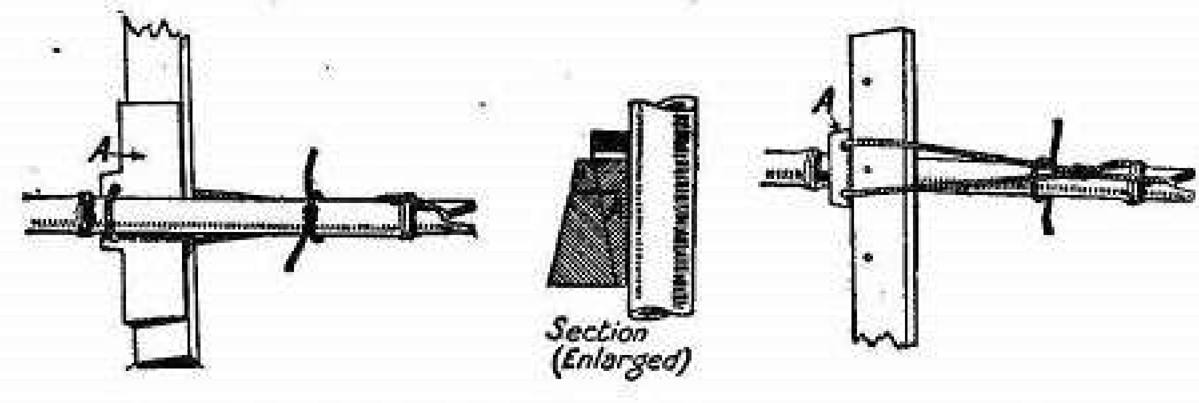

FIG. 115.—Details of stretcher attachment for diamond-shaped box kites.

Plain Rectangular Box Kites

The plain box kite is easy to make and a good flier. Readers should try their hands on it before attempting more complicated models.

Lifting pressure is exerted only on the sides facing the wind, but the other sides have their use in steadying the kite laterally, and in holding in the wind, so that they justify their weight.

Proportions of Box

Each box has wind faces one and a third times as long as the sides, and the vertical depth of the box is about the same as its fore and aft dimensions. That is, the ends of the boxes are square, and the wind faces oblong, with one-third as much area again as the ends. Little advantage is to be gained from making the boxes proportionately deeper than this. The distance between the boxes should be about equal to the depth of each box.

CONSTRUCTION

After these general remarks, we may proceed to a practical description of manufacture, which will apply to kites of all dimensions. It will be prudent to begin on small models, as requiring small outlay.

Having decided on the size of your kite, cut out two pieces of material as wide as a box is to be deep, and as long as the circumference of the box *plus* an inch and a half to spare. Machine stitch 5/8 inch tapes along each edge, using two rows of stitching about 1/8 inch from the edges of the tape. Then double the piece over, tapes inside, and machine stitch the ends together, three quarters of an inch from the edge.

> *Note:* All thread ends should be tied together to prevent unraveling, and ends of stitching should be hand-sewn through the tape, as the greatest strain falls on these points.

The most convenient shape for the rods is square, as fitting the corners and taking tacks most easily. The sectional size of the rods is governed by the dimensions of the kite, and to a certain extent by the number of stretchers used. If four stretchers are employed in each box, two near the top and two near the bottom, the rods need not be so stout as in a case where only a single pair of central stretchers is preferred.

Lay the two boxes flat on the floor, in line with one another, and the joins at the same end. Pass two rods through, and arrange the boxes so that the outer edges are 1/2 inch from the ends of the rods. (These projections protect the fabric when the kite strikes the ground).

Lay the rods on one corner, so that the sides make an angle of 45 degrees with the floor, pull the boxes taut -- be careful that they are square to the rods -- and drive three or four tacks through each end of the box into the rods. Then turn them over and tack the other sides similarly. Repeat the process with the other rods after measuring to get the distances correct.

The length of the stretchers is found approximately by a simple arithmetical sum, being the square root of the sum of the squares of the lengths of two adjacent sides of the box. For example, if each box is 20 by 15 inches, the diagonal is the square root of (20 squared plus 15 squared = square root of 625 = 25 inches. The space occupied by the vertical rods will about offset the stretch of the material, but to be on the safe side and to allow for the notches, add another half-inch for small kites and more proportionately for large ones. It is advisable to test one pair of stretchers before cutting another, to reduce the effect of miscalculations.

The stretcher notches should be deep enough to grip the rods well and prevent them twisting, and one must take care to have those on the same stretcher exactly in line, otherwise one or other cannot possibly "bed" properly. A square file is useful for shaping the notches.

Ordinarily stretchers do not tend to fall out, as the wind pressure puts extra strain on them and keeps them up tight. But to prevent definitely any movement one may insert screw eyes into the rods near the points at which the stretchers press on them, and other eyes near the ends of the stretchers to take string fastenings. These attachments will be found useful for getting the first pair of stretchers into position, and for preventing the stretchers getting lost when the kite is rolled up.

The bridle is attached to four eyes screwed into the rods near the tops of the boxes. (See Figure 118.) The top and bottom elements of the bridle must be paired off to the correct length; the top being considerably shorter than the bottom. All four parts may be attached to a brass ring, and all should be taut when the ring is pulled on. The exact adjustment must be found by experiment. In a very high wind it is advisable to shorten the top of the bridle if you have any doubt as to the strength of your string, to flatten the angle made by the kite with the wind.

