges being hemmed in by silk or leather. In this way beautiful handbags, blotters, lampshades and other fancy articles can be easily prepared.

34. **X'mas Crackers.** These (fig. 190) are made in different sizes by rolling a piece of thick paper perforated across the middle and covered with projecting fancy paper on the outside. Two constrictions are made near the extremities and in the hollow space inside, is

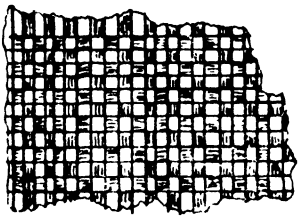


Fig. 189

Fig. 190

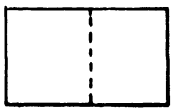


Fig. 191

put a puzzle, a picture, or a motto and also some small trinkets or toys of interest to a child. To the constricted portion are attached the ends of a folded paper-strip which contains some fulminating powder inside the fold. This detonates when the cracker is pulled apart, and the trinkets and puzzles come out to the delight of the children.

It may not be convenient to perforate pieces of stiff paper (fig. 191) but two smaller pieces joined by tissue paper will serve the same

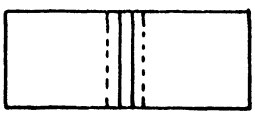


Fig. 192

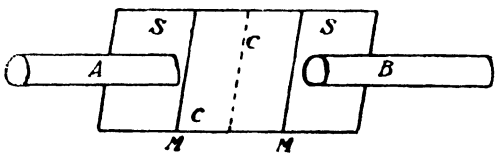


Fig. 193

purpose (fig. 192). Two wooden rollers **A** and **B** (fig. 193) having the same diameter as that of the cracker are secured. These and a piece of card-board **C**, are placed on the stiff paper **S S** side by side as shown. On the card-board is placed small interesting articles and the folded paper, which contains the detonater in the middle.* The extremeties of the folded paper are, however, fixed by paste on **S, S**, while the other

* This can be obtained from the Oriental Fireworks Co., Chitpore, which Company supplied this article to Messrs. Bonbonier Ltd. (now defunct).

articles are left loose. The whole is then rolled together and attached by paste in the form of a cylinder, which is next covered by fancy paper or crepe paper and fixed by paste. Constrictions are produced at MM (see also fig. 190) by tightly tying with a piece of twine. The cracker is then allowed to dry. When dry, the twine and rollers are removed, but if

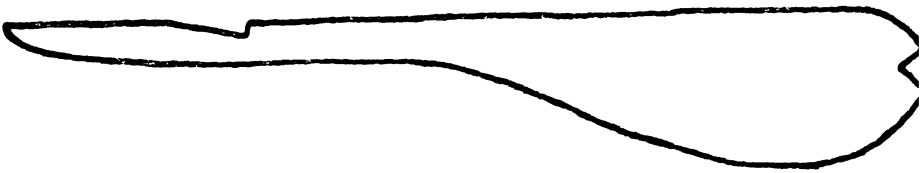


Fig 194

coloured ribbons are used instead of twine, these may be retained. The ends TT (fig. 190) may be fringed to improve the appearance. Sometimes a flag, a feather, a flower or scraps are fixed on the outside near the centre of the cracker for the purpose of decoration.

35. **The Glider.** Take a thick piece of card-board or ply-wood about one fourth inch in thickness, seven-eighth of an inch in width and four and seven-eighth inch long and cut exactly to the shape as shown full size in fig. 194. This part forms the *fusilage* of the glider. The *elevator* is cut out from a sheet of card board one sixteenth of an inch in thickness, three fourth inch wide and two and nine sixteenth inches in length to the shape shown full size in figure 195. The *rudder*

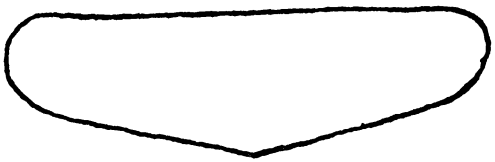


Fig. 195

Fig. 196

is formed of card-board one sixteenth inch in thickness by nine sixteenth inch in width and one and three fourth inches in length as shown full size in fig. 196. The *wings* are also formed out of a single piece of card-board one sixteenth inch in thickness, one and half inch in width and ten and half inches in length, cut to a shape of which half only is

shown in fig. 197. In the V-cut shown at the front end of the fusilage, place two shots with a small piece of gummed cloth (fig. 198). Fix the

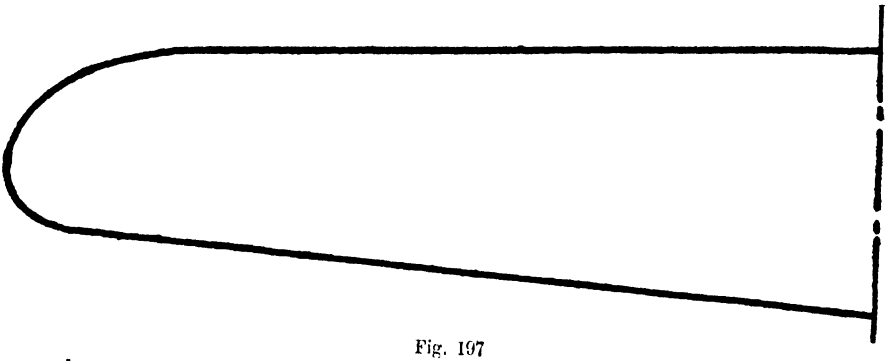


Fig. 197

elevator with glue to the notch at the other end of the fusilage. Score across the centre of the wing with a dull knife and bend the two sides over the scored line, so that when one half of the wing rests on the table, the end of the other half stands one inch higher than the table.

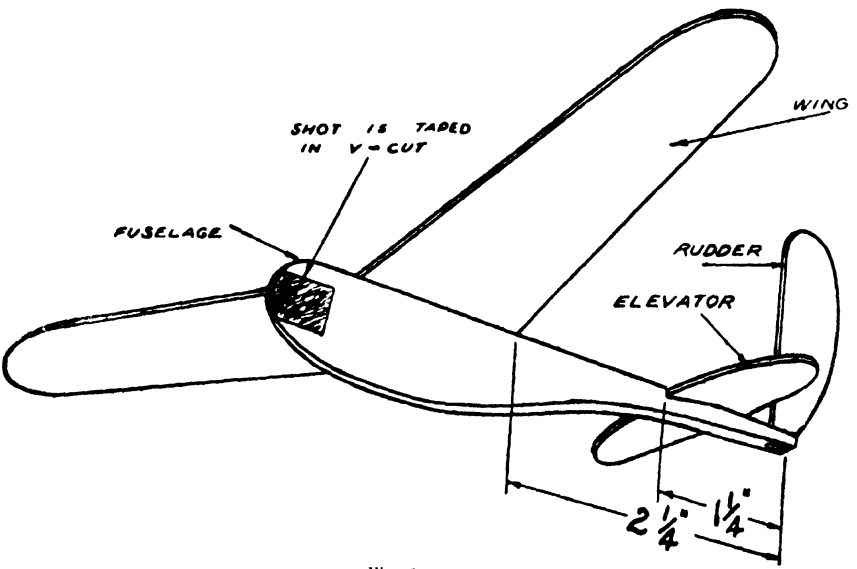


Fig. 198

Glue along the scored line and fasten the wing on the fusilage, by

fixing it with a small pin. When the glider thus formed, is thrown into the air, it comes back flying to the thrower.

36. A Hanger that changes faces. Procure pieces of cardboard, 3 ins. by 4 ins. and some tapes $\frac{1}{2}$ inch wide. The principle of working will be apparent from fig. 199, where (1) **ABCD** and (2) **EFGH**, are two such boards, attached by tapes **LM** from the middle of **AB** to the

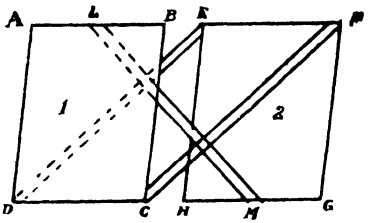


Fig. 199

middle of **HG**. On the opposite sides, corners **C** and **D** of (1) are also similarly attached on the corners **E** and **F** of (2). If tightly attached, the sides **AB** and **EF** will close on one another and so will **CD** and **GH**. It will be seen that the two cardboards cannot be separated bodily from one another, but they can be opened out either on the line **DC** or **HG**, or on the line **AB** or **EF** acting as hinges. So if we have a large number of cards attached like this, they can be opened out from **AB**, either as

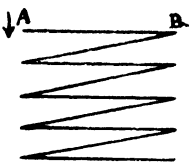


Fig. 200

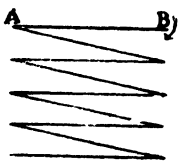


Fig. 201

shown in fig. 200, or as shown in fig. 201, separating from **A** or **B**, respectively. In actual operation, the faces of the board are coloured differently say, in black and white on the two sides, and when they are opened out by holding **AB**, either the white faces are shown, or the black ones, at one time.

The method of preparation is simple, if the boards are made up of 2 thicknesses each. One half is laid down and gummed and tapes placed on it as shown in fig. 202. The other half is placed on it evenly and pressed to fix. The tapes are then doubled (fig. 203) on the card and half of the next card placed on this, with the projected tapes turned

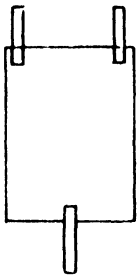


Fig. 202

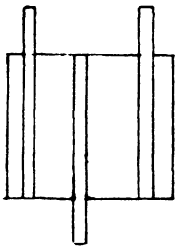


Fig. 203

down as shown at **AAA** in fig. 204, while new tapes are inserted as shown at **BBB**. Paste is applied and the next half pressed on this to fix, and so on. Finally the cards are covered by coloured pasted paper

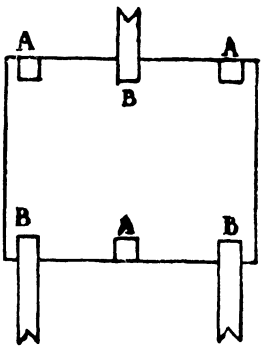


Fig. 204

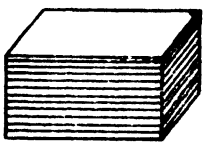


Fig. 205

from the sides as desired. The complete article is shown in fig. 205. Held in the middle, one side is lowered, when the leaves fall down in order. Next when that side is raised, the leaves change faces.

PAPER-WORK.

STAGE IV. CARDBOARD MODELLING.

1. Square Trays. A square tray would be cut (fig. 1) and creased like a square box (see § 11, stage III). The small corner squares may be cut off altogether (one is shown by thick lines at (a) in fig. 1). When in the final form, the corners should be joined and strengthened by stiff brown paper or cloth. Alternatively, only a slit as shown at (b) can be made in each of the small squares. When in the final form, the

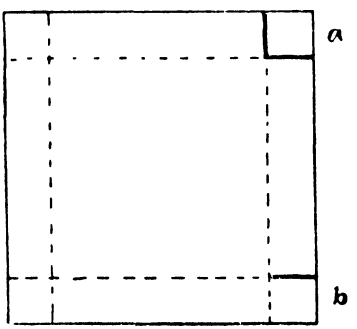


Fig. 1

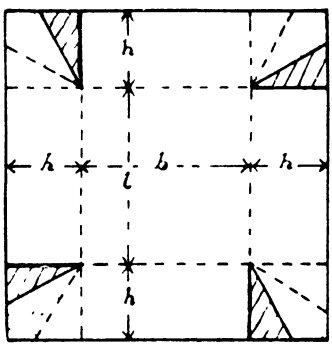


Fig. 2

smaller squares are bent and glued or fastened by tacks to the adjoining side. The finish can be improved in different ways as mentioned in the case of boxes.

2. Trays with sloping sides. Choose the size (length l, breadth b, and height h) of the tray. Cut a piece of cardboard (fig. 2) of length and breadth equal to $l+2h$ and $b+2h$ respectively. Draw the lines on

the cardboard as shown dotted in the figure and crease. Trisect the right angle as shown in each of the corner squares. Cut along one trisection line (indicated by the thick line) and crease along the other, as shown by the broken line. Take out triangular portions (shown shaded from each corner by making another cut. Now gather the sides

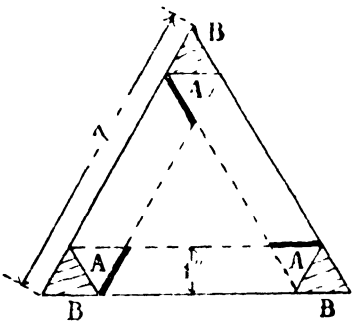


Fig. 3

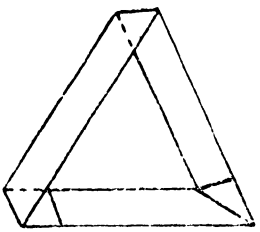


Fig. 4

and applying paste on the portion, shown dotted, fold on the creased trisection line to fix the gummed portion on the under surface of the adjoining side. When dry, cut out the projecting portions.

For a triangular tray cut out an equilateral triangle of 7 ins. sides from a sheet of stiff paper. Fold at one inch from each of the sides as shown by the dotted lines (fig. 3) and crease. Cut off the small triangular corners **B B B**, shown shaded. Make slits along the thick lines and applying paste on the triangles **A A A**, lap each on the inside of its adjacent side (fig. 4), fix and dry. Instead of using the adhesive, steel clips may be used to make the corners strong.

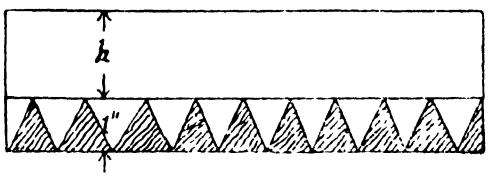


Fig. 5

Pentagonal, hexagonal &c., trays may be made in the same way for use for various purposes, say ash trays or receptacles for small articles. An oblong tray may be made to hold pens, pencils &c.

3. A Circular Tray. Take a stiff piece of cardboard and cut a disc of the diameter desired. Also cut out a strip (fig. 5) of the same

material, with a width about an inch greater than the height *h*, of the tray, desired. Fold the strip at one inch from one side and cut out shaded triangles as shown (fig. 5). Prepare with this strip a cylinder of the same circumference as that of the circle (see § 9, stage III) and fold the triangles inwards. Now applying paste on the triangles on the inside, place the cylinder disc symmetrically on the press and fix. Place

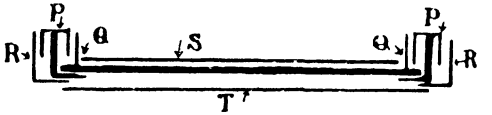


Fig. 6

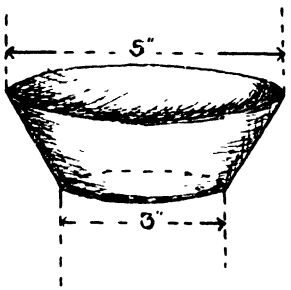


Fig. 7

a thin strip of pasted coloured paper **P** (fig. 6) shown very much enlarged) on the rim and fix by doubling it both on the inside and outside. Cover the inside wall of the cylindrical portion with a strip of fancy paper **Q** flush with the rim and touching the bottom. Also fix another similar strip **R** but a little wider, on the outside, flush with the upper edge and turn under the bottom. Now attach two discs of coloured or fancy paper **S** and **T** on the top and bottom of the cardboard disc. This would give a nice finish and make a very useful article.

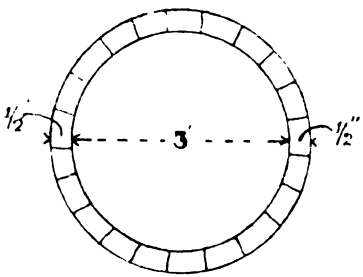


Fig. 8

4. **A Candle Stand.** Proceed as in the case of a simple circular lampshade (sec. 9, stage III) with 5″ outer diameter and 3″ diameter of the central hole (fig. 7). Cut out a disc of 4″ diameter (fig. 8) and drawing a circle of $1\frac{1}{2}$″ radius, make slits from the outside, along radial lines and fold back the flaps formed on the corresponding bases. Now apply paste over these flaps, and put the conical paper (fig. 7) over the disc symetrically in position. Work round by finger and fix the flaps inside the slant sides. Apply by paste, a thin strip of coloured paper all round the rim, and bend over the outside and inside to fix. For finishing, it only remains to cut out two

pieces of fancy paper that will form cones of the size and shape shown in fig. 7 and attach them by paste, one on the inside and the other on the outside of the article, leaving a narrow margin of coloured paper exposed at the rim. Now prepare a tube (fig. 9) about $1\frac{1}{2}''$ long to hold the candle tightly and make longitudinal slits of $\frac{3}{4}''$ length from one end. Bend the flaps (fig. 10) outwards to form a flange and wrap a strip of fancy paper, also $1\frac{1}{2}''$ wide, round the cylindrical portion protruding $\frac{3}{4}''$ at the top. Make longitudinal incisions, and applying paste on the inside of the flaps, fold them over the edge to fix. Apply paste and fix the flange on the bottom disc (fig. 8) at the centre, so that the cylinder stands erect to hold the candle. Now cut out a circle of brown paper of 3″ diameter for the bottom of the candle stand and fix by paste from below. Also cut out a similar circle of fancy paper with a central hole for the candle tube and fix by paste on the upper surface of the bottom disc. A holder of doubled stiff paper covered with fancy paper may be fixed from the inside of the candle tube to the outside of the cone, but under the outer cover of fancy paper. A finished article, which however does not correspond to the given measurements is shown in fig. 11.

