CHAPTER 4

READING AND USING PLANS

STICK MODEL PLANS. For each model appearing in this book complete plans are given together with step-by-step directions for its construction. Because of the simplicity of the average stick model, the plan for each of these has been confined to one page, except in one or two cases. All dimensions have been shown on the plan and are again repeated in the instructions.

Before any actual construction is begun, the builder should carefully study the plan of the particular model he intends to build, together with its written instructions. Turn to the first instructions in the text and then locate that particular part on the plan. Read the instructions and at the same time follow each item by locating it on the plan, checking its dimensions against the text, and then carefully following it on the plan from end to end. In this manner, its proper location on the model can be quickly seen.

Do not proceed to the next part of the text until you feel confident that you thoroughly understand all details of the one you are studying. Most motor sticks are shown in two views, the top and the side. On the top view will be seen the elevator top view, while the side view of the motor stick will usually contain the side view of the rudder. In this way, the construction of these parts can be seen together with their proper location on the motor stick. All parts are clearly marked. Wing construction is also shown by a top and edge view. The edge view shows the necessary dihedral angle of the wing. (See Chapter 7, "Wing Assembly.") The propeller is usually shown by a perspective view of the propeller block from which it is carved. (See Chapter 9, "Carved Propellers.")

If the model has a landing gear, this is usually shown by a side view of the gear attached to the motor stick, which shows its location on that member. Another plan of the front view of the landing gear, showing its dimensions, construction, and material, is also given in most cases. If the wing has sheet ribs, a side view of these is given on squares, so that the builder can quickly draw full-size rib plans.

To do this, rule a sheet of paper with cross lines, making squares of the

size called for in the plan. The outline of the rib is then drawn through these squares, which act as a guide. To make an exact copy of the rib, each line crossing each square must be located in exactly the same position as that in which the same line crosses the same square in the plan.

On wings having a sweepback, a full-size copy of the top view of the wing should be made. In this manner each part of the wing can then be cut to match the size shown on the full-size plan, placed on the plan in proper position, and the assembly made directly on the plan. In this way the necessary sweepback of the wing is obtained automatically. This is a good plan to follow whenever a wing, fuselage, rudder, or elevator has a difficult or peculiar outline.

When reading plans the builder must keep in mind that the written instructions are quite as much a part of the building instructions as the plan itself. For this reason constant checking of written instructions should be made while the model is being built.

SOLID SCALE MODEL PLANS. Because of the various sizes in which model builders construct solid scale models, these plans have been made up to cater to all tastes. To do so, a plan had to be devised whereby a model of any size could be made from the plans covering each of them. It can be readily understood that it would be impossible to give complete plans for models having a 6″, 12″, 18″, 24″, or 36″ wing length, so the graph method of presentation has been used.

With such a plan, the builder can make his model any size. To use such a graph plan is quite simple once the procedure is understood. These solid scale model plans are drawn up with twenty-four squares from wing tip to wing tip. If these squares were to be drawn 1″ square, the model built from that plan would be a 24″ model. If, however, a 6″ model is desired, each of the squares would have to be drawn ¼″ square.

The first step in the work is to rule off a piece of paper with squares of a size corresponding to the size you wish your model. Each of the three views of the model is then copied from the page plan in the book on your ruled paper. This is done by guiding the pencil through each square, making sure that the line being drawn passes through the square in exactly the same location it takes on the page plan.

When a full-size duplicate of the page plan has been drawn, it becomes a simple matter for the builder to cut his various parts exactly the size given on the plan he has drawn. With the three views, side, top, and front, each part is shown three times, so that its length, width, and thickness will appear on the plan. To aid the builder further, instructions accompany each plan and give the various sizes necessary for each part. These are given for models

measuring 12″ from wing tip to wing tip. If a 6″ model is being made, these written dimensions would have to be cut in half, or if a 24″ model is desired, each dimension appearing in the text would have to be doubled.