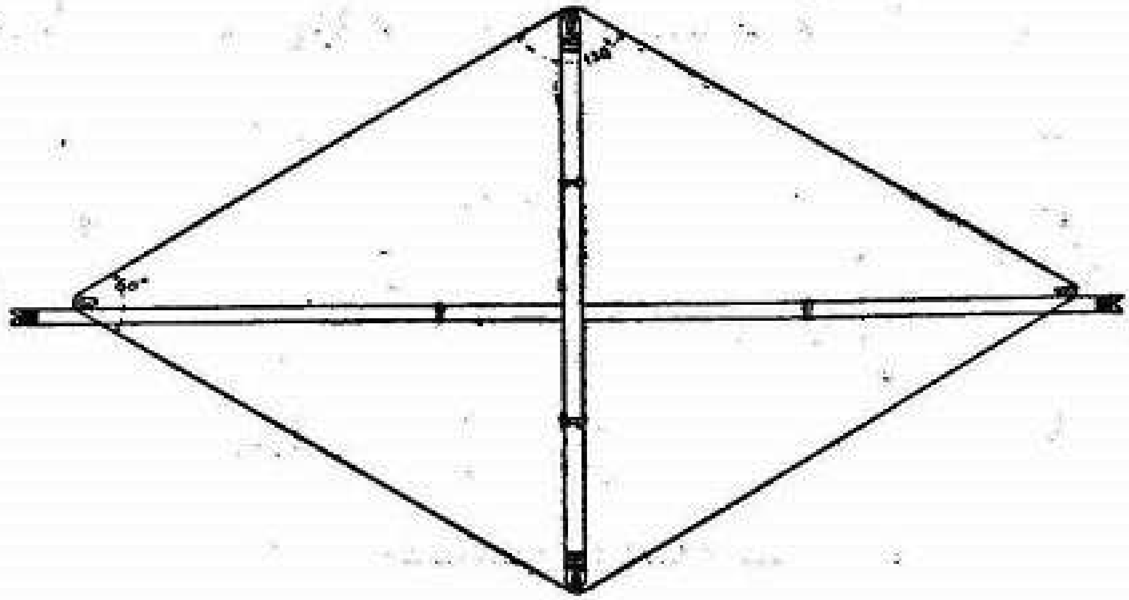

FIG. 116.—Plan of diamond box kite, showing arrangement of stretchers.

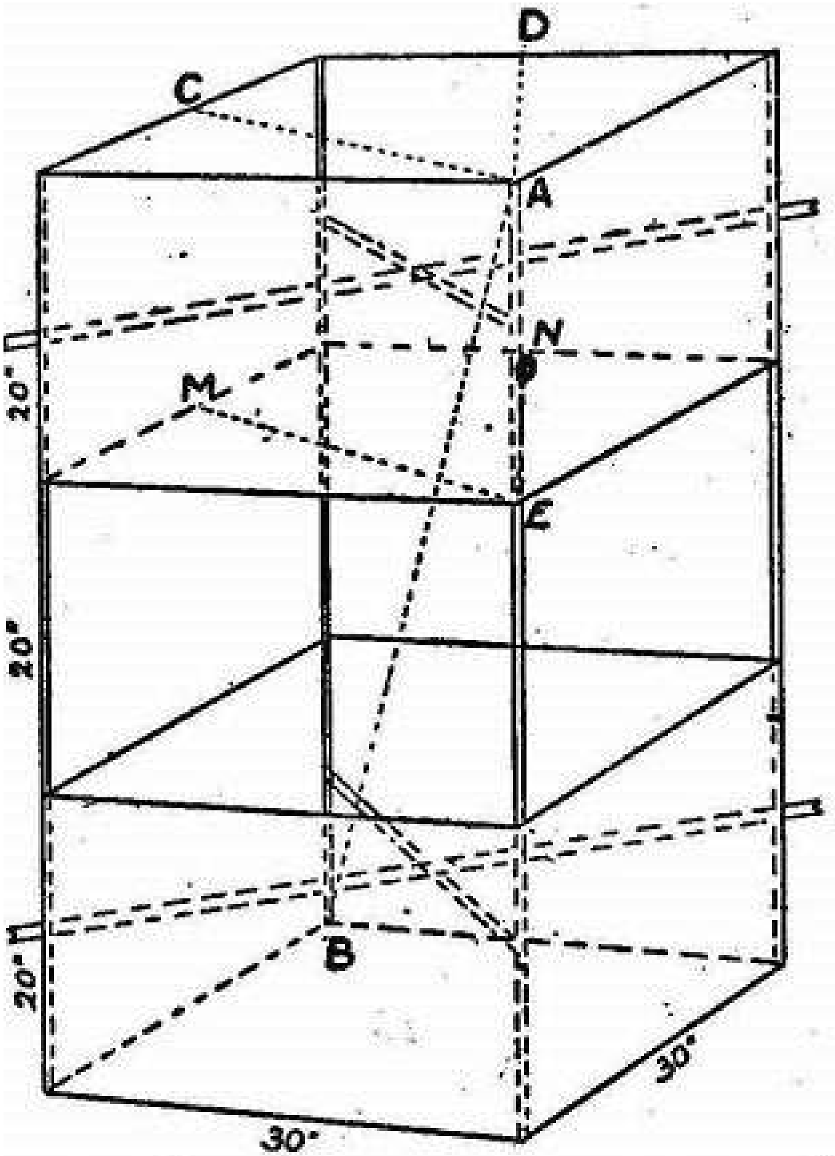

FIG. 117.—Diamond box kite in perspective. Ties are indicated by fine dotted lines.