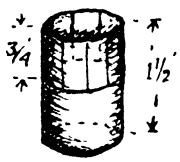


Fig. 9

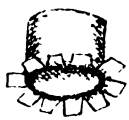


Fig. 10

5. **The Calendar.** Take an old sheet containing monthly dates from a wall almanac. Cut the sheet leaving just the dates in squares **PQRS** (fig. 12) and a strip of about an inch **QRTV**, projecting on one side. Cut out a strip of stout cover paper of height about 2″ greater than **PS**. Crease on a line at one inch from the bottom. Roll it up from

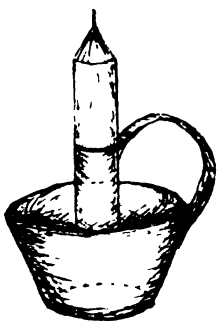


Fig. 11

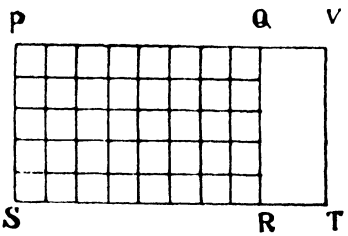


Fig. 12

a side (§ 9, III) to form a cylinder having a circumference equal to the length PQ. When dry, make triangular cuts from the bottom, up to the crease and fold the strips inwards (fig. 13). Now cut out two discs of thick paper A and B (fig. 14) having a diameter, 2″ bigger than that of the cylinder (fig. 13) and also cut out from one B, a

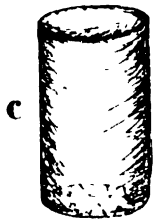


Fig. 13

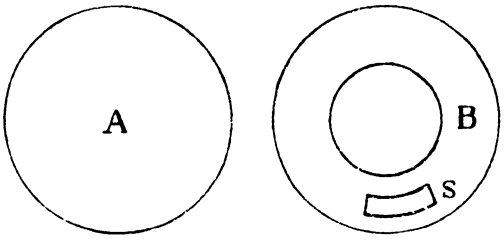


Fig. 14

central disc of a diameter equal to that of the cylinder (fig. 13). In the annular portion of B, cut out a circular slit S. Its length should be $\frac{1}{12}$th of the mean of the circumference of the inner and the outer circles on B. Its width should be slightly greater than the height of the letters of the "months" in the calendar.

Prepare two more short cylinders each of 2″ height (fig. 15). The diameter of one D is just bigger than that of the cylinder C (fig. 13) so as to slide on it easily. The diameter of the other E (fig. 16) is equal

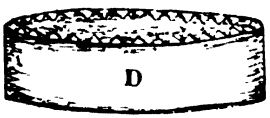


Fig. 15

Fig. 16

Fig. 17

to that of the disc A (fig. 14). Draw lines round both the cylinders about 1 inch below the top. Make longitudinal incisions parallel to the edge and fold the flaps inwards, as in C (fig. 10). Lastly prepare a conical cap F, (fig. 17) of a diameter $\frac{1}{2}$″ less than that of A (fig. 14), by cutting a sector out and assembling like a lamp shade without the central hole (see § 9, III).

Put on a finishing cover of fancy or glazed paper on F and D (fig. 12) which should be trimmed over the lower edges. D is to be further covered by the names of the week days, in 7 equal spaces (this

will also be available from old almanacs). The sheets of date fig. 12 is to be fixed round C (fig. 13) the $\frac{1}{2}''$ projecting portion on the right being attached first. The date sheet should be flush with the bottom of C leaving 1″ space open at the top of C. B (fig. 14) is to be covered with fancy paper doubled over the edges and the slit. A (fig. 14) is fixed on E (fig. 16) by applying gum on the triangles in E, and dried. The sides of E are covered by a strip of fancy paper projecting both at the top and at the bottom and turned over. On A is to be put the names of the months in 12 equal spaces, so that when B is

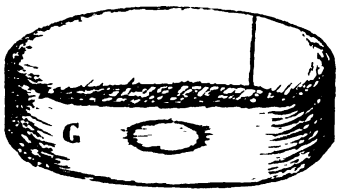


Fig. 18

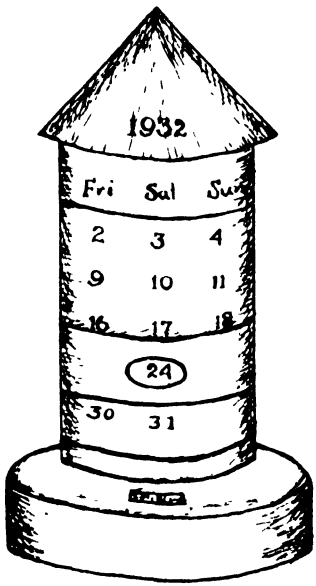


Fig. 19

put on it the name of one month only is uncovered at a time. In the final assembly (fig. 19) C is fixed on A centrally and B slipped over. F is also fixed on D to form the cover of C. A strip of thin fine cardboard G (fig. 18) with a round opening for the exposure of one date at a time, is made into a circular strip and slipped on C and moved from day to day. C also forms a receptacle for small articles. F is shifted once monthly to make the dates correspond with the weekdays. The year may be pasted on F in bold letters.

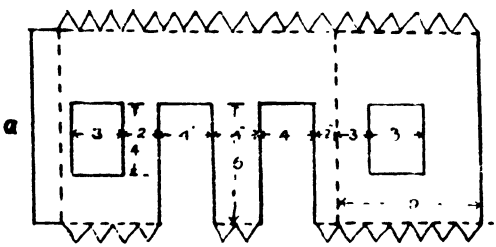


Fig. 20

6. The Model of a Tin Shed. Cut two pieces of thick cover paper in the shape shown in fig. 20. Fold on the dotted lines. Gum

the projecting edge (a) in each and fix it to the straight side (b) of the other, so that the walls of the shed assume a rectangular form. Draw on a piece of blue cover paper, parallel lines **AB, CD** (fig. 21) each 18″ in length and 14″ apart from one another. Draw a parallel line **EF** of length 6″ centrally to **AB, CD**. Draw the diagonal lines **EA, EC, FB, FD**. Find a point **G**, 12″ from **A** and at a distance from **E** equal to **EC**. Join **EG**. Similarly draw **FH**. Join **AG, BH, GC, DH**. Now cut along **EG** and **FH** and fold along **AE, EC, FB, FD**. Apply paste to the triangles **GEC** and **HFD**, and fix them below **AGE** and **BHF**, the lines **GE** and **CE** as well as **FH** and **FD** coinciding respectively. Cut out the projecting portions making **AC** and **BD** straight. This forms the roof. Make a ractangular tray 17″ × 11″ (sec. 1) with square sides of about 2″ height. This will form the plinth. The whole thing may be placed finally on a thick piece of pasteboard, say 24″ by 14″. The assembly (fig. 22) is easy enough but the work should be symmetrical. A few steps may be shown by folded paper in front of the central door. Parallel lines to suggest corrugations, may be drawn on the roof before it is shaped. Windows may be shown by attaching narrow strips of paper horizontally and vertically to form rectangles. If some old photographic film be available, it might be cleaned and cut to proper size and attached from the inside to give an appearance of glass.

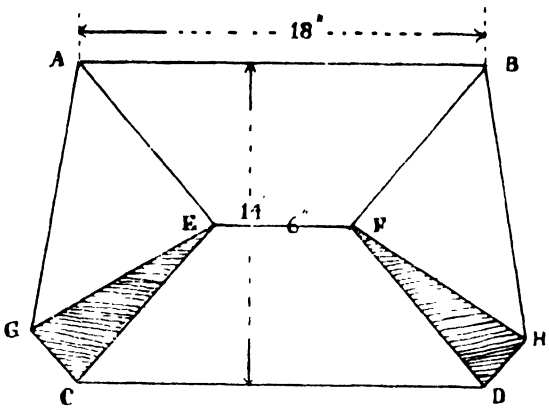


Fig. 21

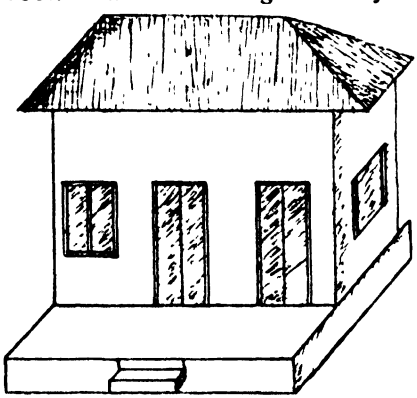


Fig. 22

7. Picture Frames. These are made of stiff paper and have all the appearance of solidity. As no great strength is required to hold a picture, even one protected by a glass sheet, these last a considerable time, once hung up. Take a piece of stiff cover paper or cardboards, covered if desired, by fancy paper of a texture of finished wood. Draw a circle (fig. 23) and in it place chords equal to the sides of the intended opening for the picture, in order. The circle should be so chosen that after placing the four chords 1, 2, 3, 4 a little of the circle

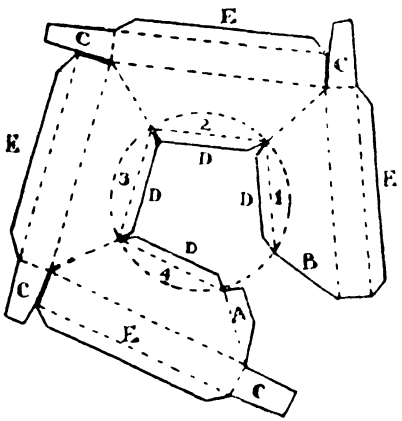


Fig. 23

Fig. 24

as shown between **A** and **B** is left over. Cut out this sector. Draw radial lines through the extremities of the chords and parallel lines four to each chord, the corresponding lines being equally spaced from these chords, as shown. Draw the other (shorter) lines for forming the four lugs **C** ; eight flaps, two for each chord **E**, on the outside and **D**, on the inside. Cut the bounding lines and make incisions where the lines are shown thick. Now fold or crease by a blunt point along the dotted lines. Apply good stiff paste on the lugs, bending them at right angles and fixing under the adjoining rectangle. Work the folds by the fingers and a solid shape (fig. 24) is given to the frame. Prepare a hollow rectangle from a stiff card of a different but harmonius colour and attach on the inside flaps **D**, bent inwards. Also prepare

another rectangle of stiff pasteboard for the back. Apply paste to outside flaps bent inwards and fix the prepared pasteboard rectangle on them.

It may be noticed, as shown in fig. 25, that the number of parallel lines may be increased, or they may be placed at various distances

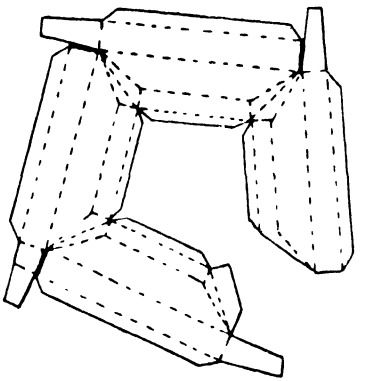


Fig. 25

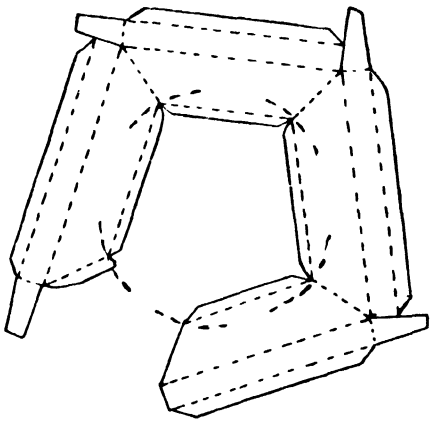


Fig. 26

from one another to give different shapes of straight moulding to the frame. If the sides of a rectangle (fig. 26) instead of a square are

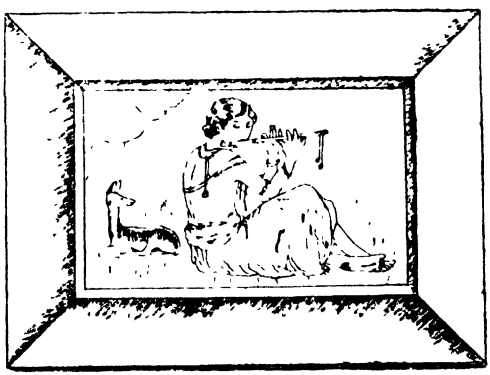


Fig. 27

placed on the circle, a different effect with rectangular opening (fig. 27)

will be produced. A curved corner is very easily given as shown in fig. 28 to produce an excellent effect (fig. 29). A circular opening

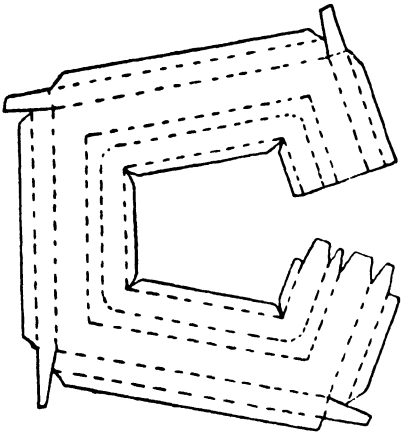


Fig. 28

Fig. 29

(fig. 30) can also be made with slight modification and improves the

Fig. 30

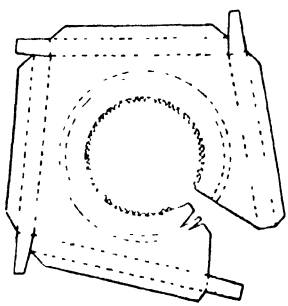


Fig. 31

look, although it involves a little more work as indicated in fig 31. For an

oval opening (fig. 32) an approximate ellipse may be formed by drawing four arcs and joining them suitably (fig. 33). The method of work is indicated in fig. 34.

Fig. 32

After a little practice an infinite variety of shapes and models will suggest themselves. If a piece of glass is to be put inside, it is first cut to a suitable size. The inside flaps may be gummed on the glass. A suspension can easily be arranged on the upper side, the fixture for which may be further strengthened by previously pasting strips of paper from the inside, at the proper places.

8. **Chinese Lanterns.** (*a*) Handsome and picturesque Chinese lanterns may be made with any fairly stiff and coloured paper which allows light to pass well. The paper is marked and creased like camera bellows (fig. 35), in the way explained in sec. 10 stage III. Having made the vertical joint, a square card with a

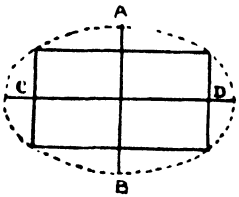


Fig. 33

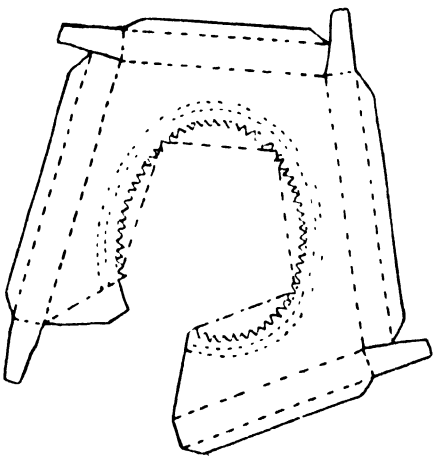


Fig. 34

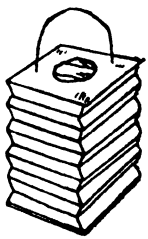


Fig. 35

circular hole (fig. 36*a*) is glued at the top and a wire is fitted for hanging, by passing the ends through small holes along a diagonal on the card and bending the ends. The bottom is another square card (fig. 36 *b*), with some perforations for ventilation and two slits for attaching a circular tin holder (fig. 36*c*) for holding candles. This is attached by passing the tongues through the slits in the card and bending the tips underneath. Figure 36*d* shows the blank for the holder to indicate its method of preparation. The above will give a square form but variations for pentagonal, hexagonal and other forms can be tried, with excellent effects. Such attempts without any instruction, will call for ingenuity in the

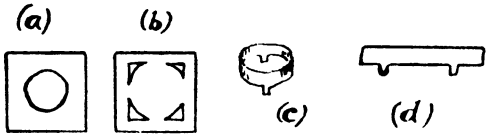


Fig. 36

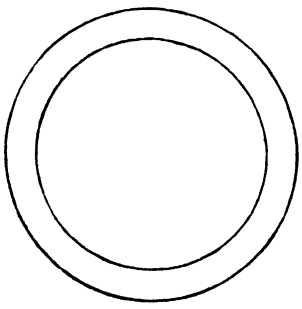


Fig. 37

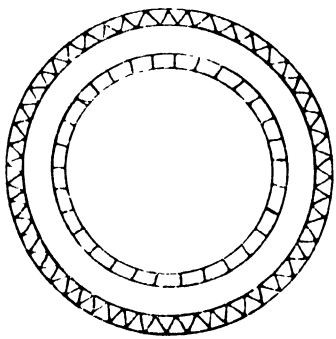


Fig. 38

drawing of the folds for the production of properly shaped corners. As a mark of acknowledgement of the Chinese origin, it is suggested to draw a dragon, or one or two figures vertically, resembling Chinese characters, as is the usual custom. It will also relieve the monotony of the appearance.