Such written instructions are given merely as a further aid to the builder, and the 12″ model has been taken as a standard.

BUILT-UP, NON-FLYING AND FLYING SCALE MODELS. These plans are more closely allied to their accompanying text than any of the others, because space would not allow full dimensions to be printed on the plans. To avoid a crowded page, the author has used letters and numbers to indicate the various parts of the model, and has then given the length, width, and thickness of each of these in the text, together with step-by-step instructions on assembling.

Fuselages have been given in great detail, many of them taking a full page and sometimes two full pages of plans. Each former of a fuselage has been given in graph, or squares, so that the builder can easily redraw them full-size.

All longerons and stringers of the fuselage have been numbered or lettered, the sizes given in the text, and full data on location clearly shown. Most fuselages appear on the plans in three views, side, top, and bottom. Each of these shows only that particular side of the fuselage. In other words, if a bottom view of the fuselage is shown, only the braces, formers, and stringers along the bottom appear. If a skeleton model of the fuselage was held bottom side up, a number of parts on the top of the fuselage would be seen, but on the bottom view of the plans these are not shown, because of the possibility of confusing them with those of the bottom. This is also true with the top and side views of the fuselage in the plans.

Each former location on the fuselage has been numbered or lettered and these numbers or letters appear under each individual drawing of each former in the plans. Top and edge views of the wing have been provided in the plans. The first shows the location of all ribs, wing tips, inner wing spars, and leading and trailing edge spars. The latter shows the necessary dihedral angle of the wing, given in inches, and appearing under "Dihedral." All wing ribs are numbered or lettered on the top view of the plan. These ribs are then shown in squares in the plans under their particular letters or numbers. Thus the builder can see at a glance the exact location on the wing of each rib. All ribs appearing in the plans in graph require redrawing full size, as already explained for solid scale models.

Various other parts having curved outlines, such as wheel pants, landing gears, etc., are also given in graph.

A three-view plan in graph appears with each flying or built-up, non-

flying scale model, as an aid to the builder when assembling his model. These do not require redrawing, since for assembly work only locations are required, and they can easily be found on the plan as it appears on the page. These three-view plans have been given in graph so that the builder can make from them a solid scale model of any of these flying or built-up, non-flying scale models. The same procedure is used for these models as for the solid scale models and their plans.

With each flying or built-up, non-flying scale model, two photographs are provided. One of these shows the model assembled uncovered, so that the model can be studied by the builder. The second shows the finished model. While these are not part of the plans, the builder will find them of assistance when making the model.

CHAPTER 5

MODEL CARRYING CASES

A CARRYING case for the model builder is quite as important to him as a brief-case is to a lawyer. Any well-made airplane model is a delicate affair at best, because of the fact that the lightest of woods are used in its construction and its wings are usually covered with tissue paper. Each part is so fragile that great care must be exercised in handling and especially in transportation.

Here are two boxes designed for just this purpose, and they are so simple in construction, so handy to carry, so cheap to build, and so useful that no first-class modeler can afford to be without one.

They are carried like a suitcase, and will be found commodious enough to hold ten stick models, all extra parts, necessary tools for repairs, and a winder. Lids are provided for the compartments where small articles are stored, so that they will not spill out when the box is opened. Some builders cover their boxes with oilcloth, and the author recommends it. Such boxes are often placed on the ground at outdoor meets, where dampness from rain or dew might ruin weeks of work and many dollars' worth of materials.