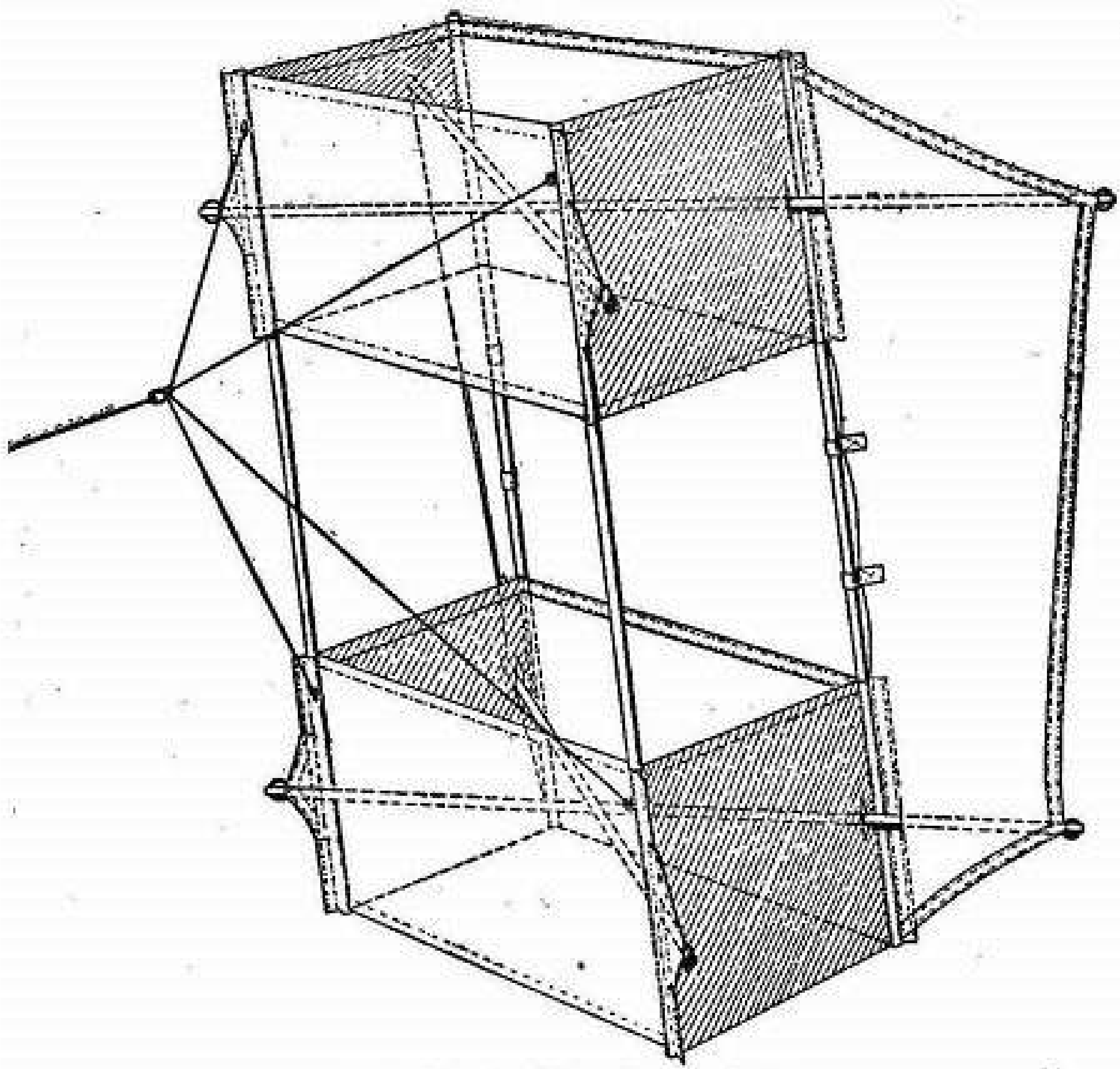

FIG. 118.—Box kite with rear wings.

Diamond Box Kites

In another type of box kite the boxes have four equal sides, but the boxes are rhombus-shaped, as in Figure 116, the long diagonal being square to the wind, and the bridle attached at the front corner.

For particulars of design and construction I am much indebted to Mr. W. H. Dines, F.R.S., who has used the diamond box kite for his meteorological experiments to carry registering meteorographs several thousands of feet into the air.

The longitudinal sticks used at the corners have the section shown in Figure 115. They are about four times as wide at the front edge, which presses against the fabric, as at the back, and their depth is about twice the greater width. This shape makes it easy to attach the shorter stretchers, which have their ends notched and bound to prevent splitting.

Figure 117 is a perspective diagram of a kite. The sail of each box measures from top to bottom one-sixth the total circumference of the box, or, to express the matter differently, each face of the box is half as long again as its depth. The distance separating the boxes is equal to the depth of a box.

The sides of a box make angles of 60 degrees and 120 degrees with one another, the depth of the space enclosed from front to back being the same as the length of a side. With these angles the *effective* area of the sails is about six-sevenths of the total area. Therefore a kite of the dimensions given in Figure 117 will have an effective area of some thirty square feet.

The long stretchers pass through holes in the fabric close to the sticks, and are connected with the sticks by stout twine. Between stretcher and stick is interposed a wedge-shaped piece of wood (A in Figure 115), which prevents the stick being drawn out of line. This method of attachment enables the boxes to be kept tight should the fabric stretch at all--as generally happens after some use; also it does away with the necessity for calculating the length of the stretchers exactly.

The stretchers are tied together at the crossing points to give support to the longer of the pair.

The dotted lines AB, AC, AD, EM, and EN in Figure 117 indicate ties made with wire or doubled and hemmed strips of the fabric used for the wings. AB, running from the top of the front stick to the bottom of the back stick, should be of such a length that, when the kite is stood on a level surface, the front and back sticks make right angles with that surface, being two sides of a rectangle whereof the other two sides are imaginary lines joining the tops and bottoms of the sticks. This tie prevents the back of the kite drooping under pressure of the wind, and increases the angle of flight. The other four ties prevent the back sails turning over at the edges and spilling the wind, and also keep them flatter. This method of support should be applied to the type of kite described in the first section of this booklet.