(*b*) It is more laborious to make the round shape, but certainly it has a better appearance. Cut out hollow discs of thin transparent paper, of 8 ins. and 9 ins. inside and outside diameters (fig. 37) and also of $7\frac{1}{2}$ and $9\frac{1}{2}$ ins. diameters (fig 38). Mark on the second lot, circles of 8 and 9 ins. diameters, and crease. Cut radially a large

number of slits between the 9 and 9½ ins. diameter circles, as shown. Now take one of the bigger discs, double the inside strips and apply paste on these strips Next fix one of the small discs, and doubling the outside flaps inwards, apply paste on them. Then fix the first couple, turned upside down, evenly on this disc. Turn over and proceed with the other discs in the same way. The top and bottom covers consisting of somewhat thicker paper, a candleholder and a suspension should be provided to complete the lantern (fig. 39).

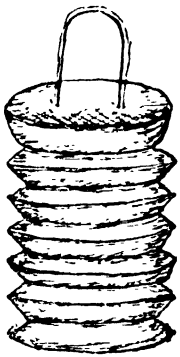


Fig. 39

The effect of making the zigzag edges bigger, or smaller or that of making the joining flaps very narrow will be evident after one or two trials. A hidden support to keep the top and bottom discs apart, may be necessary and will at least make the whole lantern rigid.

9. **A Paper Electrolier.** Cut out 10 sections (fig. 40), each consisting of one pentagon and two equilateral triangles as described §9*d*, Stage III. Arrange to have three flanges in one set of five sections as shown in fig. 40, and five flanges (fig. 41) in the other five sections. Crease along the lines shown dotted. Cut out suitable designs (leaving a decent margin at the edges) by incisions with a knife on the body of the pentagons and triangles. Placing each of these cut sections on a piece of waste paper, apply paste along the margin of the incisions. Transfer it to a clean paper and fix a tracing paper of appropriate size projecting over the margin of the design cut. Dry under moderate pressure. Dye the tracing paper from the back if desired, but be careful that the different colours do not run into one another. Now fix by some quick-drying adhesive, sides 1 and 3 of fig. 40, to sides 2 and 4 of fig. 41 with the flanges underneath. With five of such compound pieces build up the whole, and fix covers of thick cardboard pentagons

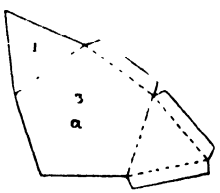


Fig. 40

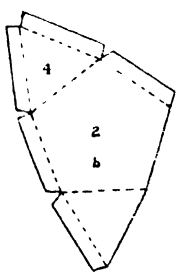


Fig 41

of proper size on the top and bottom. The top should have a hole to allow the electric wires to pass through, and the bottom another bigger hole to allow the bulb to go in. Fig. 57 Stage III, may be seen.

10. Paper Lanterns. These are not very difficult to make and as decorations on festive occasions at nights, produce a most surprising effect. The principle is the same as indicated in sec. 9. The surrounding wall of the lantern is made in 4 to 8 sections, from 6 to 10 inches high and 3 to 6 inches wide at the top and bottom respectively, and all of the same pattern. They may be of symmetrical design, the two sides being similar ; or one side (**B**, fig. 42) may be made up of straight lines and the other (**A**) of curves, but with the lengths of corresponding portions equal to one another. This is an important point to note in the design. The right side of each is provided with fish-tail lugs for joining up with the plain left side of the next. Only strong and quick-drying adhesives should be applied when tacky. Fixing of too many sections before they are properly dried should not be attempted at the same time. As much of the fixing as will hold, may be done at one time, and the compound piece left to dry while other sections are taken in hand. If desired, strengthening may be done at the joints by attaching suitable paper or cloth strips. When the design is symmetrical, fixing of the sections together is not difficult. Place them back to back on the table with the lugs projecting in the lower section and applying paste on the lugs, bend over and fix on to the upper sections one by one. Press and leave to dry. When a number of pairs have been joined in this way, proceed, as also in the case of unsymmetrical sections as follows : Lay down one section and apply paste to the lugs all folded inside. Now bring the next section with the corresponding edge against the lugs. Raise the lugs of the first section from the top and fix them on the edge of the second section, gradually bending the sides and the line of junctions, as the fixing proceeds downwards. But do not proceed until you are sure that the lugs thus joined are quite secure,

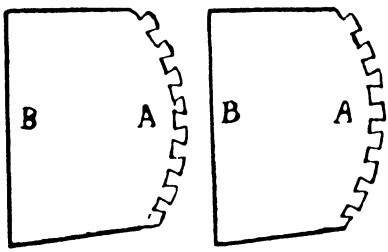


Fig. 42

A few examples are given of designs in their final forms and of corresponding sections to be cut, but as suggested elsewhere, designs

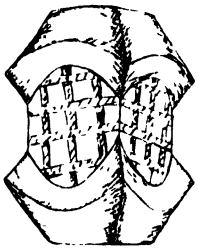


Fig. 43

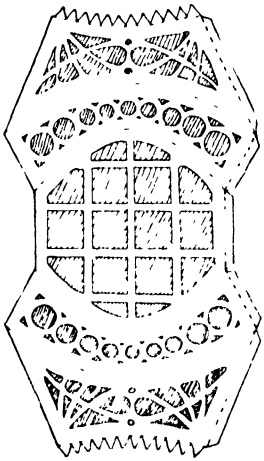


Fig. 44

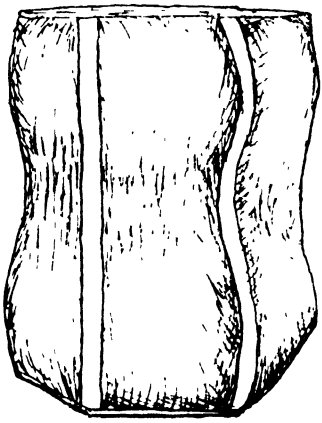


Fig. 45

to suit the occasions should be chosen. Fig. 43 shows the shape of a lantern prepared with 4 sections of the outline given in fig. 44, which

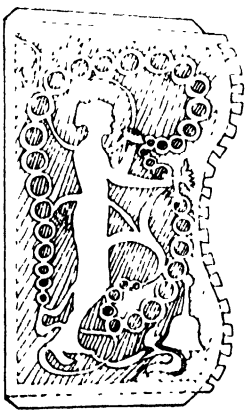


Fig. 46

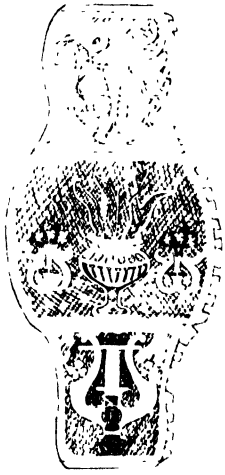


Fig. 47

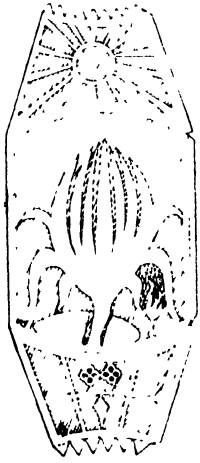


Fig. 48

is a pretty design with windows. Fig. 45 gives another shape of 6 sections and fig. 46, a suitable design for it. So also, figs. 47 and 48

and figs. 49 and 50 respectively represent two other shapes of 6 sections and designs. Fig. 51 gives an odd shape with 4 sections and fig. 52 gives the outline of the sections required, with a design shown on it. In all these the hatched portions are to be cut out leaving ties carefully with-

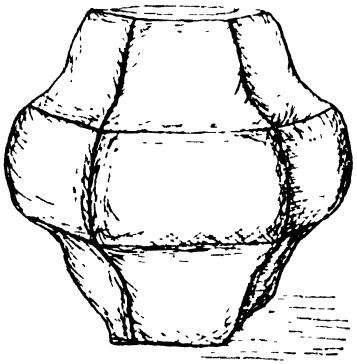


Fig. 49

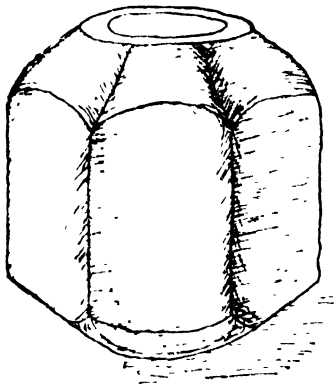


Fig. 50

out prominently interfering with the design, wherever possible. Inside the sections placed on a wooden board, draw and cut out the designs several at a time by a chisel. Or, if preferred, cut singly with a knife edge placing the design on glass; in the latter case, marking with the help of carbon paper

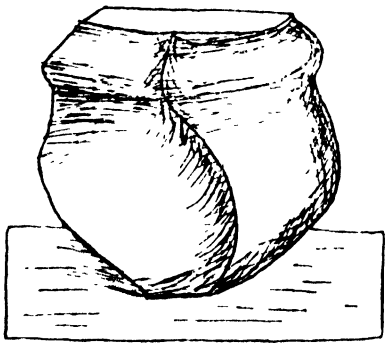


Fig. 51

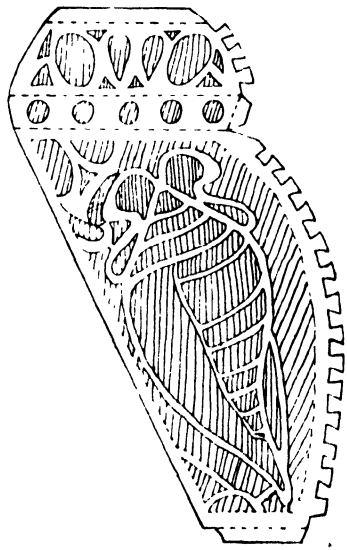


Fig. 52

or stencils will be of great help. Punches or cork borers will

come in handy for cutting holes in the designs. Place each section upside down on waste paper and apply paste. Then transfer it to a clean sheet of paper and fix tracing or tissue paper of appropriate sizes, so that all openings are covered. Dry under moderate pressure, say under a number of books. Now apply transparent ink or dyes tastefully on the tracing paper from the back, but do not allow one colour to run into another, as they may not mix. When dry, the sections may require pressing again, to regain flatness. Now crease along the lines about which bending is to be done by a blunt point against a straight edge or against desired curves, cut on cardboard.

Fix the sections together as suggested already. Cut out cardboards of appropriate size to fit the top and bottom. Both will have circles

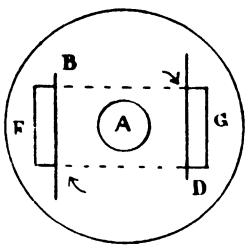
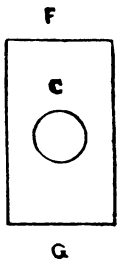


Fig 53



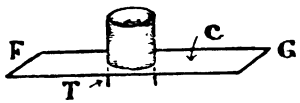


Fig 54

cut out at their centres, the top one being of a bigger diameter. The bottom board will further have 2 slits **B** and **D** cut at the sides (see fig. 53). Bend the flaps of the sections at the top and bottom and applying paste, fit these cardboards on the flaps. Make arrangements for suspension at the top. Through the bottom insert a tin candle holder as described in § 8. The support of the round holder may be a rectangular piece of cardboard **C** (fig. 54) through which the tin tongues **T** of the holder have been inserted and bent underneath. This round holder is pushed through the opening at **A** (fig. 53) in the bottom piece and turned round so that the short edges **F** and G of the rectangle enter the two slits **B** and **D**, cut on the bottom piece.

(c) **Conical Camera Bellows. A Chinese Lantern.** Rule a

vertical line **CD** in the centre of the material (fig. 55)—paper, cloth or leather. From a point **D** on the line near the bottom, measure off **CD** slightly bigger than the vertical extension required. Through **D** draw the horizontal line **EF** equal to one side of the big opening of the bellows with **ED** equal to **DF**. Through **C** draw the horizontal line **GH** equal to a side of the small opening of the bellows with **GC** equal to **HC**. The figure **GEFH** gives the shape of one side of the bellows. To set out the remaining sides at the correct angle proceed as follows : With **E** as centre and any convenient radius describe a circle cutting **EF** in **I** and **EG** in **J**. With **J** as centre and **JI** as radius describe an arc, cutting the circle in **K**. Join **EK**, which is produced. This gives the angle for **EL** which forms a side of the big opening of the

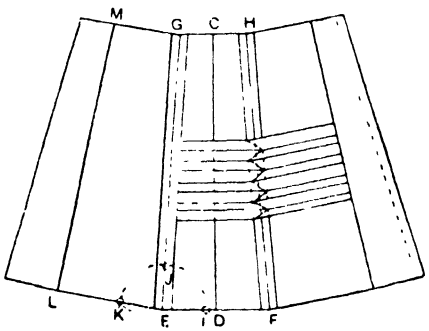


Fig. 55

bellows. Make it of proper length and obtain the angle for the side **GM** by means of a circle and arc in the way described. Make **GM** equal to the size of the second side of the small opening of the bellows. The third side (in the opposite direction) is set in a similar manner. The remaining (fourth) side is taken in two parts on the two sides for convenience in joining. Note that the construction by the use of a circle and an arc is simply to place an equal angle.

Having set out the five vertical divisions, rule horizontal lines parallel to the top and bottom edges $\frac{1}{2}''$ apart, thus dividing each section into a large number of parts. Then draw the vertical parallels, one on each side of the vertical lines **GE, HF** etc., and $\frac{1}{4}''$ distant from them as shown about **FH**. In the small irregular figures thus formed, draw short

diagonal lines from corner to corner, from right to left and from left to right alternately. Finally mark off $\frac{1}{8}$th in. all round for joining as shown in the right side only by the dotted lines.

To fold, crease along the horizontal lines to form edges of the folds from the bottom, first one way and then in the other, the shorter edges being placed on the inside. The lines which would form the inward edges should be ruled with a hard point to help in easy folding. The short diagonal lines are then creased, after which no great difficulty will be found in bending the four sides to form the bellows. The joining flap is glued, fixed and left to dry.

Beautiful paper lanterns can be prepared by using these conical bellows. Excellent effect is produced by joining two conical bellows, and finishing off as indicated in the previous section.

PAPER WORK.

STAGE V. DECORATIONS AND STENCILS.

1. Decorations. A preliminary notion in paper-cutting has already been given in stage II. This stage, however, involves a thorough practice of freehand drawing, as preliminary drawing is necessary before cutting begins. Those who have a natural aptitude for drawing are likely to excel. Even for those who have not, copying will not be very difficult after some practice. Besides, designs are nowadays easily available from design books, newspapers, magazines and catalogues of dealers of art materials. The outlines can easily be reproduced on any paper by pricking with a pin through the original placed on it. The only care that should be taken is that the paper, placed underneath the picture, should be firmly secured to it, so that there may be no displacement until the work is complete. Alternatively, a sheet of carbon paper may be taken and placed between the design, which is placed on the top, and the paper on which the drawing is to be made, with the carbon side facing downwards. The outline of the design is then traced with a blunt point, when a reproduction of the design will be obtained on the paper below.

Cutting is done by the sharp point of a knife along the outline traced on the paper, which is held on a sheet of glass or zinc. Simple decorations, consisting of centres, corners, running designs etc., are cut on thin card-board and are largely used on festive occasions. Compound decoration consists of one superposed on another, if desired, differently coloured. A large number of examples including flowers

with stem, petals and centres, which could be differently coloured, to form exquisite decorations, have been given in stage II. A few more are shown in figures 1, 2, 3 and 4, which are suitable (by repetition) for borders. Interior lines are to be touched up in finishing.

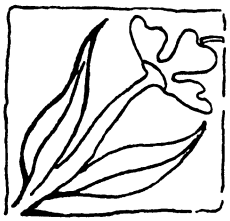


Fig. 1

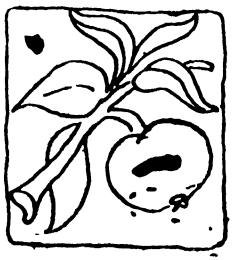


Fig 2

2. Stencils. Stencilling is a mechanical method of reproducing patterns in which the design is cut out of a thin card, which is laid on the surface to be decorated and the pattern worked by dabbing colour through the cuts, thus giving a reproduction underneath.