Two designs are given, complete with plans, so the builder has only to choose the one he prefers. The first one (see Figs. 10 and 11) is the shape of any common suitcase, and requires the following pieces of pine:

2 pcs.—⅜" x 11¼" x 42"	—Box bottom (E) and Lid Bottom (G)
2 pcs.—⅜" x 6" x 42"	—Box sides (A and C)
2 pcs.—⅜" x 6" x 12"	—Box ends (B and D)
2 pcs.—⅜" x 3" x 42"	—Lid sides (F and H)
2 pcs.—⅜" x 3" x 12"	—Lid ends (I and J)
2 pcs.—⅜" x 5" x 5 7/16"	—Box partitions (1 and 2)
1 pc. —⅜" x 5" x 11¼"	—Box partition (4)
1 pc. —⅜" x 5" x 35 13/16"	—Box partition (3)
2 pcs.—⅜" x 2½" x 3"	—Lid partitions (1 and 4)
2 pcs.—⅜" x 2½" x 20¼"	—Lid partitions (2 and 3)

Each of these eighteen pieces should be squared up, planed smooth, and then finished with sandpaper. We are now ready to assemble our box. Nail the two side pieces A and C to the sides of E. Complete the box by nailing

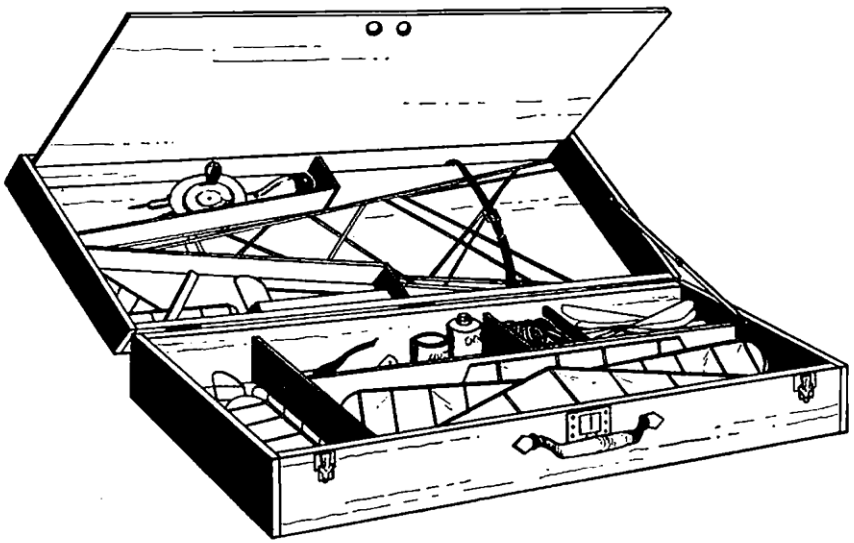


FIGURE 10. CARRYING CASE—SUITCASE TYPE

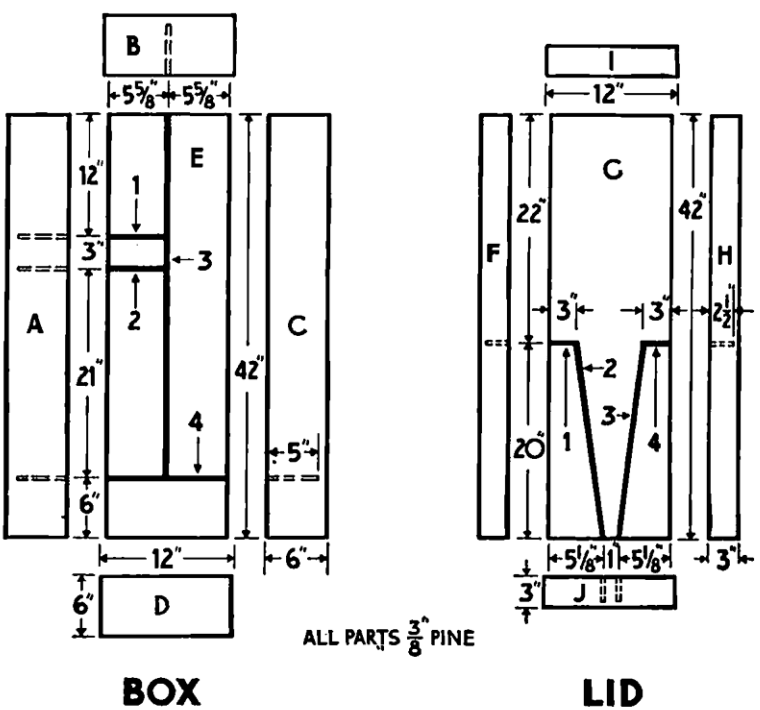


FIGURE 11. PLAN FOR CARRYING CASE—SUITCASE TYPE

the ends B and D to the bottom piece E and the side pieces A and C. The partition boards are attached. Piece 4 is nailed between A and C, and further strengthened by nailing to piece E. The long partition board 3 is nailed between piece 4 and the end board B. This should also be nailed to the bottom board E. The partitions are completed by nailing the two short pieces 1 and 2 between partition board 3 and the side board A, which completes the box portion of our case.

The lid is now assembled. Proceed in the same manner, nailing the side boards F and H to the sides of the bottom board G. Nail the end boards I and J to the ends of F and H, as well as to the ends of bottom board G. The four partition boards are now assembled. Nail the short ones 1 and 4 to