String Attachment

A box kite will fly very well if the string is attached to the top box only. The tail box is then free to tilt up and trim the kite to varying pressures independently of the ascent of the kite as a whole. When the bottom box also is connected to the string it is a somewhat risky business sending a kite up in a high wind, as in the earlier part of the ascent the kite is held by the double bridle fairly square to the wind. If any doubt is entertained as to the ability of the string to stand the pressure, the one-box attachment is preferable, though possibly it does not send the kite to as great a height as might be attained under similar conditions by the two-box bridle.

When one has to attach a string or wire to a large kite at a single point, the ordinary method of using an eye screwed into the front stick is attended by obvious risks. Mr. Dines employs for his kites (which measure up to nine feet in height) an attachment which is independent of the front stick. Two sticks, equal in length to the width of the sail, are tacked on to the inner side of the sail close to the front stick. Rings are secured to the middle of the sticks and connected by a loop of cord, to which the wire (in this case) used for flying the kite is made fast.

A Box Kite with Wings

The type of kite shown in Figure 118 is an excellent flier, very easy, to make and very portable. The two boxes give good longitudinal stability, the sides of the boxes prevent quick lateral movements, and the two wings projecting backwards from the rear corners afford the "dihedral angle" effect which tends to keep the kite steadily facing the wind. The "lift," or vertical upward pull, obtained with the type is high, and this, combined with its steadiness, makes the kite useful for aerial photography, and, on a much larger scale, for man-lifting.

The materials required for the comparatively small example with which the reader may content himself in the first instance are:-

8 wooden rods or bamboos, 4 feet long and 1/2 inch in diameter.

4 yards of lawn or other light, strong material, 30 inches wide.

12 yards of unbleached tape, 5/8 inch wide.

8 brass rings, 1 inch diameter.

The Boxes

Cut off 2 yards 8 inches of material quite squarely, fold down the middle, crease, and cut along the crease. This gives two pieces 80 by 15 inches.

Double-stitch tape along the edges of each piece.

Lay the ends of a piece together, tapes inside, and stitch them together half an inch from the edge. Bring a rod up against the stitching on the inside, and calculate where to run a second row of stitching parallel to the first, to form a pocket into which the rod will slip easily but not loosely. (See Figure 119*, a.)*

Remove the rod and stitch the row.

Now repeat the process at the other end of the folded piece. The positions of the other two rod pockets must be found by measuring off 15 inches from the inner stitching of those already made. (Be careful to measure in the right direction in each case, so that the short and long sides of the box shall be opposite.) Fold the material *beyond* the 15-inch lines to allow for the pockets and the 1/2-inch "spare," and make the two rows of stitching.

Repeat these operations with the second strip of material, and you will have prepared your two boxes, each measuring, inside the pockets, 15 by about 20 inches. (See Figure 119.)

Now cut out the wings in accordance with the dimensions given in Figure 120. Each is 47-1/2 inches long and 15 inches across at the broadest point. It is advisable to cut a pattern out of brown paper, and to mark off the material from this, so arranging the pattern that the long 47-1/2-inch side lies on a selvedge. [The edge of a fabric that is woven so that it will not fray or ravel.]

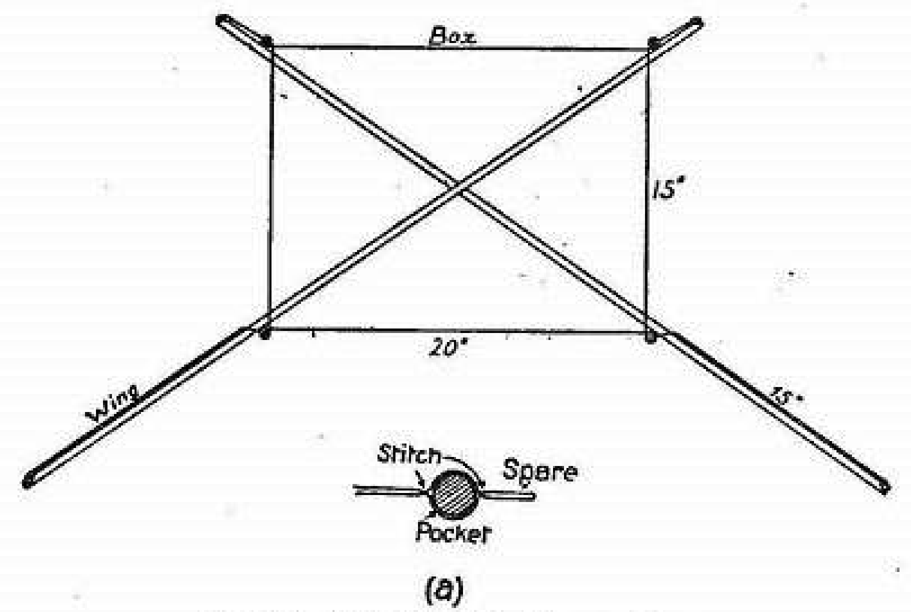

FIG. 119.—Plan of box kite with rear wings.

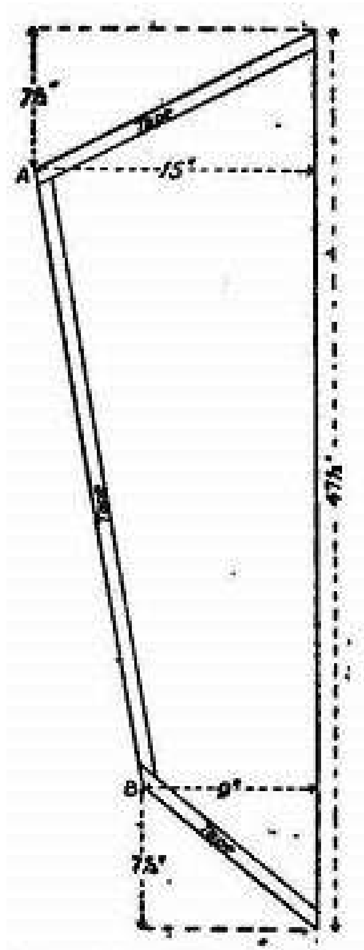

Fig. 120.—Wing for box kite.