Stencilling as an easy, quick, effective and cheap method of art decoration, on almost any ground, is greatly in favour at the present time and does not demand more than average ability, and is a splendid pastime even for amateurs. If the worker cannot originate designs he may buy them, or copy bold and suitable designs from wall-papers, cretones or embroidery patterns. Oiled paper serves the purpose of the material for stencil plates. Cartridge paper or Bristol board is better, but is more expensive. Paper which is not water-proof, requires an after-treatment to make them non-absorbent. French polish is admirable for this purpose. It not only stiffens the paper but also preserves it. For big stencils and rough work, ordinary tar makes a good water-proofing medium. One great advantage of the process of stencilling is that very few appliances are required ; a good pen-knife which has to be frequently sharpened at the point ; an oil-stone to sharpen it ; a sheet of plate glass or zinc or a slate for cutting upon (mill-board or

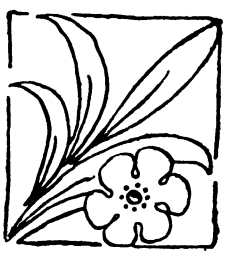


Fig. 3

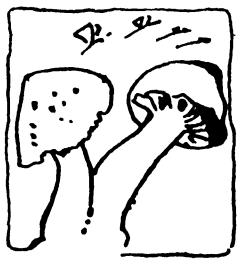


Fig. 4

drawing board becomes useless after a little use) ; stencil brushes (fig. 5) of hog-hair, of a short stubby and round form, the larger the better—not only for quicker work but also for giving a more uniform result. Further, a palette, a muller and a glass slab are required for mixing up the colours. Prepared colours in tubes can be conveniently bought, but where quantities are required and expense is a question, powders, may be bought, to be ground with oil or water as required, by the muller on the slab with a circular motion.

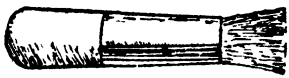


Fig. 5

In the actual preparation of the stencil plate, a full-sized drawing is first made on the special paper, with the ties or connecting strips, clearly defined. These are necessary to prevent isolation of island parts in the design, and to add to the strength of the plate. If necessary, extra ties may be pasted across the weak parts with glue. Copying may be done by placing the paper on the table with the carbon sheet (the carbon side facing down-wards) on the paper, and then the selected design over the carbon. Fix them by drawing pins. Mark the places for the ties and go round the outline with a polished point. The sheet at the bottom will have received an impression of the design. The sheet is next pressed flat, down to the glass or zinc plate with the left hand, the right hand holding the knife with the little finger resting on the work for support, to steady the blade and to prevent it from slipping. The knife should be very sharp so that a stroke with medium pressure makes a clean cut through the sheet, leaving the edges smooth and free from raggedness. This is essential for success. When every part of the design has been gone through, the pattern is shown in the cut out portions. Unless the proper stencil paper has been used, the cut stencil has to be made water-proof, which is done by placing the paper on several sheets of old newspaper, and brushing freely with French.polish (such as used by carpenters) until the paper is saturated. Allow it to dry a little, turn over and treat the back similarly. When they are to be repeatedly used, several coatings of French polish would be advisable, which, in any case, toughens the paper and renders it less liable to damage.

Next take the material to be stencilled and set out the details roughly, after pinning it on a board or table. Place the stencil plate in the desired position, keeping it pressed by the left hand (fig. 6) to prevent slipping. Now take some paint on the slab, mixing it thoroughly if required, with the muller. Dab the paint with the brush vertically until the paint is taken uniformly. Use a brush which is almost dry, i.e., with the least amount of paint on it and dab vertically on the material.

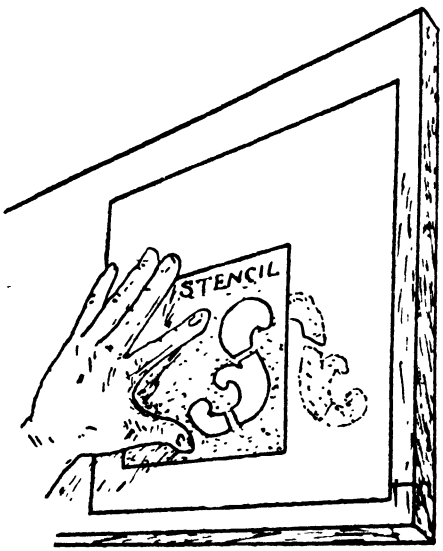


Fig. 6

3. **Stencil letters.** The practice of "printing" letters, as is used in Mechanical Drawings or decorations, is an art by itself and is acquired by long practice and is furthered by a natural aptitude. It has been dealt with fully in Appendix I. The purpose may be served by taking letters from copy-books or even old newspapers and magazines, if necessary. It is advisable to use block letters only. Waxed paper or stiff brown paper (to be waxed or varnished with French polish afterwards) of suitable size is taken, so that a decent margin can be kept finally all round the letter cut. A carbon sheet is placed on the paper with the carbon side facing downwards, and then the design over it. A polished blunt point is next used to trace the outline. Or, the letter itself may be cut out and applied by paste on the waxed paper. On the outline thus obtained, the sharp point of a knife is used to cut the letter out of the paper, placed on the glass or slate. Small strips, (*i. e.* the ties) are left to support portions, which would otherwise be totally isolated and displaced—as in the middle portions of such letters as O, D, etc. These strip (ties) would be left bare in the stencilling and are to be afterwards done up

separately. Unless a combination of letters forming a much used word is required, it would be handy to cut all the letters of the alphabet and the figures 1 to 9 and 0, separately in block letters of the same size. The top and bottom sides are then so cut as to leave an equal space above and below the letters. The side margins should be about 2/5th of the height of the letter on either side of it. Care should be taken while actually painting, to place the stencils so that the letters may be in alignment. It has been suggested that by the combination of 5 stencil plates (fig. 7) all the letters of the alphabets and figures can be obtained.

Fig 7

Stencil letters have a very large use in practical life. Names of boxes, distinctive marks on packages, etc.—in fact, much that is done by actual painting can be easily performed by the use of stencils without much labour, time and cost. Of course, a final touch with the brush at the time of covering the ties improves the work, but unles closely inspected, the difference is not marked.

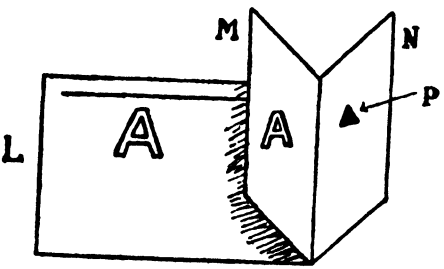


Fig. 8

On the material to be stencilled, are drawn parallel pencil or chalk lines at a distance equal to the height of the letters, so as to make sure if the proposed setting of the writing is fair. Two other lines are also drawn at distances from these, equal to the top and bottom margins of the letters, in order that the stencils may be placed in proper positions.

4. A simple stamping press. Secure a piece of thin card board of good finish, say an old invitation card. Fold it double (fig. 8), **L** and **M** being 2 leaves, and crease well. Draw by pencil any monogram, words or letters of a small size as could be used on note-heads or envelopes, on the top leaf **M**. With a sharp knife cut out the outline

of the design by vertical strokes. After the design has been cut completely on **M**, take out the island portion (*e.g.*, the middle portion of the letter **A**). Apply a little good hard adhesive on the lower leaf **L**, under the blanks in **M**, and press **M** over **L** from the top. The blanks adhere to **L**. Allow this to dry thoroughly. Now take a sheet of strong thin paper **N** and cut it to a size equal to that of the card. Double it, apply paste to one half and fix it under **L**, bringing the other half to the top, over **M**, by folding. Now place the island portion in position on the folded card in **M**, and applying paste on the thin paper, press it hard to fix the island **P** to it. Allow to dry and open out. Papers to be stamped are inserted on **L**, **M** is turned down on **L**, and then the thin paper **N**. A little working with the nail of the thumb or some hard surface brings out the lettering in bold relief. For proper registering, lines are drawn **L**, above and to the left or right of the design. This ensures that the printing will be done on the sheets at the same position relative to the edges, which are placed on the lines. The line on **L** at the top is shown.

A little practice will give excellent results, and it is expected that it will come as a surprise to the children that such excellent effects can be produced with so little trouble. It gives not only an outline of an interesting process, but also produces results, good enough for the personal use of the child.

5. Letter and figure cards. These are splendid appliances for initiating the child to the knowledge of the alphabets by the play method. Paste both sides of a sheet of cardboard with glazed paper and when dry, cut out 36 pieces, all of the same size, about $1\frac{1}{2}$ inch square each. Use stencils to print the letters and figures on them symmetrically, *i.e.*, leaving an equal amount of space all round. It may be more convenient to print all the letters on the whole sheet first and then to cut out the individual cards. A few touches with the brush or even with the pen to cover the ties or ragged edges will improve the prints considerably. A small rectangular box may now be made, as per instructions elsewhere, to hold these cards.

The set forms a very useful present to the child. The cards would be more interesting if the picture of an animal, the name of which

begins with a certain alphabet, be fixed on the reverse side of the card which contains that alphabet. A collection of such pictures of a suitable size for the cards can be secured from various sources.

6. The Fifteen Puzzle. Fifteen pieces of square cards are made of cardboard, all of the same size, and numbers 1 to 15 are stencilled on them. A square cardboard box is also prepared so that 4 square cards may be placed along each side loosely (fig. 9). When the 15 cards are placed in the box, one square is left vacant. The problem is to place the numbered cards in a haphazard order and then to slide one of the adjacent cards into the blank space, used as the working room, until the cards are all in correct position ; that is, numbers 1 to 15 are in their proper order. This will be found more difficult than might be thought, and attempts at solution will prove very interesting.

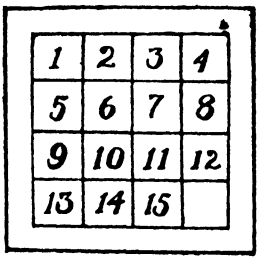


Fig. 9

7. Stencils for wall decoration. In contrast with the lower half of any room elaborately furnished, the upper portion usually looks bare and austere -almost painful to the artistic eye. An ornamental frieze would often soften the contrast. If, however, the frieze is put against the ceiling, the room appears to be of a height, lower than it actually is. If the design is drawn somewhat below the ceiling, say, below the picture rail, if there be any, it does not seem to affect the apparent height of the room, the picture rail forming an effective eye-barrier against this tendency. The amount of the ornament and the scale in which it is drawn, likewise affect the apparent size of the room—if too profuse or big, the room appears smaller than it really is.

The pattern is drawn on thin strong paper and the outline is pierced by a series of holes with a pin after placing the sheet on a pad formed by several sheets of old newspaper. The design should be so chosen that by repitition of the pattern, a complete chain is formed. A little extra length of the design may be cut out on the pattern to help in guiding the stencil plate in its successive positions. In a piece of thin linen put some fine charcoal powder. Gather the edges of the

linen and tie at the mouth to form a bag. With the stencil plate in position on the wall, this bag is dabbed on the holes and an outline is obtained which is next filled up by paint. A quicker method requiring

Fig. 10

less experienced labour would be to cut the stencils outright and to use the stencil brush and paint. The first method is however usually

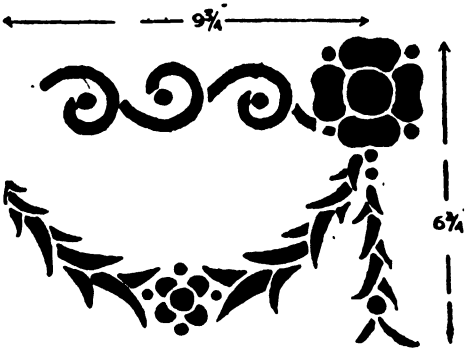


Fig 11

Fig. 12

followed. Three examples of stencils for wall painting are shown in the figures 10, 11, and 12.

8. **Stencilling linen.** The work of stencilling linen can be satisfactorily done in either paint, ink or dye, the main point being that whatever medium is used, it must be applied very sparingly at a time.

That is to say, the stencil brush must be just moistened with the paint, and the surplus paint removed by dabbing on a piece of waste cloth before the application of the paint on the stencil plate. Successive applications are made in this manner until the requisite density is secured. By this means, "running" is entirely avoided. The ties or the fine strips are liable to be torn by the brushes. The use of a roller has been suggested to obviate this difficulty. A wooden roller (fig. 13) of about 3 ins. in diameter has a slot about ¼ in. deep, cut parallel to its axis. The roller is tightly covered with felt or melton cloth, the edges being placed in the slot and fixed by means of small

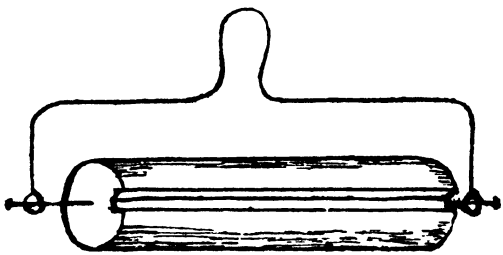


Fig 13

pins. Nails are inserted at the ends of the roller along the axis and a handle is made from a stiff piece of wire bent over the nails, as shown. The paint is spread on a board or a slab and the roller rolled on this board, until sufficiently and evenly charged with paint. The charged roller is then run on the stencil.

Table covers, cushion covers etc., might be folded diagonally, the creases serving the purpose of some sort of guide for laying the stencil plate. After pinning the material on the board, the position and other details for correct laying of the stencil plate is marked. Very little medium is used. Dip the brush sparingly into the paint and dab it on the slab several times for an even distribution of the paint. Now holding the stencil plate down with the left hand (see fig. 6), apply the brush to the openings of the stencil plate with a gentle dabbing action until an even coating of paint is spread on the linen. The tendency of the beginner to use too much paint at a time is to be guarded against. The paint should not be smeared or brushed, but dabbed with the brush at right angles to the face of the work. When finished,

lift the plate and wipe the back, and proceed with the next position of the stencil plate on the material.

In stencilling curtains, the width of the material and any texture on it should be taken into consideration in the actual design of the stencil. For a width up to 18 ins., only a few horizontal lines of varied thickness and spacing are necessary. For example, lines may be drawn (fig. 14) within $\frac{1}{2}$ in. to 1 in. space, a little above the

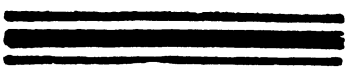


Fig. 14

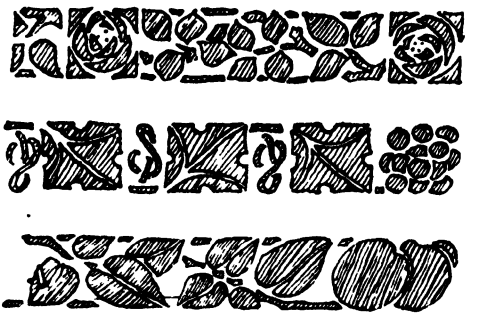
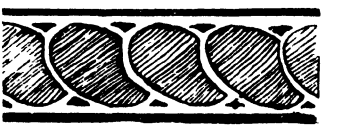


Fig 15

bottom edge of the material, of a thickness from $\frac{1}{10}$th to $\frac{1}{4}$th inch. Up to 3 to 4 feet width of material, a combination of some design (fig. 15), with horizontal lines, above and below the design, say within $1\frac{1}{2}$ ins., is desirable. The lower lines should however be drawn a



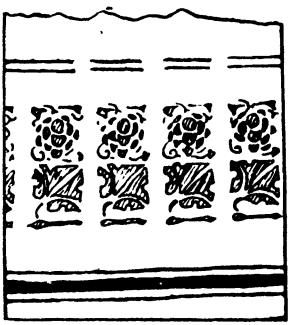


Fig. 16

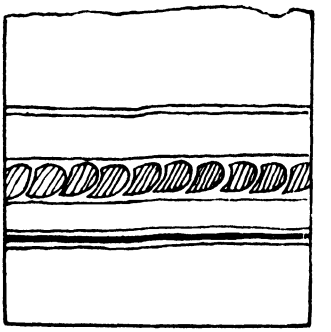


Fig. 17

little thicker. For still greater widths, say from 5 to 6 feet, this border can be doubled (fig. 16) to occupy 4 to 6 inches. Then again, any texture formed of vertical lines should be neutralised by a design (fig. 17)

having a horizontal pull (thus supplying balancing horizontal eyepaths). Before applying the stencil, pin down the material on a flat table so that an even and regular surface is obtained. Map out by soft pencil, charcoal or chalk, the path of the pattern. This is a vital point for good effect. Stencil colours, which are dyes and which are washing, can be bought, but good stiff oil colours, well brushed in from both sides are almost as good. Use little oil and thin it with petrol or benzine, if necessary. If carefully stencilled, the material can be washed to give an appearance of freshness.