the sides F and H. These should also be nailed to the bottom board G. The two remaining partition boards 2 and 3 are nailed to the ends of boards 1 and 4, and then nailed in position to end board J. These should also be nailed securely to the bottom board, completing the lid with the exception of its cover. This should be made of 1/8" stock, so that it will come flush with the top of the lid's sides. Cut it 11 1/4" wide and 42" long, and attach it, as shown in the illustration, with three hinges. Two small holes can be bored in it to aid in lifting.

Three 3" hinges are used to hinge the lid in place on the box, and it is then equipped with regular fasteners such as are used on ordinary suitcases. A suitcase handle and a lock complete the box. When packing it, all "A-Frames" are placed in the lid, as well as the winder and spare parts, as shown. The long compartment holds wings, being long enough to take a 36" length, while the small end compartment holds all elevators and rudders. The other three compartments are for propellers, rubber motors, and miscellaneous tools, dope, ambroid, etc.

The second box is made in the shape of an "A-Frame," as shown in the illustration. (See Figs. 12 and 13.) It requires the following pieces of pine:

2 pcs.—3/8" x 15" x 48" —Box bottom (E) and Lid bottom (G)
2 pcs.—3/8" x 6" x 48 3/4"—Box sides (A and C)
1 pc. —3/8" x 6" x 15" —Box end (B)
1 pc. —3/8" x 6" x 9" —Box end (D)
2 pcs.—3/8" x 3" x 48 3/4"—Lid sides (H and J)
1 pc. —3/8" x 3" x 15" —Lid end (I)
1 pc. —3/8" x 3" x 9" —Lid end (K)
1 pc. —3/8" x 5 5/8" x 36 3/4"—Box partition (2)
1 pc. —3/8" x 5 5/8" x 13 1/2"—Box partition (1)
2 pcs.—3/8" x 5 5/8" x 5 1/4"—Box partitions (3 and 4)
1 pc. —3/8" x 2 1/2" x 48" —Lid partition (F)
1 pc. —3/8" x 2 1/2" x 5" —Lid partition (E)
1 pc. —1/8" x 5" x 48" —Partition cover