Double stitch tapes along the three shorter sides of each wing, finishing off the threads carefully. Then sew the wings to what will be the back corners of the boxes when the kite is in the air--to the "spares" outside the rod pockets of a long side.

Take your needle and some strong thread, and make all corners at the ends of pockets quite secure. This will prevent troublesome splitting when the kite is pulling hard.

Sew a brass ring to each of the four wing angles, AA, BB, at the back, and as many on the front of the spares of the rod pockets diagonally opposite to those to which the wings are attached, halfway up the boxes. These rings are to take the two stretchers in each box.

Slip four rods, after rounding off their ends slightly,through the pockets of both boxes, and secure them by sewing the ends of the pockets and by the insertion of a few small tacks. These rods will not need to be removed.

The cutting and arrangement of the stretchers and the holes for the same require some thought. Each stretcher lies behind its wing, passes in front of the rod nearest to it, and behind that at the corner diagonally opposite. (See Figure 119.) The slits through which it is thrust should be strengthened with patches to prevent ripping of the material.

Two persons should hold a box out as squarely as possible while a stretcher is measured. Cut a nick 3/8 inch deep in one end of the stretcher, and pass the end through the fabric slits to the ring not on the wing. Pull the wing out, holding it by its ring, and cut the stretcher off 1 inch from the nearest point of the ring. The extra length will allow for the second nick and the tensioning of the material. Now measure off the second stretcher by the first, nick it, and place it in position. If the tension seems excessive, shorten the rods slightly, but do not forget that the fabric will stretch somewhat in use.

Make the stretchers for the second box, and place them in position. The wings ought to be pretty taut if the adjustments are correct, but should they show a tendency to looseness, a third pair of stretchers of light bamboo may be inserted between the other two, being held up to the rods by loops of tape.

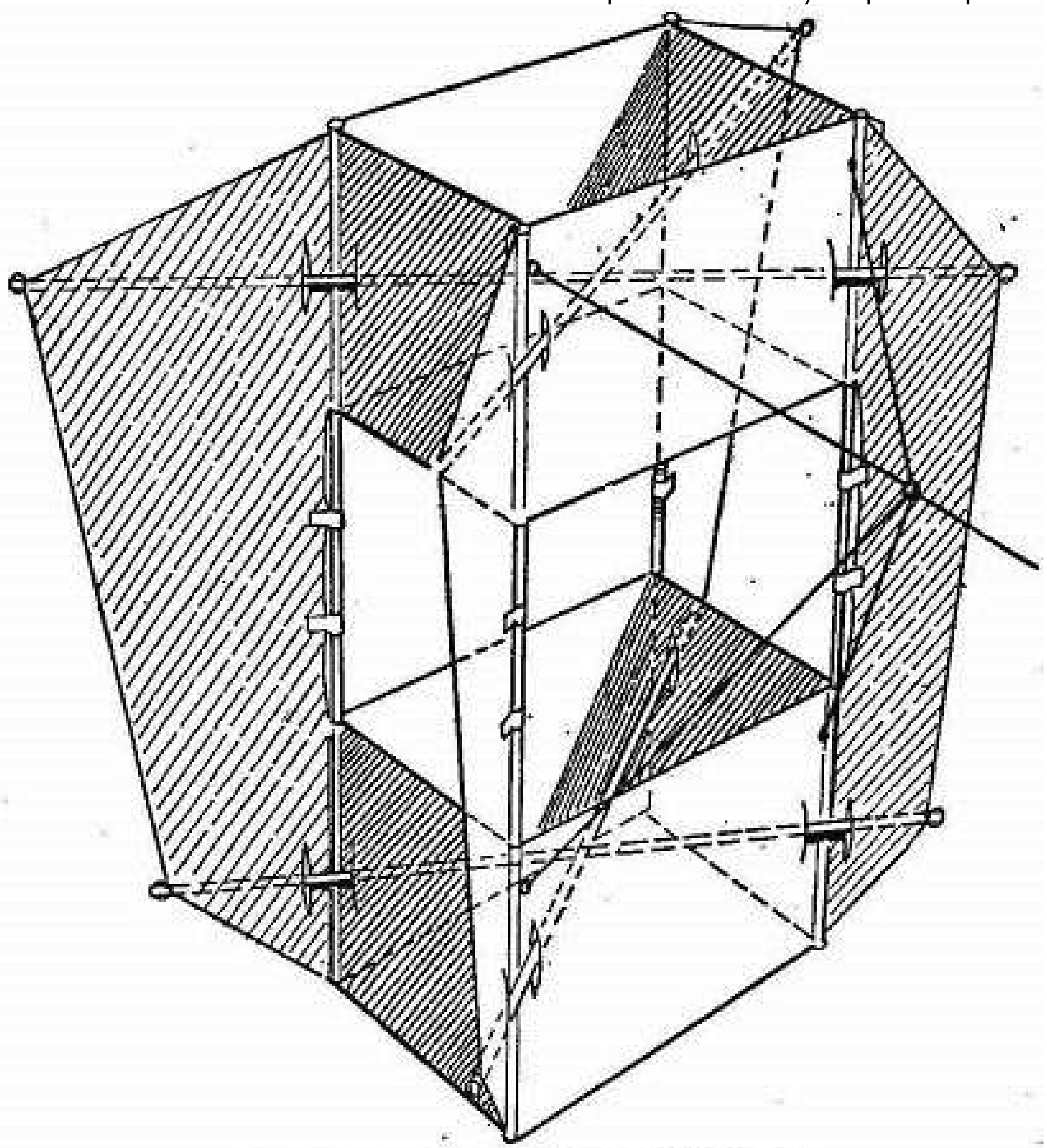

FIG. 121.—Box kite with front and back wings.