Colours mixed with gum arabic solution, whether they be paste colours or dyes, can never be made fast enough to stand washing. Whiting should never, in any circumstances, be used. In using the aniline dyes, the dye powder should be dissolved in a concentrated form and when used, should be mixed with a weak gelatine solution. The stencil brush should be dipped in a little of the mixture poured on a plate, the colour being well worked into the brush. The colour should be applied as sparingly as possible to avoid spreading at the edges of the stencil and well brushed into the fabric. The dyes require to be fixed subsequently by ironing the fabric over a damp cloth on the wrong side. Another means of working, which gives results that will stand washing for a number of times without injury, is to use artists' tube oil colours and a medium of fine copal varnish and turpentine in proportion of 2 of varnish to 1 of turpentine, well mixed to fix the colours. Pure colours may be used, the light shades being obtained by slight rubbing with very little colour on the brush, deeper shades by a freer use of the colour and harder rubbing. If neutral tints in solid shades are desired, tube flake white in oil should be used. A spray would not generally give the desired result unless the air pressure is sufficient (See Sec. 13).

9. Stencilling on silk. An interesting application of the principles of stencilling is the preparation of silk covers for shades of electric bulbs. About 18 ins. square of yellow or light blue thin silk is taken and the edges hemmed all round. It is stretched by pins on a

board or on a table (fig. 18). Near the border, lines are drawn to ensure a true alignment of the work. Stencils cut as in the examples above are placed on the lines and an almost dry brush applied. A central hole in the material is also cut and hemmed round to

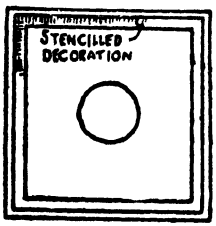


Fig. 18

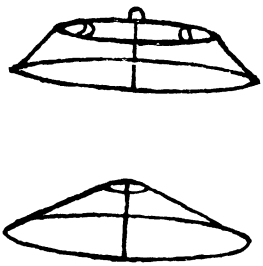


Fig. 19

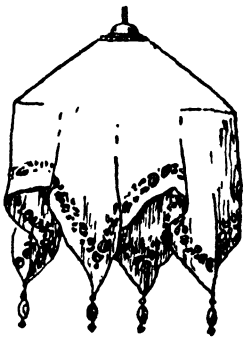


Fig. 20

pass the flexible wire for the electric light. When in position over suitable wire frames (fig. 19), glass or wooden beads are hung from the corners to ensure proper hanging of the silk (fig. 20).

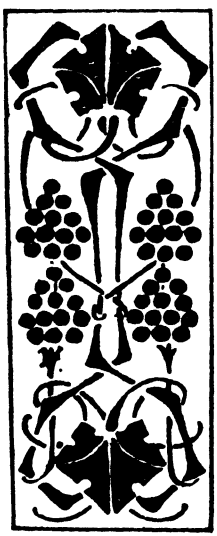


Fig. 21

Fig. 22

10. Stencilling on wood. Sides or panels of furniture, screens, finger plates or other suitable articles may be stencilled easily to produce very artistic effects. The ground should be glass-papered, stained or finished to suit the surroundings. With the stencils in position, oil colours mixed with boiled linseed oil, if necessary, may be dabbed in. Some quick-drying varnish may be conveniently used. The best medium is however the oil colours from tubes. Two examples (figs. 21 and 22) are given but suitable designs may

be made by an artistically inclined worker, or can be obtained from various sources. This is an extremely useful process and a ready means of introducing artistic ornamentation at a minimum of expenditure and labour.

11. Compound Stencils. For any coloured design, each separate colour is to be put through a separate stencil plate. To ensure the correct registration, lines may be marked at the corners, or better

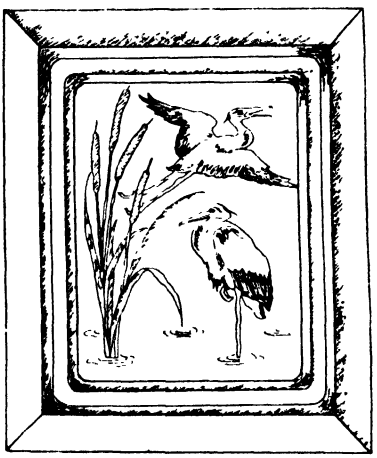


Fig. 23

still, any prominent isolated portion might be cut out from one of the plates and then the corresponding portions from all others. This opening is then used for the purpose of registration. The necessity of using separate plates lies in the fact that adjoining openings, unless they are widely apart from one another, are sure to get mixed up in colours, when separate colours are used in them. Cloth tightly stretched on a wooden screen, or panels of furniture will form excellent ground for applying the stencils. One example (fig. 23) is given, composed

of four different stencils shown in figures 24 to 27. The colour scheme is indicated on the individual plates. The ground may be of a buff colour.

The larger the stencil brush, the better it works. After taking up

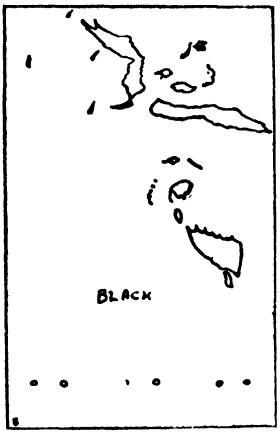


Fig. 24

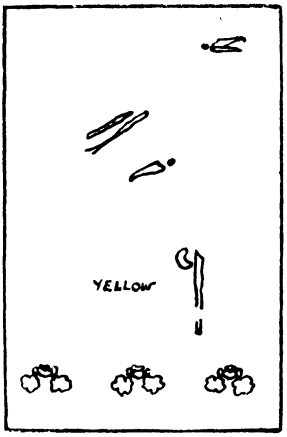


Fig. 25

a little colour, work it on a sheet of glass to distribute it evenly on the

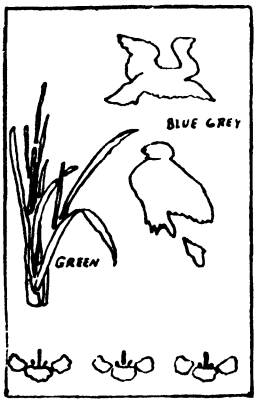


Fig. 26

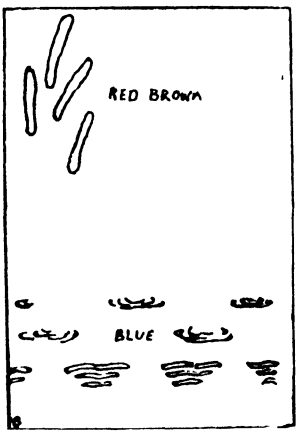


Fig. 27

brush. Hold the stencil plate in the place required and then starting from the edges, dab the colour into the openings, until it is evenly coloured all over.

12. Stencilling on coarse surface (say, on canvas, and on boxes, etc.). The best procedure is to cut the stencil in fairly stout paper and to gum the stencil (use no other paste) on the rough surface, pressing it well to make contact all round the edges of the cuts in the stencil plate. When dry, a coat of paint is applied. When the paint is thoroughly dry, the paper is removed by moistening it with warm water, which softens the gum. Supporting ties should be used as usual and the blank spaces may be painted in, to complete the design, after the paper is removed.

13. Spray stencilling. With the invention of the air brush, it is possible to turn out work in an astonishingly short time with a far better result, allowing the work to be done on delicate materials, such as velvet, silk, or plush, with any desired amount of shading, not possible by any other method. Water hues of rich tones can be employed with considerable effect. A good scent spray with two balls can be procured from the chemist and used for the purpose to produce a much softer result, than by dabbing in by the ordinary stencil brush. The plates are prepared in the same way, one for each colour, and pinned on the material stretched on a board, conveniently placed at a slant, while working. Aniline dies (soluble in water) are very suitable for the work and can be procured at a very small price in small packets, only requiring to be mixed with water to the required depth of tone, which is first found by trying on a piece of spare material and observing the effect when dry. Half fill the bottle with the solution. Well inflate the larger bulb and holding the finger over the nozzle, obtain a sufficiently forcible jet of air to make a fine spray from the start. Then remove the finger and spray equally over the open parts of the stencil plate, holding the diffuser about 2 ins. from the work and working the bulb the whole time. The plate is removed when spraying is done and the dye is allowed to dry. Spraying of the next colour is then proceeded with. If necessary, the spraying for any particular colour may be repeated for obtaining the depth of tone.

Professionally, a spray pencil or gun (available for about Rs. 50/-) will be used with a constant supply of compressed air, but the method indicated above will give fair results.

14. Stencilled monograms or lettering. Stencilling is a particularly suitable process for initialing linen or other household stuff with indelible marking ink. The initial or monogram (fig. 28), however, requires to be most delicately cut; as the design is on a very small scale, it is wise to use very simple designs. The pattern is accurately set out on the stencil paper with sufficient ties in the design to give a strong plate. A steel knitting needle, one end of which is ground flat, the other end sharpened to a point and set in a small holder, gives a cutting tool that will not injure the most delicate forms. The cutting must be very accurate, as a ragged uneven line will be most noticeable in such small forms. The marking ink is lightly dabbed on with a slightly moistened brush. Too much ink on the brush works under the edges of the plate and causes disfiguring smears. Only just enough of ink should be on the brush as will cause a pale streak, when drawn across the hand.

Fig. 28

15. Silhouette stencils. (a) A very interesting pastime is to cut out silhouettes of familiar forms. The simple method consists of placing the subject in front of a white screen and behind a small light, say a candle, so that a sharp shadow is cast on the screen. This is traced on the screen by a pencil and reduced afterwards to a small size on paper and the outline is cut out. When this is placed in front of a small light to cast a shadow, it becomes an interesting show, producing caricatures, when turned round one way or another.

Fig. 29

(b) A girl's head. Take a piece of hard black paper and draw the illustration shown in figure 29, on it. Remove the black portion with a sharp pen-knife and cut the outline with a pair of scissors. Hold the stencil a few yards from a sheet of white paper behind a light and the figure of a beautiful woman's face

will appear. By slowly turning the stencil about, in different positions and bringing it closer to the paper, many varied and realistic expressions can be produced.

Fig 30

(c) The above example (fig. 30) is of a stencil plate of Dr. Rabindranath Tagore. Placed a few inches from a piece of white paper in direct sunlight, the effect will be surprising. Similar examples may be tried from pictures cut out of magazines or newspapers by cutting out the white portions of any black and white representation.

16. Silhouette lamp shades. From the lamp shades described in Stage III, silhouettes may be cut out. The operation is simple and suitable subjects pertaining to special occasions or seasonable periods can be chosen from newspapers and magazines, and stencils prepared without the expenditure of a great deal of time. In the selection, forms should suit the style of treatment and shapes should effectively contrast in juxtaposition and at the same time be easily intelligible. As an

improvement, stout transparent paper may be used instead of thick cover paper and suitably dyed. A band of black paper may be applied near the bottom edge ; so also, some ornamentation near the upper

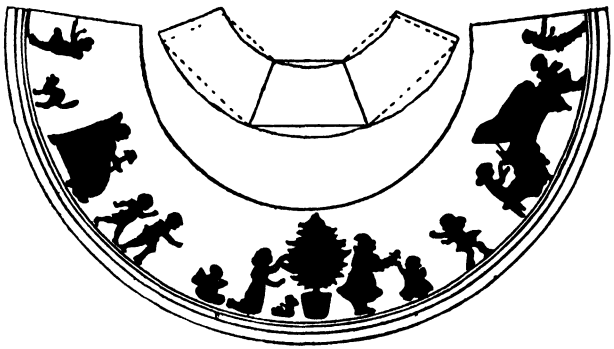


Fig. 31

edge. The figures chosen, may be drawn and painted black. It will be easier still to cut these from newspapers, to paint them wholly black and to paste them properly on the shade. This is a much simpler process. Examples are shown in figs. 31 and 32.

17. **The Diskiascope.** The following is a simple device that affords interest and amusement, particularly to the young. It has been

Fig. 32

named "Diskiascope", for Shadowgraphy. A cardboard shape is prepared, the contours of which give no clue to its mysteries. Inter-

posed between two candles and a white screen (fig. 33) and the distances properly adjusted, a definite silhouette appears of a portion of dark shadow (cast from both the candles) surrounded by considerably lighter ones (cast from one candle only). A grotesque head or some other figure is drawn in duplicate on the cardboard—best done by placing the original over a carbon paper on two contiguous portions of the cardboard, as shown in fig. 34. Portions of the outline are added to both, of arbitrary shapes,

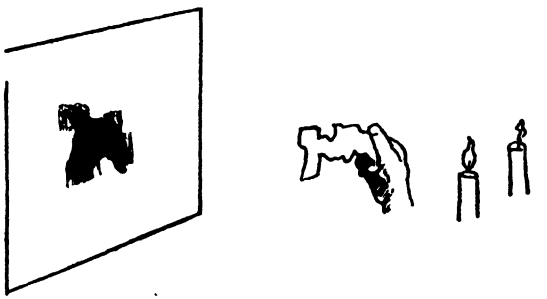


Fig. 33

but making certain that there is no corresponding portions obliterated in both. Of course, the drawing lines should not finally show on the cardboard. A quite meaningless shape would give a surprisingly definite figure (fig. 35), if the correct overlapping of the two shadows be effected by finding the proper position of the card.

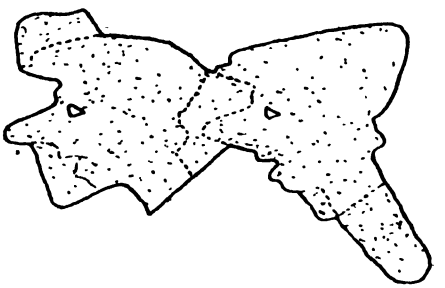


Fig 34

Fig. 35

18. Elaborate scene or figure cutting. Examples of this kind of work, very finely executed by Indian ladies, are often seen in private houses, specially in East Bengal. Take any black and white (as distinct from halftone) illustration of a flower, of a leaf or of a human face. Place it on a sheet of white paper, which is already placed on a sheet of glass. Now proceed as in cutting stencils, pressing it by the left hand to keep it in position and cutting it by a sharp point of a pen knife, or country

barbar's weapon—the *Narun*, with the right. To keep the sheets in perfect register all the time, it may be convenient to attach the sheets together at the four corners, although it is immaterial, if the two together slip on the glass. Incise along the outline of the pattern, taking care that any island portion is not isolated, by having ties, which, if possible, should be made to appear as part of the design, gradually reduced at one end to a point. When the cutting is complete, take out the first sheet, which is the sample and place the second white sheet which has been patterned out, on a dark coloured sheet of paper, pasted on a sheet of cardboard. The design is now shown in good contrast. Figs. 36 and 37 give easy examples of this kind of work.

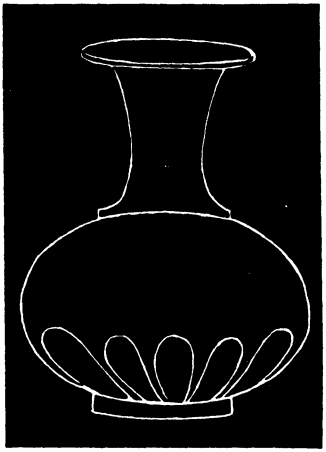


Fig. 36

It is patient work and so far effect is concerned, the labour is worth the trouble. To make a new design will be beyond the scope of the ordinary student, but enough to learn the method is easily attained by practising from copies. Faithful portraits of persons can also be produced after practice. This form of work is tried by first drawing the portrait in black and white on a print, photographic or otherwise, and cutting it out as suggested above. A border or a print of the name below the picture improves the appearance and is preferable when the work is to be framed and hung up on the walls. Fig. 38 shows an elaborate example on the lines of one of Ravi Varma's pictures,

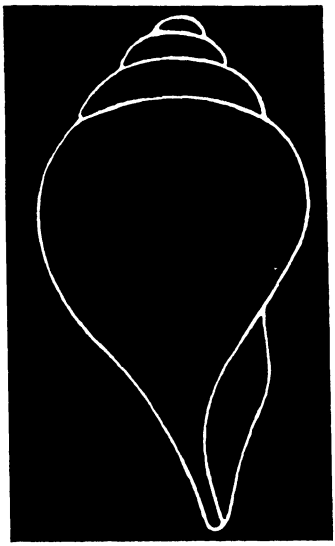


Fig 37

PAPER-WORK.

STAGE VI. PAPIER-MACHIE WORK.

1. **Introductory.** This stage requires paper cuttings, as can be had from Duftries' shops, waste paper, etc., as the main material. Other materials are mentioned at their proper places. The processes described herein are based on the general principles underlying several interesting trades and industries. It is not claimed that after this course, unless exceptionally clever, one would be able to earn a decent income, but further practice is sure to prepare one in the way of earning a living.

2. **Japanese Paper Beads.** The Japanese are well-known for their clever manipulation of paper and its pulp. It is however within the reach of any one to manufacture the paper beads. The work too is not beyond the skill of children. In fact this industry is undertaken mostly by young children in Japan. The beads are double cones or oval in shape, and are made simply from triangular strips of paper.

The best paper to use is ordinary wall-paper, decorated fancy paper, or any kind of unglazed tinted paper. Those having a pattern will serve the purpose, and many kinds of self coloured papers are excellently adaptable as there are often silvery or other prominently tinted markings, which make beautiful self-tinted beads.

The paper is first cut up into bands of about 3″ in width, and 6″ in length (fig. 1). These bands are cut into triangles, of $\frac{7}{8}$ in. bases alternately from top and bottom. The triangles are then rolled up into beads in the following way. The operator sits in front of a board and holds a steel wire of the thickness of a knitting needle, about 8″ long. The triangular slip is laid face downwards with its apex away from the operator. The wire is then laid (fig. 2) on the base of the triangle and the base is turned over the needle. The first finger of the left hand is laid on the base and pushed forward with a rolling motion until the whole of the paper is rolled up into a double cone-

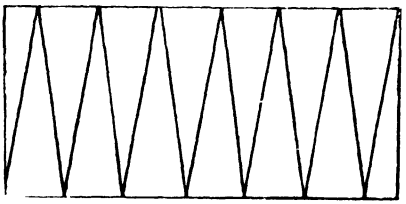


Fig. 1

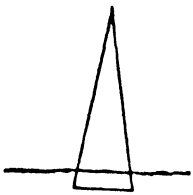


Fig. 2

shaped bead. The apex should be lightly touched by the middle finger of the right hand at the point, with a good adhesive which has been scented with some strong perfume. The bead is given a final roll to squeeze it tight, the adhesive binding the end down, immediately it is applied.

The sets are strung together with small round composition or painted wooden beads or with red sandal fruit or "*kuch*", two or three in number, between each pair. Glass or China beads, which can be bought very cheap, also answer the purpose admirably. A cheap clasp may also be attached at the top to help in hanging. For the preparation of composition beads, see App. II.

Sometimes the slips are creased with 2 or 3 parallel ridges, before rolling up. This improves the appearance. Glazed paper should not be used, but glazing may be done by immersing the beads in a varnish.

3. **The Paste Over Method of preparing Papier Machie articles.** This is an easy method of work on a small scale, although it takes a longer time than the pulp or composition method of working. Briefly, it

consists of pasting successive layers of wet and softened paper over a suitable mould until the required thickness is obtained. First of all, a suitable model is secured. It will be best to start with a simple clay or wooden model, such as a mask, a nose, a cap, a boat, a tea tray, a candle stand, a plain China doll, or a wooden model of a showcard. There should be no re-entrant spaces in the model, as in that case, it will be extremely difficult to take off the dried paper article from the model.

Allow water to run over the model for 5 minutes or so. Drain off and mop up the surplus moisture with a piece of rag and brush the model all over with oil. Linseed oil will do, even without moistening the model. If a clay model is chosen, the use of water has to be avoided. Metal models work best when dusted with French Chalk. Almost any kind of paper may be used except those with a glazed or a coated surface. Cheap newspapers are however too flimsy and if there is a choice, dull-surfaced paper of decent quality, as employed in the more serious types of magazines, may be selected. Thick brown paper is useful towards the finishing layers, and even thin straw-boards may be utilised, if well-soaked, thus securing the needed thickness more expeditiously. If possible, use white and unprinted paper for the first layer. Have a large basin half full of water, and tear the paper to be used into irregular pieces, about 4″ by 3″ in. sides. Push them one by one under water, and leave them to soak for about half an hour. Soaking all night, as some workers have advised, is quite unnecessary and tends to make the paper fragile. If it calls for prolonged soaking, the paper is really unsuitable. Any good paste or slow-drying and non-cracking adhesive may be used. A little experience will indicate the kind of adhesive required.

Taking the pieces of paper out, separately, as required, crunch each piece with the fingers to make it more flexible and expel the surface-water ; then open out again and apply paste well on one side of the paper only, laying down the unpasted side next to the mould. This is to lessen the risk of sticking. Each piece should sufficiently overlap the preceding one when laid, and be pressed into close contact with the mould Let the paper extend beyond the pattern if it is open (as in the case of a boat or a mask, as distinct from that of a doll) for

about $1\frac{1}{2}''$, all round. The second and all succeeding layers are placed, pasted side down. As the work proceeds, keep pressing round from centre outwards. This process serves to squeeze out air bubbles, creases, surplus moisture and paste. A thickness of about 1/10th of an inch, of the paper article, will be sufficient. To dry, the mould may be supported in a slanting position in the sun or in front of a fire, turning it round occasionally to warm both sides. Too great a heat must be avoided, as it would steam the paste and loosen the layers. The drying must take its time, and no attempt should be made to remove the papier machie until perfectly hardened. When dry, the edges will readily come out from simple models, or will do so on gently inserting a knife at the edge. Generally however, for closed models, such as dolls etc., a sharp pen-knife has to be used to cut from a side until the model comes out of the moulded article. The article has to be strengthened at the cut by attaching strong slips of paper, both on the inside and on the outside. In such cases of closed models, thin strips of paper to cover the slips, used for strengthening, have further to be applied with adhesive over the article. In cases of open models, the surplus paper at the margin will need to be neatly trimmed off with a small pair of scissors and the edges bound by pasting round a narrow strip of wet linen, or even wet strips of paper. Filing and rubbing with pumice stone may be required for finishing the surface of the model. Finally rub all over with paste and allow to dry. A bath of linseed oil may be given to strengthen the article. Further, painting on the outside improves the appearance, and excellence in producing the work will depend on practice.

In painting show cards, the ground may be painted a light blue, leaving the letters white but shading their sides and the shadow edges of the card in dark blue. Or, as an alternative, the ground may be of different shades of steel blue and the letters treated with aluminium paint.

A method giving good details, would be to prepare a cast in Plaster of Paris or even in clay and to use this as the mould.

This type of work is admirably adapted for displaying articles in shop windows and many other purposes and lends itself well for an

attractive show. Fig. 3 shows the mould for a tea card and fig. 4, the cast or the card prepared from it. Fig. 4 may also represent a model which is placed in a box (fig. 5) for obtaining a cast of Plaster of Paris or clay to be used as a mould.

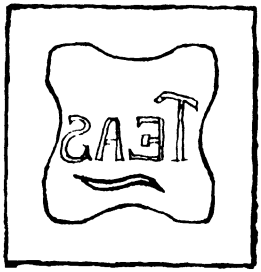


Fig. 3

Excellent examples on a bigger scale may be seen in the Dacca Janmastamy procession and at some Calcutta shows.

4. The Kite. As a fascinating and absorbing pastime, there is no equal to kite-flying to interest the children. Besides being an open-air pastime, which is good for health, it requires a good deal of concentration. It can be enjoyed individually and is an inexpensive hobby. Kites are made of tissue paper, generally tinted. A combination of sections of paper, differently tinted, is also used with good effect. In the latter case, a piece roughly of a square shape is first prepared by gumming the edges of the differently coloured sections and joining them together. The process of joining the sections is as follows: The two sections to be joined are taken. One piece **A** is laid flat on a hard surface and on the edge to be joined is placed the corresponding edge of the other section **B** (fig. 6),

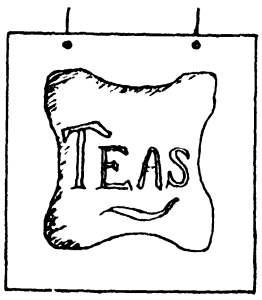


Fig. 4

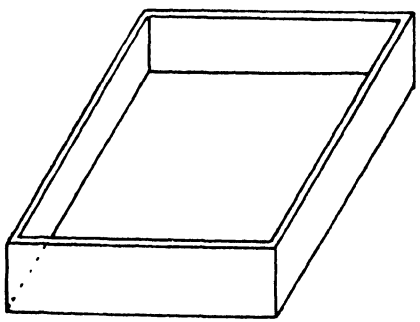


Fig. 5

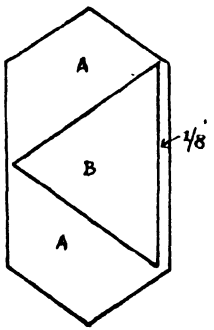


Fig. 6

turned over, leaving a narrow strip of about 1/8th or 3/16th of an inch exposed. Thin paste of flour is applied to the exposed strip and the top sheet **B** is taken in hand, turned over and placed carefully on the bottom section with a little overlap, so that a parallel join is obtained. It may be noted that this is the best method of joining two straight edges of paper, specially when the overlapping is to cover a small surface. The lower sheet is gummed on a parallel strip at the edge, after the upper one is placed over it, upside down, leaving exposed only the strip in the lower to be gummed. In applying gum, the upper sheet is only smudged in places, which is covered in the join when the upper sheet is

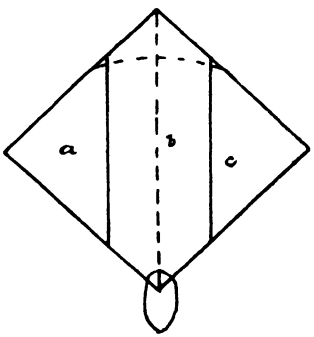


Fig 7

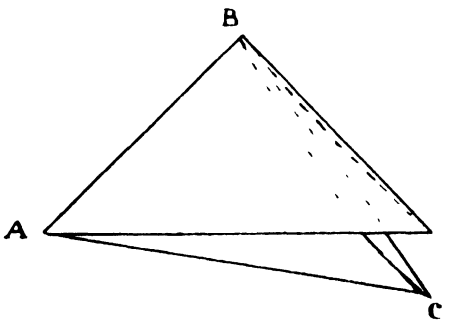


Fig 8

turned over and pressed. Attention should be paid to bring the fair surfaces (if any) of all the sections on the same side, finally.

A few combinations, as generally followed, are suggested. The portions **b**, fig. 7, are generally white ; **a** and **c** are of the same or of different tints. In fact any combination can be made. Sometimes, two eyes of mica or of some dark coloured paper are put, overlapping corresponding holes made near the top of the section **b**, which is designated as the nose of the kite. Once the rough square shape of paper is obtained, the size varying from 9″ square to 2′ square, as desired, it is folded twice as shown at **ABC** (fig 8), and cut by scissors along **BC**, so that when opened, the vertical diagonal is appreciably

shorter than the other. Also pieces (fig. 9) **P** (one), **Q** (two), **R** and **N** (six) and **S** (one), of somewhat stronger white paper, (**S**, may be tinted) are cut out approximately in the shapes shown, these sizes depending on the actual size of the kite.

Now prepare two bamboo strips (from the variety known as the *mooly*) of about an eighth of an inch in diameter, and smooth down the surface. One should be about 2″ bigger than the vertical diagonal of the paper. The other, which is thinner, should stretch from one corner to the opposite corner of the other diagonal, passing two sides at the corner tangentially as shown. In preparing the strips, the shorter one should be of uniform thickness throughout. Knots if any, in the strip should be placed near the centre. If the knot is situated on the upper half it makes the kite top heavy. This produces a tendency in the kite to spin. If heavy in the lower half, the kite becomes steadier, but it may be too steady to respond to any attempts at inclination and side way movements. The other bamboo strip, should be symmetrical. If knots cannot be avoided, they are to be put symmetrically about the vertical diagonal of the paper. If any side be heavier, the kite will fly inclined that way and will tend only to move in that direction and steady flying will not be possible. Remedies have to be taken recourse to in such cases, for instance, by loading the kite with paper, pasted on the opposite side, near the corner.

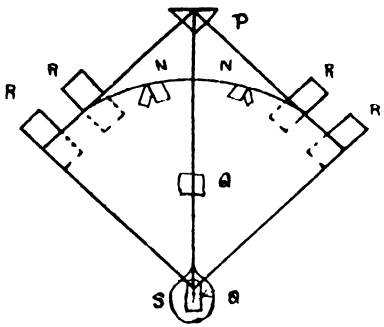


Fig. 9

As to the actual preparation, lay the paper flat on a hard surface and attach from below, four pieces **R**, two at the points where the bent strip leaves the edges, as shown in fig. 9. **S** is pasted at the tip and fixed on the bottom corner from below. Paste the skin side of the vertical strip, and fix on the paper along the vertical diagonal, the projection being left wholly on the lower side. Now turn over the paper with the strip and gently press on the diagonal by a pad of soft paper or cotton rag. Again turn over and paste two pieces **Q**

and fix from the top, pressing down the narrow edges over the vertical strip, one piece to fix S, and another, a little below the centre. Similarly fix P to attach the top of the strip and turn round the 2 edges. Now fix the bent strip symmetrically, cut properly to size, one side at a time, by pasting the exposed portions of R and turning over. Fix also the two remaining pieces, N, pasted on half its length, under the bent strip, as shown at N, N, and applying paste on the other half, fold back and fix. This forms a very satisfactory strengthening of the attachment of the bent strip. Take a piece of a string about 3 or 4 feet long and attach one end from the paper side of the kite to the crossing of the strips, through the paper, pierced by a pin. The other end is similarly tied round the vertical strip, where a

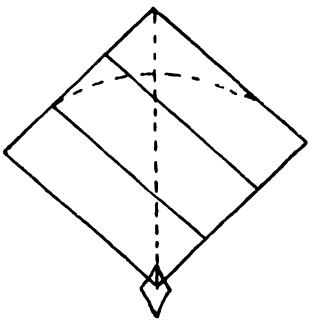


Fig 10

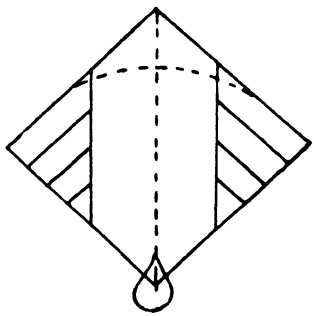


Fig. 11

piece Q has been attached near the middle. Take equal lengths from the points of attachment, on the two sides of the loop of the string, by placing them successively along the diagonal and taking the lengths up to the point of attachment of the other on each, and tying a knot. This ensures equality of the two lengths of string coming out of the kite to the knot. If there is a tendency in the kite to spin too much, shorten the lower attachment by looping the string round the free small end of the string after the knot near the middle. If on the other hand, the kite is too steady, shorten the top attachment in the same way.

The above is the practice in East Bengal, specially in Dacca, where a great deal of interest is taken, even by grown-up people, who sometimes form into sides and play matches. Figures 10, 11

and 12 show different designs of the kite, as is commonly prepared. In West Bengal, further strengthening of the paper is done by attaching a thin string along the edges and folding the paper back in a very fine strip by paste. But this spoils the mobility of the kite.

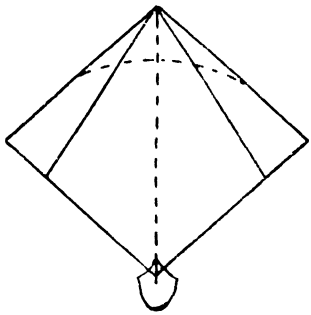


Fig. 12

5. A Fire-balloon. Take three large sheets of tissue paper, fold lengthwise and cut down the middle. This will give 6 pieces of about 42″ × 14″ each. Fold all 6 sheets again down the middle. With the scissors cut along the dotted line as shown in fig. 13. When this is opened up again, it will give 6 cigar-shaped pieces. Take one sheet and lay out flat : take the second sheet and lay on its top, leaving one side of the lower one, protruding about half an inch from the upper. Then run some good paste all along this lap, and fold back, pressing down firmly. Turn the pasted sheets right over and then take the third sheet and paste on the other side of the first sheet in the same manner. Follow in the same way with the remaining sheets. The sixth sheet will be found to overlap the one on the opposite side. Fold this over and paste down. Allow a little time to dry and then open out carefully. If these directions have been followed, a perfectly shaped balloon will be formed as shown in fig. 14. Cut a 6′ circle and paste over where the pieces meet at A. Then take a piece of light copper wire and put round the mouth at B by shaping the wire in the form of a circle and fix by lapping over the paper and pasting down. Dry carefully over a lamp or a fire. The balloon is then ready for ascent. Take a very light tin (say, a quarter pound tobacco tin) and fill with wadding, leaving it nice and fluffy and not pressing it tight.

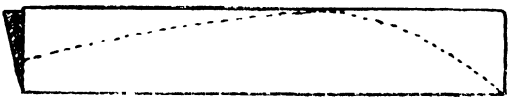


Fig. 13

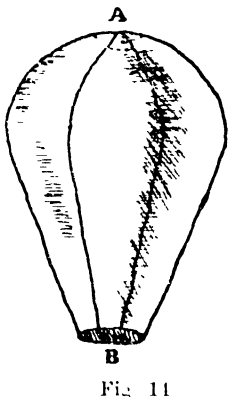


Fig. 14

Soak the wadding with methylated spirits. Fix this at B in the centre with a piece of fine copper wire. Get two or three persons to hold open the balloon and then light the spirits. The balloon will soon fill out. Hold it until it begins to tug. Do not let it go too suddenly and be very careful not to jerk the balloon, or the spirits may be spilt and set fire to the balloon. When properly inflated, the balloon will glide off splendidly. Too much cannot be said to emphasize the care that should be taken to handle the spirits and tissue paper near it.