In order to be able to take up any slackness, the wing end of each stretcher may be allowed to project a couple of inches, and be attached by string to the near ring, as described on p. 271. The bridle to which the flying string is attached is made up of four parts, two long, two short, paired exactly as regards length. These are attached to eyes screwed into the front rods three inches below the tops of the boxes. Adjustment is made very easy if a small slider is used at the kite end of each part. These sliders should be of bone or some tough wood, and measure 1 inch by 3/8 inch. The forward ends of the bridle are attached to a brass ring from which runs the flying string.

It is advisable to bind the stretchers with strong thread just behind the notches to prevent splitting, and to loosen the stretchers when the kite is not in use, to allow the fabric to retain as much as possible of its elasticity.

The area of the kite affected by wind is about 14 square feet; the total weight, 1-1/2 lb. The cost of material is about 2s.

The experience gained from making the kite described may be used in the construction of a larger kite, six or more feet high, with boxes 30 by 22 by 22 inches, and wings 24 inches wide at the broadest point. If a big lift is required, or it is desired to have a kite usable in very light breezes, a second pair of wings slightly narrower than those at the back may be attached permanently to the front of the boxes, or be fitted with hooks and eyes for use on occasion only. (Figure 121.) In the second case two sets of stretchers will be needed.

Note: If all free edges of boxes and wings are cut on the curve, they will be less likely to turn over and flap in the wind; but as the curvature gives extra trouble in cutting out and stitching, the illustrations have been drawn to represent a straight-edged kite.

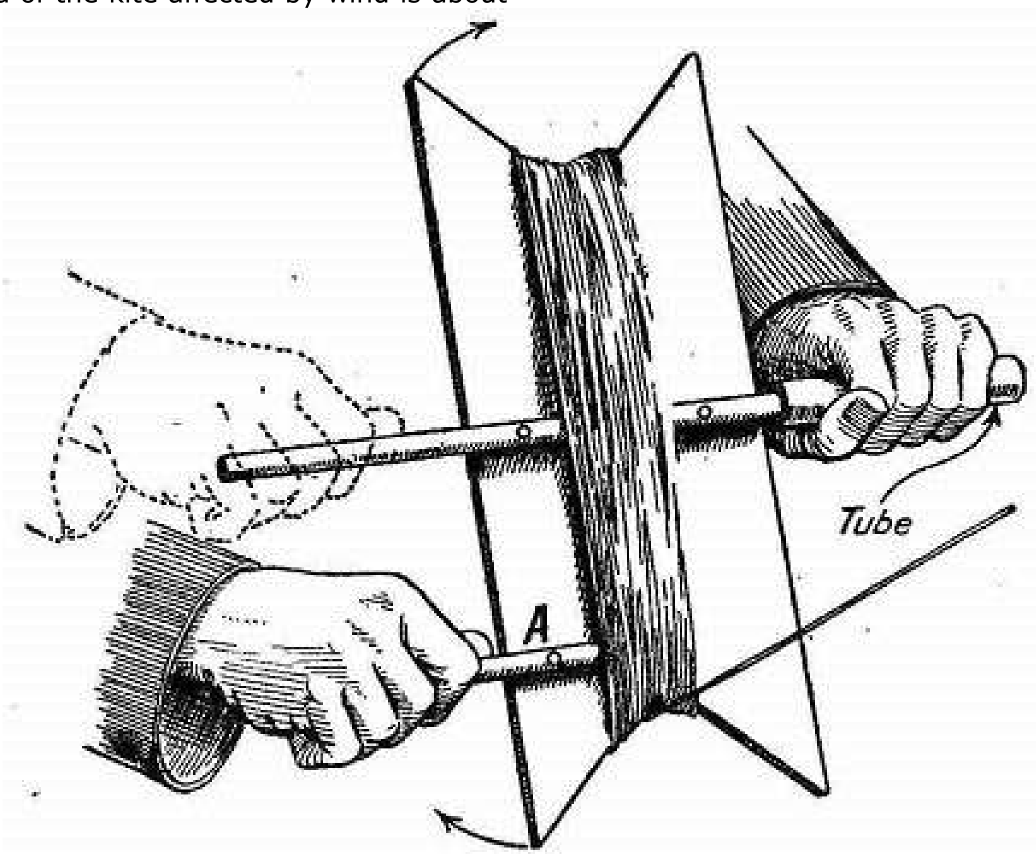

FIG. 122.—Simple string winder for kite.

Kite Winders

The plain stick which small children flying small kites on short strings find sufficient for winding their twine on is far too primitive a contrivance for dealing with some hundreds of yards, may be, of string. In such circumstances one needs a quick-winding apparatus. A very fairly effective form of winder, suitable for small pulls, is illustrated in Figure 122.

Select a sound piece of wood, 3/8-inch thick, 5 inches wide, and about 1 foot long. In each end cut a deep **V**, the sides of which must be carefully smoothed and rounded with chisel and sandpaper. Nail a wooden rod, 15 inches long and slightly flattened where it makes contact, across the center of the board, taking care not to split the rod, and clinch the ends of the nails securely. The projecting ends of the rods are held in the hands while the string runs out. The projecting piece, A, which must also be well secured, is for winding in. The winding hand must be held somewhat obliquely to the board to clear the spindle. Winding is much less irksome if a piece of tubing is interposed between the spindle and the other hand, which can then maintain a firm grip without exercising a braking effect.