6. Fire-balloon from two pieces. Spread out a sheet of any brightly coloured tissue paper on a table, and with a pencil mark out a curved shape as shown in fig. 15. Make this as big as the paper

Fig. 15

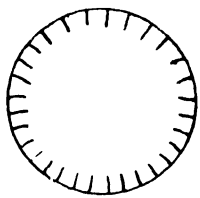


Fig. 16

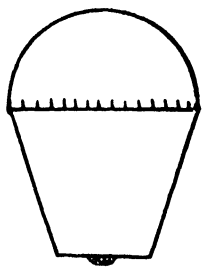


Fig. 17

will allow and also of a good width. Then take another sheet of paper of the same or of a different colour and draw on it a large circle, the diameter of which is a trifle bigger than the width of the curved shape. Get the circle as true as possible, although it will not matter if it is not quite exact. Round the edge of the circular piece of paper, cut radially for a few inches as shown in fig. 16. Next take the curved paper and paste the two sides together, forming a funnel, which is rather broad at both ends. Now take the round paper and paste this over the broader end of the funnel. It will be found that the cut parts make it easy to arrange the round piece over the funnel for fixation by paste in each of the segments. It should be noted that the upper length of the curved piece should be just sufficient to go round the circle, where it is attached. The shape of the balloon will now be something like that shown in fig. 17.

The framework for supporting the cotton-wool that is to be soaked in methylated spirit, is made from a length of wire bent in the form of a circle, so that it is just the size of the bottom of the balloon as shown in fig. 18. Twist the ends together. Then fix two cross pieces of wire. With thin wire, tie a piece of cotton wool in the centre of the wire support. Place the circle of wire a little way up the balloon on the inside, turn the paper round and paste it. The frame-work will then be held in position.

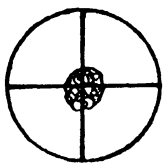


Fig. 18

To set the balloon going, get a second person to hold the top part well up. Soak the cotton-wool with methylated spirits and set it on fire. As soon as the balloon fills with hot air and tends to rise upwards, let it go. If there is not a great deal of wind, the balloon will rise to a considerable height, before catching fire.

7. **Suit and Attache Cases.**—The general principles of construction is the same and should not present any serious difficulty to any one. Actual dimensions depend on the fancy of the worker but as a general rule, suit cases run from 16″, rising by lengths of 2″, up to 26″, which is regarded as the limit, in length. The width and depth will vary with different makes, but will usually be found to run from about 12″ to 20′ in width and about 6″ to 12′ in depth. Attache cases may be made from about 8″ up to 16′ in length with about the same proportions in other dimensions. It will be found best to do the actual making up on a block, of the size of the inside of the article, as this greatly facilitates the working. Such a block need not necessarily be of solid timber, but may be made up of fairly stout wood, like a closed box, care being taken to get the corners exactly square. If this is not done, a bad shape will be given to the finished article and it will also decidedly increase the difficulties of working. The box portion should be made up first, and the sides drawn in, before preparing the lid. One piece of thick paste board will do for the front, bottom and back of the case, with the sides. Another piece will be required for the top and sides, including the front of the lid. First draw as

shown in fig. 19, noting the breaks in the horizontal dotted lines, the sides being smaller than the bottom by two thicknesses of the board, in length. Make similar allowances for the lid also. Now cut along the full lines and crease along the dotted lines. This creasing is to be carefully and properly done, so that an even bending, strictly on the desired lines giving a sharp right angle, without injuring the board, is obtained. Slight cutting with a sharp pen-knife is not to be advised at the beginning, creasing with a blunt knife-edge with pressure being sufficient. Now mount this on the block and get it to shape, putting the joining flaps inside. For proper shaping, the block should be recessed properly, to make room for these flaps. A few tacks may now be applied, right to the wood to keep the parts together. Some properly distributed holes, near the edges, for rivets of copper, have to be punched out. Strips of cardboard, about 1½″ in width are fixed on the inside of the box with about half an inch protruding out, to ensure a proper seating of the lid. Holes are also to be punched for rivets for attaching this. The back edge of the box is to be bevelled, which may be done now. The case may then be taken out and the rivets applied by placing the case on a projecting iron support and light hammering. A rectangular strip of two inches in width, of leather or strong canvas, to serve as a hinge, is placed with about half of it inside the board at the back before rivetting. The same procedure is followed for the cover, the protruding canvas or leather being tucked inside the back side. The back edge of the lid, is bevelled to allow the case to open properly, as already noticed. Putting shelves, lining, attaching handles, locks and straps etc. will depend on individual tastes. Cloth or paper in imitation of leather is available and makes a splendid finish on the outside, while any kind of tinted paper will do for the inside.

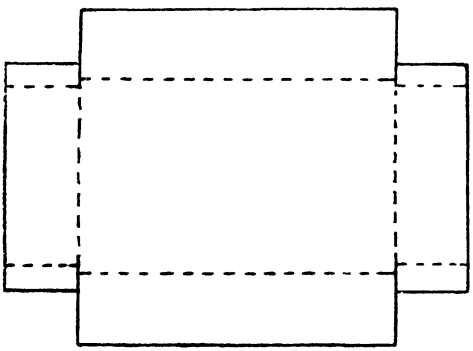


Fig. 19

Small locks and handles can be bought cheaply and fixed by rivets. Suitable triangular strips attached at the corners can support shelves, if any, on the inside.

8. Use of Papier-machie as a Matrix. Stereo-typing. Papier-machie makes a good matrix and is well adapted for taking casts from very fine and shallow engravings where the plate of metal is very thin. Figures with low relief, medallions &c., can be duplicated by the process, which is largely used in the printing trade and known as stereo-typing, where blocks or set up types are duplicated so as to save the types from being used for large impressions. The first requisite is to put a border of desired thickness all round the model, and of a height equal to the greatest height in the model. Any great depth between the border and the design may be filled up by putty, in order to prevent breaks in the finished matrix. The whole is clamped suitably under pressure from the four sides, e.g., by placing the model on a piece of planed wood with strips attached to it in the form of a rectangle slightly bigger than the model and driving wedges, to fix the model.

The surface of the model is slightly oiled all over or dusted with French chalk. A sheet of soft tissue paper slightly bigger than the model on all sides is placed on a hard plane surface and paste applied on it smoothly. A sheet of thin blotting paper is next placed on it. This is gently rubbed down and then pasted and a second sheet of blotting paper is similarly fixed on it. A sheet of brown paper is next pasted on it and the whole (the prepared *flong*) is now put properly on the prepared model, with the tissue paper next to it. A thin damp cloth is placed on it and with a stiff brush, with a plane surface, the paper is worked into all the lines of the pattern, care being taken not to use the brush so forcibly as to tear the paper. After the sheet has been well beaten in, small pieces of card-board, cut roughly to the shape of the depressions formed at the back of the sheet, are pasted in their proper places. Another layer of brown paper is then pasted on and a second dabbing is given to the form. Finally, a weight is applied and the paper left to dry, if possible, by application of heat, when the matrix should come away easily from

the model, carrying a clean, sharp impression. It is next trimmed to the size of the casting frame, to be presently described, and the embossed portion finely dusted with plumbago, which should be well worked into the details with a fine soft brush.

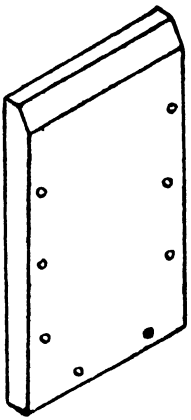


Fig 20

The casting frame can be improvised by securing two planed rectangular boards of wood (one shown in fig. 20), with one edge of the short sides, bevelled in each, and with holes along the three other edges for tightening with bolts. The *flong*, as prepared, is placed on one of the boards. Strips of wood of a thickness, slightly bigger than that of the flong, are put along the border and against one another, round the three edges, with the idea of keeping the boards separate. The top board is then carefully put on the lower with the bevelled sides of the boards against each other and with the bolt holes in register. The bolts are then tightened up. The whole is then clamped and placed vertically and molten old type metal, as can be cheaply obtained from a printing house, or a mixture of equal amounts of lead and tin, from a small ladle, is poured from the top in front of the paper (fig. 21). It solidifies almost at once and the casting may be trimmed, by a saw and a course file, to the desired shape. This part of the work, if necessary, can easily be done, at no great cost, by a professional from outside. If the design is meant for a printing block or a stamp, it has to be further mounted on wood. Castings for toys with low relief, medallions etc., do not require any mounting, unless specially desired. Similarly, duplication of medals, coins, that are old or rare, engravings, or any inscriptions, can be done and do not also require any special mounting.

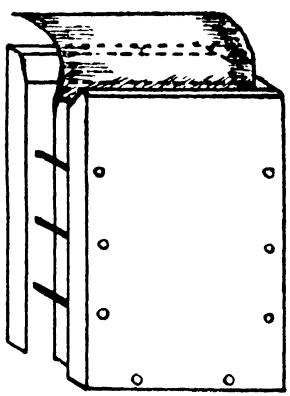


Fig. 21

9. Papier-machie Pulp-work. Cuttings from the book-binder's shop, old newspapers, in fact, any paper that is meant for throwing away, can be collected and steeped in a vessel in water until very soft. Printed or written paper will give a dirty appearance to the pulp, which may not be desirable in some cases, when only white pieces should be taken. The softened material should be broken up into small parts and kneaded until the whole is converted into a homogeneous mass. Frequent rinsing with water removes the impurities and gives a whiter shade. A meat mincer can be very effectively used to get the material fine and uniformly mixed. There are various compositions for preparing the pulp paste, as used by different workers, but one with flour and chalkpowder with a little glue mixed with the pulp and heated in an oven while being stirred, is almost as good as any.

The following are alternative mixtures :—(1) Wet paper pulp, 4 ozs. ; dry plaster of Paris, 8 ozs. ; hot glue, 5 table spoonfuls. Make some hot thin glue solution. Take some paper pulp from the water with a gentle squeeze, by no means drying it, and put it in a bowl and put some hot glue, stirring the mass into a soft and sticky paste. Add some plaster of Paris, until almost dry and stiff. Now add the remainder of the glue and when sticky, add the Plaster of Paris. Work with the fingers until thoroughly mixed and finely kneaded so as to be free from lumps and not be sticky. Covering with a wet cloth or addition of a few drops of glycerine will help the paste to keep for some time without getting very hard. This will be a better mixture than the first and will give finer details. (2) A mixture for pressing into form is easily made by grinding the pulp with milk of lime or lime water and a little starch. Sometimes clay or chalk may be added. It can be made partially water-proof, by the addition of sulphate of iron, quick lime and glue or white of egg. It can also be made incombustible, by the addition of borax and phosphate of soda. (3) The pulp is made into a paste with flour (1 lb.), water (3 quarts), and ground alum (a table-spoonful). (4) Another mixture for pressing into form, is obtained by mixing the pulp only with hot thin glue. (5) The pulped paper is boiled in caustic soda, rinsed in clean water with a small quantity of soap dissolved in it to neutralise the alkali. Chalk

and sand may be added as fillers. (6) Whiting, 20, parts ; pulped paper, 20 parts ; thin hot glue solution, 12 parts ; and formaldehyde, 2 parts. (7) Paper pulp, 10 ; saw-dust, 10 ; flour, 6 ; ammonia, 2 ; and water, 15 parts. (8) Plastic papier-machie for pressed work can be made by adding to the pulp, an adhesive of strong gum arabic ; or dextrine solutions ; or strong solutions of ordinary glue softened in water and melted in a water-bath. This is to be pressed hot and dried in a stream of hot air and varnished. It will be noticed that all these compositions are simple variations of the same principle of selection of materials.

The finish in all cases may be done by giving a bath of linseed oil, baked at a high temperature and finally painted and varnished. Sometimes a priliminary coat of glue size is given.

10. Hollow Toys and Decorations, from Pulp. A hollow mould of metal or wood of the toy or decoration, is required, if necessary in 2 or more sections, clamped together for easy removal of prepared articles. Oil the inside or use French Chalk copiously. Sheets of brown paper in small pieces are laid, one over an other on the inside with a coat of glue between every two layers, as in the case of the paste over method of working papier-machie. The paper is pressed into he recesses. When some thickness is obtained, it is left to dry and when dry it is taken out and trimmed to shape. The pulp in a thin layer is next applied to the oiled mould, and worked by the fingers in the recesses. Fresh paste is added where indents have been formed. The paper mask is then again inserted and pressed upon the pulp composition, which adheres to it. When somewhat dry, it can be taken out and a sharp and well-defined toy or an ornament is obtained. A finish, as desired, depending on the individual taste can then be given to it.

11. Solid Toys or Decorations ; Alphabets. Busts, toys, or other decorations with low relief, can be made in the same way by securing the mould and working the interior with paper pulp composition with the fingers, so that all the fine details are reproduced. Where a press is available, the work is much simplified and by repitition the articles are rapidly produced. Even the paste-over method can be used where a pair of dies is available in conjunction with a press.

The method is however of passing interest, as it will be difficult to secure a press and still more difficult to have a decently made die or mould. Those dies used by goldsmiths, who beat down precious metal foils with lead into the recesses of metal moulds, can be borrowed and the process tried by pressing the pulp inside by working with the fingers. When assured of success, the expense of having moulds made to design can be incurred. For decorations, any design cut in hard close-grained wood, e.g., moulds for sugar models as prepared by sweetmeat makers, will not be difficult to obtain and the process tried. It is sure to give entire satisfaction.

English Alphabet Block letters could be quite well manufactured from a dough made up of paper pulp and ordinary glue-size. After thorough incorporation of the two ingredients, the resulting dough should be squeezed into moulds of the desired shape and the whole slowly dried at as low a temperature as possible. This method should give letters which are tough, easily paintable with oil paints and capable of being finished to a fine and smooth surface. It is true that in the unpainted condition they would not be particularly resistant to the weather: but since it is proposed to finish them in oil paint, the coats of the latter should be quite sufficient to protect the glue from the action of the rain. By the use of fairly high pressure in moulding and with subsequent careful drying, very dense masses could be obtained, which, after a few coats of oil paint, should be weather resistant to a fairly high degree. Adhesives, which after drying become insoluble in water, could of course be used, but their use would be accompanied by an increase in the cost of production. Glue when treated with formaldehyde, potassium bichromate, or tannic acid, becomes insoluble in water when exposed to light, and this property is made use of in preparing waterproof adhesives. Thus 1 part of glue is soaked in 5 parts of cold water until thoroughly soft, then melted on the water bath to which 1 part of potassium bichromate is added. Exposure of this adhesive to the light would result in the precipitation of an insoluble variety of gelatine; so until required for use, the mixture should be kept in the dark. Preferably it should be used as soon as made, and only sufficient quantity should be prepared for

the work in hand. Another waterproof adhesive which should be of use is prepared by softening and dissolving 1 part of gelatine or glue in 5 to 8 parts of water, and then adding to the solution one-fifth part of potassium bichromate and one-fifth part of acetic acid, the latter being introduced to prevent gelatinisation of the solution. It is just possible that exposure of still moist letters—which have been prepared from pulp and ordinary glue-size—to the action of formaldehyde vapour would be sufficient to convert the glue into the insoluble variety, which after drying will make the product quite weather resisting. In order to get as tough a product as possible, the waste material should not be reduced to too fine a state of division, and moulding should be carried out under fair pressure. Whichever adehesive is used, weather should have little effect on the finished products, if these are protected with one or two coats of good paint.

12. Sign printing with paper pulp. Show cards for various purposes can be made easily by the use of rather thin paper pulp. The design is first made in good fancy lettering with or without any border, on the paste board suitably covered by paper to form the ground. An ordinary small tin syringe is procured but a short narrow tube is attached instead of the usual conical delivery tube. Then a cork bored through its length is mounted on this tube. Several narrow tin tubes, as can be fixed to this cork, are then prepared with the other end of triangular, circular, rectangular, square or other sections of openings, of different sizes, as desired. The paste of the pulp is put in the syringe and the point carried over the design, while the piston is gently pressed to eject in a thread the necessary amount of the paste of a cross-section and thickness of the delivery tube used. No other finish is required than dusting bronze powders of different colours, if desired, to the different parts of the work. These can be suitably hung at the proper places and form a most useful and cheap advertisement, which is also attractive.

A doctor's syringe or an appliance used for ornamentation of cakes (icing tubes with several mouth pieces can be bought within Rs. 3/-) or even a paper case improvised for this purpose, can be used.

13. Papier-machie beads. The pulp is prepared rather stiff

and a quantity is placed on a hard surface and the palm of the hand and later, a small piece of plied wood is used to roll the pulp backward and forward to form a long cylinder of any thickness desired. It is allowed to dry a little and a table knife is used to cut it into short lengths by a rolling motion so that it may not lose the cylindrical shape. Colouring may be done by bronzing powders on these, while still sticky. A better plan will be to moisten them by rolling in a vessel which has been sponged by a thin solution of glue and then again rolling them immediately in vessels containing bronze powders of different colours. They can be dusted of the excess, when dry. The matter of piercing holes in them by a needle would be an easy matter, but should be carefully done, so as to make them symmetrical.

14. Papier-machie Animals. A manufacturing process, based on the principle of making hollow articles in porcelain, consists of the following method. The moulds for making these (say for doll's heads) are made of Plaster of Paris, in sections, if necessary, similar to those, used for casting hollow China toys. The "slip", in this case, a rather thin paper pulp composition, including Plaster of Paris (improved by the addition of a little china clay) is poured in and swirled round and allowed to set slightly at the sides when the core, while still in a liquid condition, is poured away, leaving a hollow cast. The mould is then taken to parts and the cast taken out, allowed to dry by gentle heat and finished as desired. After a time (about 30 casts), the Plaster of Paris mould loses its property of absorbing moisture, on which action depends the setting, which starts from the surface. The moulds have then to be baked, when this property is restored. It is a most interesting process but due to the necessity of occasional baking, is difficult to practise, except for experimental purposes. No oil should be used but the article comes out of the mould easily.

———.o:———

APPENDIX I.

THE ART OF LETTERING.

(On the lines suggested in "Work.")

The subject of lettering well repays careful study of the principles it involves. It is not merely a matter of mechanical drawing, but involves freehand work and requires an eye for form and proportion.

The first consideration should be to learn the fundamental forms of the letters of the alphabet, including signs (ampersand) and the numerals. It is astonishing what mistakes the average man will make in the forms of letters, inspite of the fact that every printed sheet furnishes him with endless examples of correct lettering.

Lettering conveniently may be divided into three classes: (1) Plain or "block" lettering (upright or slant), in which the letters are formed by lines of equal thickness throughout and have no pointed projections; (2) lettering combining thick and thin strokes, with or without cross lines—known technically as *serifs*; and (3) pen-made letters, capitals beautifully ornamented.

These variations of form are shown in fig. 1.

In regard to the second class, the student may be puzzled at times as to which strokes should be thick and which, thin. He will avoid mistakes, therefore, if he remembers that the thick strokes are those which would be down strokes, if written with the pen. In fact, letters of this kind have clearly evolved from the written character, which sufficiently explains the relations between these thick and thin strokes. A study of the following example will be helpful. The addition of the serif in no way affects the question.

A H I M S U W Z

The only way to learn the correct forms of the letters is to practise with the pencil, brush and pen in order, copying from good bold types. Begin with bigger sizes, to appreciate the proper shapes and proportions.


ABCDEFGHIJK
LMNOPQRSTU
VWXYZ&.,?
2345678
ABCDEFGHIJKL
MNOPQRSTUUV
WXYZ.,123456789
IHLFET OQCG
VWYAXZNMK
DPBR SUJ.,
1234567890

Fig. 1

Although expert artists take certain liberties with the fundamental form, altering the proportions of its various members, or the sweep of its curves, they invariably preserve its original structure intact. It is by such alteration that variety in style is created ; but it is not work for the novice, nor is it easy of accomplishment, as it fails to satisfy the eyes unless the same style is carried out throughout the whole alphabet. The oblong size is the most preferable. Sometimes they are "expanded", the square shape being common ; or "contracted." These are used in their proper places to produce a good effect.

A few points in connection with the individual letters and numerals may now be considered, noting certain characteristics that must be borne in mind by the student.

The cross stroke in **A** should come below the centre of its height. The cross stroke of **H** should come above the centre. The letters **B, S, X, Z** and the numerals 3 and 8 have the upper half invariably smaller than the lower half. Familiarity leads one to believe that the disparity is small or altogether absent; but if some printed lettering be examined upside down, the difference will be evident at a glance.

The middle horizontal member of the letter **E** and the lower horizontal member of the letter **F** should come above the centre of the height.

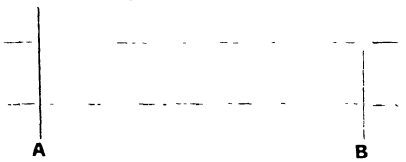
The letter **K** has the tail joined to the upper sloping member and not to the vertical one.

The letter **N** has the peculiarity that the sloping member joins the two uprights differently at top and bottom. The principle of its construction is made clear from any printed specimen, in which it is seen that the lower edge of the sloping member starts from the inner corner of the right-hand upright, and if continued upwards far enough would meet the left-hand top corner of the left-hand upright. The upper edge of the sloping member is parallel with its lower edge, and the width is the same as that of the uprights ; so the result is that the width of the horizontal edge at the top is greater than that at the bottom, the latter of course, being the width of the stroke. This letter has been treated at length because it so often forms a stumbling-block for the beginner.

It may be added that in letters carrying the serif, the serif is omitted from the base of the right hand upright, as seen in **N**.

The setting out of a line of lettering may be facilitated by adopting some such procedure as that presently to be explained. Attention must first be drawn, however, to the fact that the alphabet includes three anomalous letters, **M**, **W**, and **I**, that do not conform to standard width. Were it otherwise, the letterer could set out his wording by simple measurement, as in a type-writer.

However, the difficulty can be got over with a little trouble by a useful expedient, which may be best explained by an example. Assume that it is desired to set out a line of lettering consisting of the words "Maw's Pain-killer" (containing the three anomalies and an apostrophe and hyphen). First rule two parallel lines to determine the height of the letters and mark the length **AB**, the lettering is to occupy, thus :—



Then write down on paper, the words "Maw's Pain-killer" and proceed to allot values to the letters and spaces in accordance with the following schedule :

M = 3, **W** = 3, **I** = 1, all other letters 2, hyphen 2, apostrophe 1½, spaces between letters ½, and spaces between words 3.

In fig. 2, the method of using these units is made clear. When added together in this case the total is 39½, and the space **A** to **B** may

Fig 2

be divided into 79 equal parts, when it will be a simple matter to allot to each letter space, its value as per schedule.

Next pencil in the letter forms, ruling the straight member of each letter and taking care to make the strokes of equal width throughout by the use of the dividers. The curved and sloping

members may then be added, the former free-hand and the latter by ruling, after first having indicated the angle with the pencil.

Up to this point the work should be in pencil, if on paper, and chalk or charcoal, if on a painted or plain wooden surface, accordingly as the background is light or dark, so as to admit of subsequent adjustment.

Having set out the letters by measurement in the manner just described, it will be found that, regarded as a whole, the result is not altogether satisfying to the eye. In certain combinations the letters will appear too openly spaced. That is owing to the fact that some letters like A, V, L, and F terminate at top or bottom in very little width. The effect is aggravated when two of these letters come into juxtaposition, as for example, L A, or F V, leaving a wide blank space between them at the top or bottom, as the case may be. It is necessary, therefore, to readjust the spacing so as to eliminate, as far as possible, these empty spaces,—a matter that calls for judgment and a good eye. Examples are shown for such expedients in fig. 3.

In practice it has been found that the geometrical method of setting out the letters may be simplified as soon as one has acquired some facility in the work. Starting with the centre point in the line, and working to right and left, sketch in the letters freehand, making the spacing adjustments as necessary. As soon as the eye decides that a good result has been attained, give each letter its proper width by measurement. If the line should be a long one, it is best to divide it into four or more equal spaces, and thereby fix the positions of those letters which fall near the points of division.

Fig. 3

In certain cases, a group of words may be constructed with the initials of the first word of each line in a vertical line thus :—

IT IS PEOPLE
LIKE YOU
MAKE PEOPLE
LIKE ME
LIKE PEOPLE
LIKE YOU.

In this instance the work is simplified, the only care necessary

being to adjust the spacing in the manner already described and of course, to see that the letters conform to uniform width according to their unit values.

In dealing with a large mass of lettering some amount of judgment is needed to get a pleasing result. There is no rule to guide the novice. He must experiment for himself. It is mainly a question of balance in which the eye is the best guide. When the lines of lettering vary in the size of the letters, it will be found that the spaces between line and line must be varied in proportion to the size. Also, of course, they will be determined by the sense, a larger space allotted between sentences than between words of a sentence.

Fig. 4

A study of the example given in Fig. 4 will make these points clear. In a large mass of lettering, variety in style should be introduced to avoid monotony; for example, italicised characters may be used for certain lines, as shown above.

Fig. 5

Fig. 5, shows an expedient for obtaining uniformity in the intermediate horizontal members of a line of lettering that is useful. Whenever possible, aid the eye by mechanical means; it is worth doing and saves time.

As to style of characters, that is a question mainly of good taste, appropriateness and resource. Generally it may be said that the plainer the letter, the more legible it is, and in most cases, legibility is the first consideration. Elegance and decorative character may result from good form without elaboration in the way of ornamental detail.

Books of alphabets have been published in numbers, but it is rarely that they prove helpful. Many of the so-called ornamental styles of lettering seem to be designed expressly to offer a puzzle to the reader.

For purposes of study there is an immense bulk of material available. Apart from current examples which meet the eye everywhere,

Fig. 6

there is a wealth of beautiful lettering stored up in old books and printer's catalogues.

Fig. 6. gives a few specimen styles that derive their decorative

quality from form alone. Letters may be in outline in full block or colour or filled in with a hatched tint.

The question of pleasing the eye has been emphasised. Unless the lettering as a whole achieves that object, it can hardly be regarded as successful, though it may be neatly executed and be free from errors of form. There is an expedient relating to letters which are wholly curved at top or bottom, or both—for example, O, Q, U, G, C, S and J—which is not always understood, namely, to allow the curve to intersect slightly straight lines bounding the other letters at the top and bottom. This is shown in Fig. 7. It is called for, because, owing to illusion, the eye judges these letters to be less in height than those of square build. The use of interlocking letters or curved extentions sometimes improves the work greatly.

The beginner is advised to practise putting in the curved members of his letters free-hand. In certain styles of lettering, the curves, or

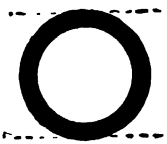


Fig. 7

some of them, may be struck with the compass, but that only applies when they may be represented correctly by parts of a circle (or a complete circle as in the case of the letter O). It more often happens that the curves are portions of ellipses or other curves departing more or less from the circle ; and then the hand and eye are best guides.

The appearance of a printed page (of a card or nameplate) is greatly enhanced in beauty by a simple border, similar to those illustra-

ted (fig. 8). The reader is recommended to study good advertisements in periodicals.

Reference may now be made to some elegancies affected by writers that, when well designed and executed, lend distinction to their

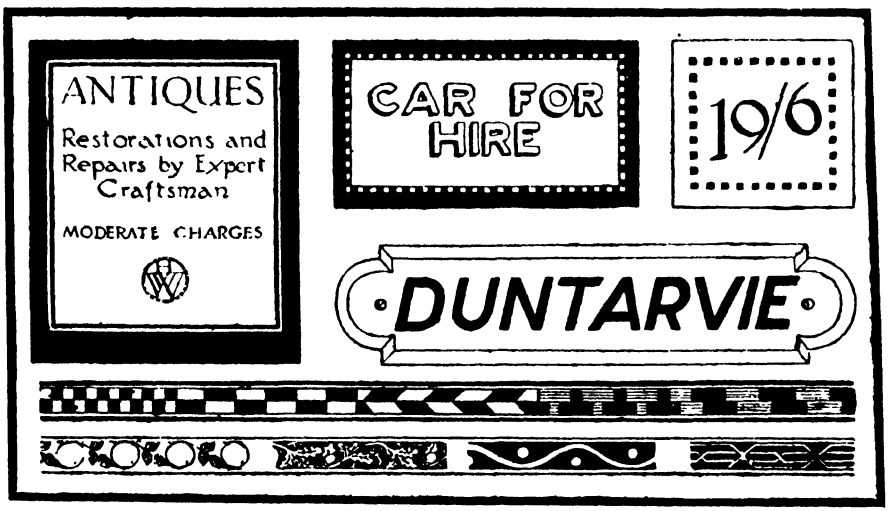


Fig. 8

work. This is the use of interlacing letters and of those curved extensions of certain members of the letters that go to redeem the general uniformity of the work. These call for an eye trained for the

purpose and some amount of resource and ingenuity, and they can best be expounded by the examples which are given in Fig. 9.

Of course there is a limit to the uses of such an expedient, which may easily be overdone, as may be inferred from the example embodied

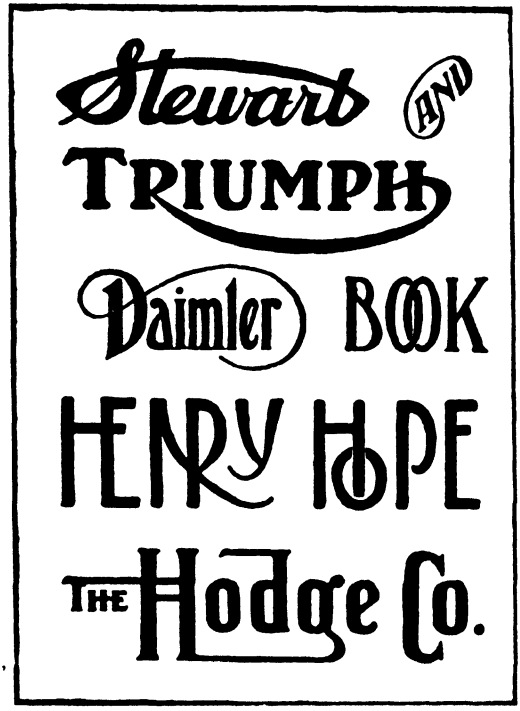


Fig. 9

in the words "Henry Hope," this being given simply to illustrate the abuse of the practice, which it outrages not only in making for illegibility but also in introducing crudities of design and lack of balance.

APPENDIX II.

COMPOSITION MATERIAL FOR BEADS OR BUTTONS.

The following are compositions which will give good results:

(1) pitch 2 lbs., ground shellac 1 lb., resin 1/4 lb., silica 3/4 lb., resin oil $\frac{1}{2}$ lb.; powdered "fritt" or crockery may be used in place of silica. The ingredients are melted in a water pan and passed through a "mixer". The dough-like metal is rolled into sheets and the beads or buttons stamped out under dies.

(2) Another recipe of German origin and used for buttons, beads, insulating purposes and small ornaments is as follows: 1 lb. of ground shellac, $\frac{1}{4}$ lb. of thick turpentine, $\frac{1}{4}$ lb. of guttapercha, 2 oz of pitch, 8 oz of tar oil, $\frac{1}{2}$ lb. of linseed oil, $\frac{1}{4}$ lb. of plaster-of-paris, and $\frac{1}{4}$ lb. of Portland Cement. The liquids are mixed and made warm. The solids are thoroughly sifted, the shellac, gutta-percha and pitch added to the liquid, and gentle heat applied; the plaster and cement are added last. The whole is kneaded in a "mixer" and rolled between brass rollers, the articles being stamped from it.

(3) The following is a very good recipe for a glazed black-button: pitch 10 lb., resin oil 5 lb., lime (slaked) 5 lb., powdered vulcanite 4 lb., gutta-percha 10 lb., whiting 2 lb. and powdered "fritt" (crockery or silica) 1 lb. The pitch and resin oil are melted, the gutta-percha added next and then the vulcanite, the remaining ingredients are mixed together and slowly added, stirring for an hour. It is rolled on steel rolls. Add boiled linseed oil if the material is too brittle.

(4) Coloured articles may also be made by adding earth or

mineral colours to the following ingredients: powdered silica or fritt $2\frac{1}{2}$ oz., white-lead (powdered) 2 oz., lime (slaked) 1 oz., powdered resin 1 oz. and boiled linseed oil 4 oz. Add the lead, litharge and resin to the boiled oil, heating gradually and add the lime last. This composition can be moulded or worked by hand, but care should be used not to have it too sticky. A dry crumby mixture is required.

Composition articles are becoming popular, and are superior to stamped metal articles, which lose their coating of lacquer and show the bare metal beneath. They are also superseding the covered wooden articles in many cases and are ideal substitutes for horn and bone, which require expensive machinery to make them.

APPENDIX III.

DRAWING—COPYING, ENLARGING, REDUCING AND DISTORTING.

Copy drawing gives accuracy and should be the first exercise of the pupil. Object drawing next, gives an idea of colour and shape, while memory drawing involves the expression of a considerable amount of thoughts and ideas. A copy shows how, in objects one sees how, and in memory drawing one thinks how, a drawing is to be made. In all cases, proportion is an important element.

In the following, the method of *triangulation* for copying is described. The copy is first marked by thin pencil lines at its bounderies by the sides of a square, a rectangle or a parallelogram. In the paper on which the drawing is to be made, is also marked a similar figure, equal, bigger or smaller, but in proportion, according as

Fig. 10

Fig. 11

Fig. 12

an equal copy, an enlargement or a reduction is desired. Oblique, vertical and horizontal lines are then similarly drawn on both, with the object of cutting as much of the details of the copy as possible. The details are then worked out in the drawing paper. Figure 10 shows the head of a horse enclosed in boundary by vertical, horizontal and oblique lines. Figs, 11 and 12 give the enlarged head on double and half the scale.

Proportion is, however, not observed in distortion, although the lines are placed in the same way as in the original. A study of the following figures is instructive.

Fig. 13

Fig. 14

Fig. 13 is a simple ornamentation. In fig. 14, the figure is expanded, while in fig. 15, it is attenuated. Fig. 16 shows it distorted in a

Fig. 15

Fig. 16

Fig. 17

slant, while fig. 17 gives another way of distorting the same figure.

THE END.