This kind of winder is unsuited for reeling in a string on which there is a heavy pull, as the hands are working at a great disadvantage at certain points of a revolution.

A far better type is shown in Figs. 123 and 124. Select a canister at least 6 inches in diameter, and not more than 6 inches long, with an overlapping lid. Get a turner to make for you a couple of wooden discs, 3/8 inch thick, and having a diameter 2 inches greater than that of the tin. Holes at least 3/8 inch across should be bored in the center of each. Cut holes 1 inch across in the center of the lid and the bottom of the canister, and nail the lid concentrically to one disc, the canister itself to the other. Then push the lid on the tin and solder them together. This gives you a large reel. For the spindle you will require a piece of brass tubing or steel bar 1 foot long and large enough to make a hard driving fit with the holes in the wood. Before driving it in, make a framework of 3/4-inch strip iron (Figure 123), 3/32 or 1/8 inch thick, for the reel to turn in. The width of this framework is 1 inch greater than the length of the reel; its length is twice the diameter of the canister. Rivet or solder the ends together. Halfway along the sides bore holes to fit the spindle.

Make a mark 1 inch from one end of the spindle, a second l/8 inch farther away from the first than the length of the reel. Drill 3/16-inch holes at the marks. Select two wire nails which fit the holes, and remove their heads. Next cut two 1/4-inch pieces off a tube which fits the spindle. The reel, spindle, and framework are now assembled as follows:

Push the end of the spindle which has a hole nearest to it through one of the framework holes, slip on one of the pieces of tubing, drive the spindle through the reel until half an inch projects; put on the second piece of tubing, and continue driving the spindle till the hole bored in it shows. Then push the nails half-way through the holes in the spindle, and fix them to the ends of the reel by small staples. A crank is made out of 1/2-inch wood (oak by preference) bored to fit the spindle, to which it must be pinned. A small wooden handle is attached at a suitable distance away. If there is any fear of the wood splitting near the spindle, it should be bound with fine wire. An alternative method is to file the end of the spindle square, and to solder to it a piece of iron strip in which a square hole has been made to fit the spindle. The crank should be as light as is consistent with sufficient strength, and be balanced so that there shall not be unpleasant vibration when the string runs out fast, and of course it must be attached very securely to the spindle.

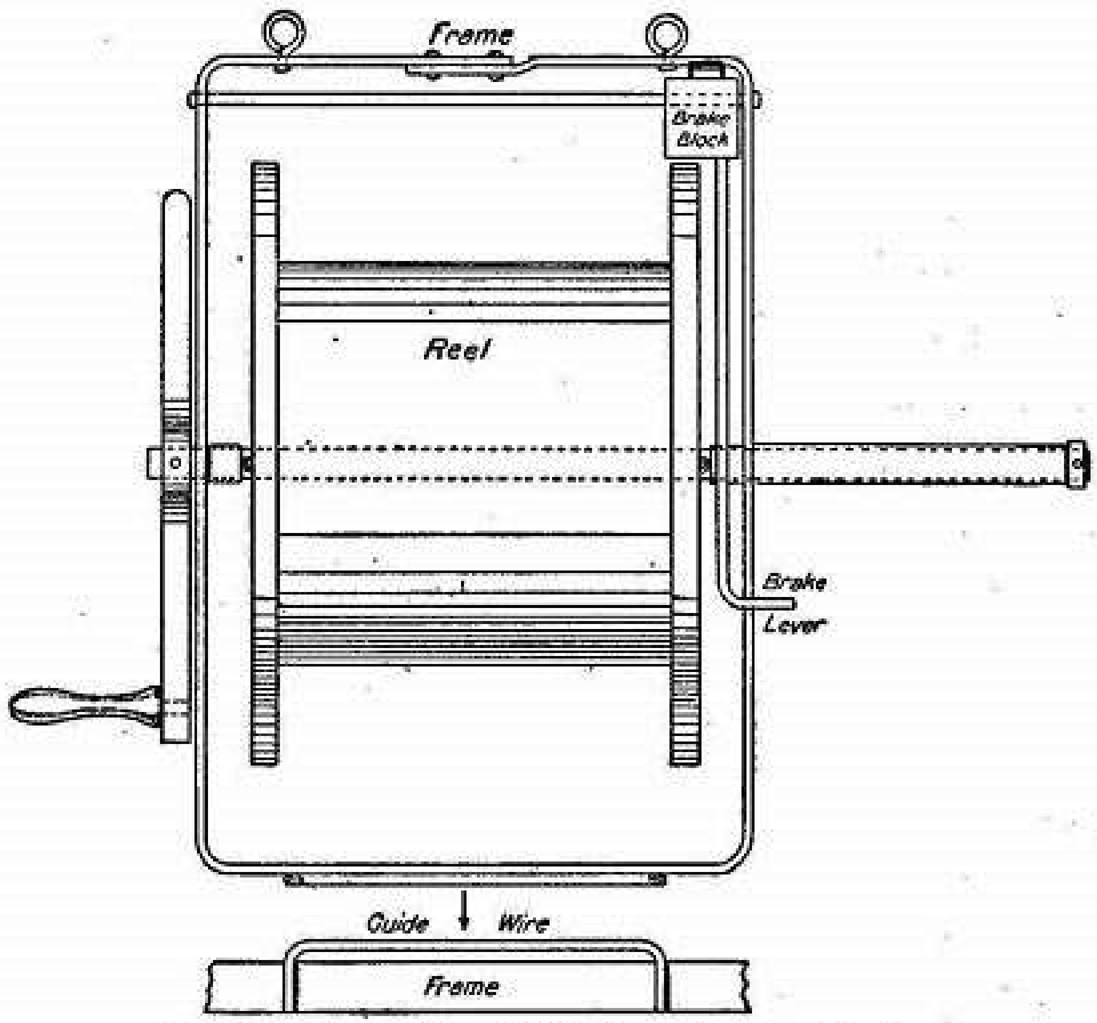

FIG. 123.—Plan of string-winding drum, frame, and brake.

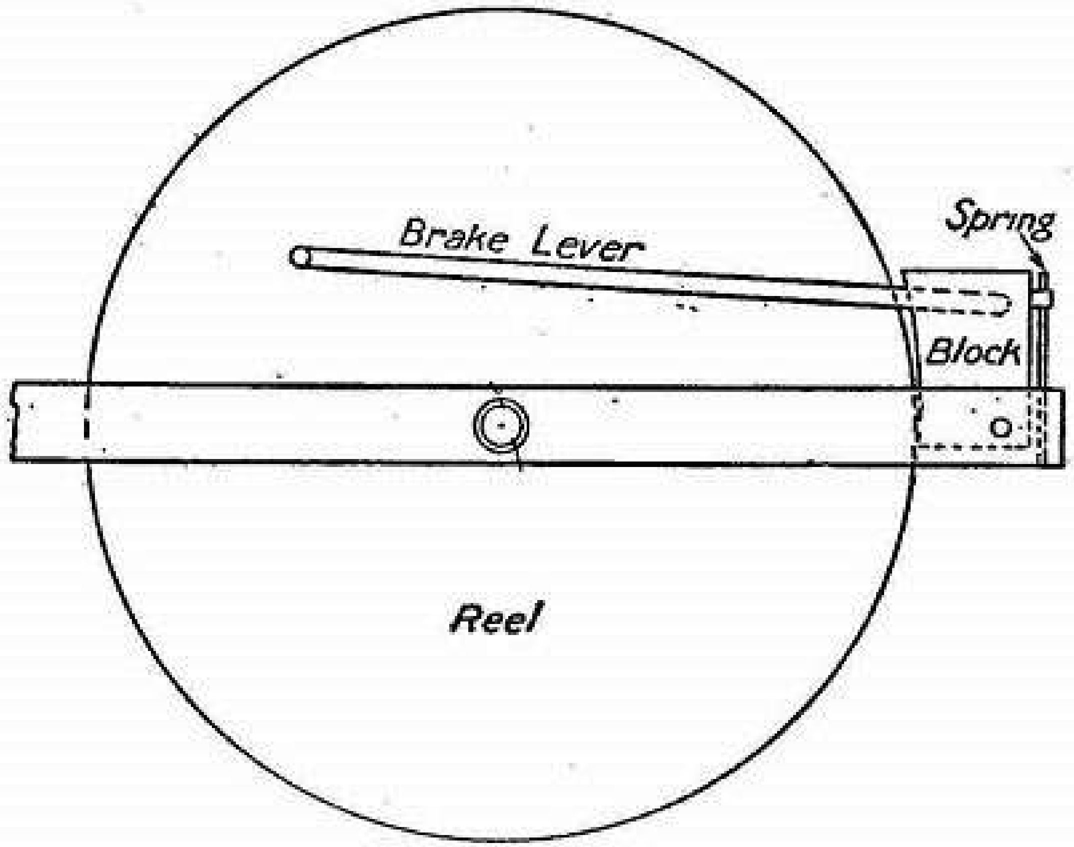

FIG. 124.—End view of string winder, showing brake and lever.

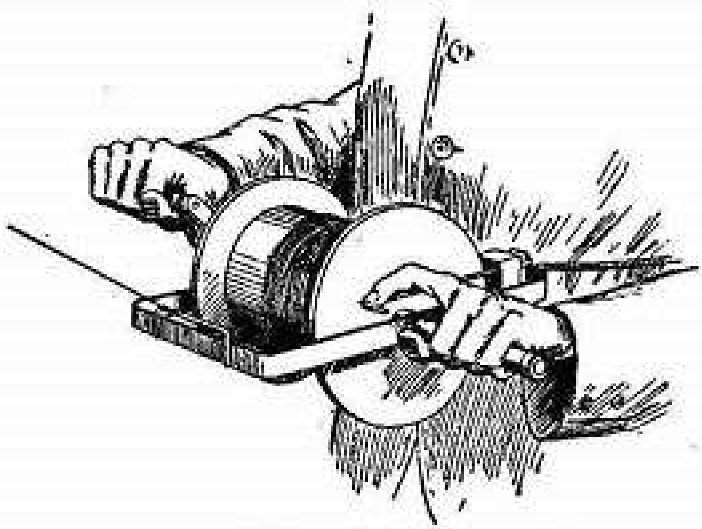

FIG. 125.—String winder in operation.

What will be the front of the framework must be rounded off on the top edge, which has a wire guide running parallel to it (Figure 123) to direct the string on to the reel; and into the back are riveted a couple of eyes, to which are attached the ends of a cord passing round the body, or some stationary object.

A pin should be provided to push into a hole at one end of the reel and lock the reel by striking the framework, and it will be found a great convenience to have a brake for controlling the reel when the kite is rising. Such a brake is easily fitted to the side of the frame, to act on the left end of the reel when a lever is depressed by the fingers. There should be a spring to keep it off the reel when it is not required. The diagrams show where the brake and brake lever are situated.

Note: To obtain great elevations a fine wire (piano wire 1/32 inch in diameter) is generally used, but to protect the user against electric shocks the wire must be connected with an "earthed" terminal, on the principle of the lightning conductor.

Transcribed by David Lee (dslee@together.net)

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