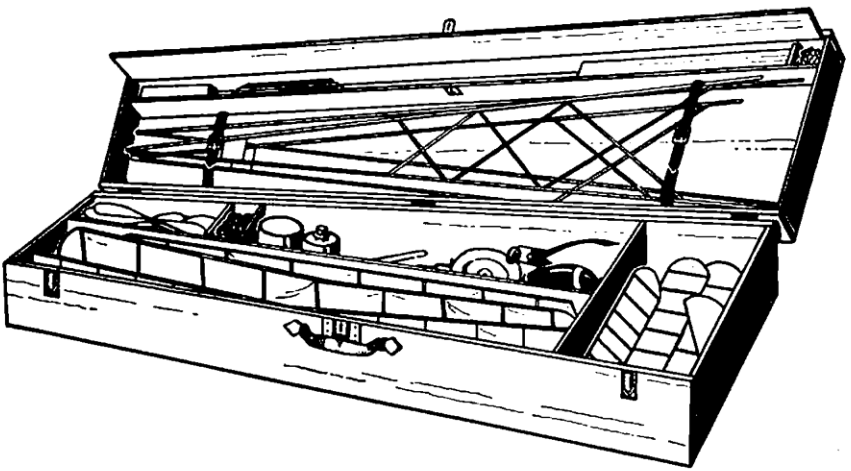


FIGURE 12. CARRYING CASE—TRIANGULAR TYPE

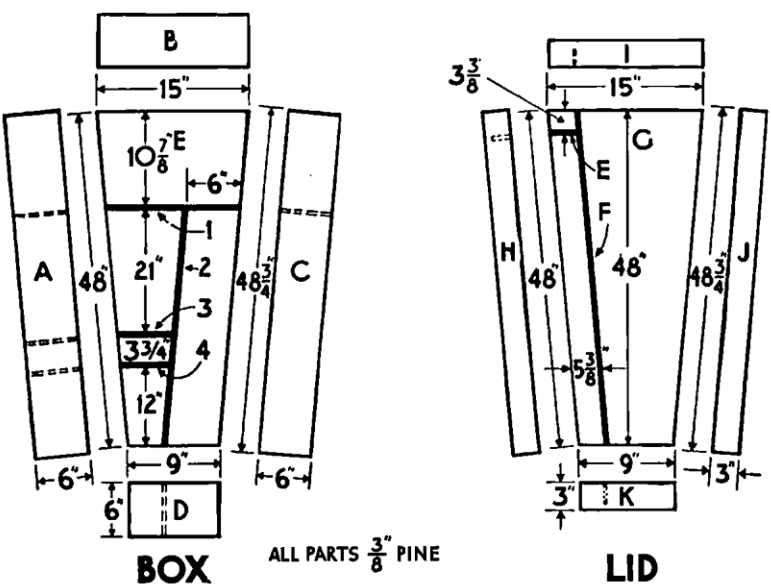


FIGURE 13. PLAN FOR CARRYING CASE—TRIANGULAR TYPE

The two bottom pieces E and G should be cut, as shown in the plans. One end of these two pieces measures 15″ and the other 9″ in width. Take all measurements from a line drawn through the center of each board along its length.

When these pieces have been sawed, the entire seventeen should be planed smooth and completed with a careful sanding. The box is now assembled. Attach the side pieces A and C by nailing them to bottom piece E, after which the end boards B and D are nailed in place between side boards A and C. These end boards must also be nailed to the bottom E.

The partition board 1 is nailed between A and C 10⅞″ from the 15″ wide end of E. Nail this to the bottom board E as well as to the sides. The long partition board 2 is now attached between end board D and partition board 1. This is placed 6″ in from side C, parallel with it, and nailed securely to partition 1, end board D, and bottom E.

The two short partition boards are now attached. Board 4 is nailed between partition 2 and side A 12″ from end D, while the other partition (3) is located 21″ from partition 1, or 3″ from partition 4. These should be nailed to the bottom E, the side A, and the partition 2, completing the box part of our case. We now assemble the lid.

The sides H and J are nailed to the sides of the bottom G. Nail the end pieces I and K between the sides H and J. Strengthen them by nailing to the bottom piece G. The long partition board F is nailed between the end pieces I and K 5″ from the side board H. The short partition board is nailed between the long partition board F and the side board H 3″ from end board I, as shown. The cover for the narrow lid compartment is held with three hinges, being fastened to the side board H.

Hinge the lid of the case to the box with three 3″ hinges, and cover it carefully with oilcloth, attaching it with glue. The large compartment in the lid holds "A-Frames," motor sticks, and extra long sticks, while the small corner one is for metal fittings. The third lid compartment is for spare wood pieces.

In the box, the largest of the five compartments is for wings, while the end one holds elevators and rudders. The third compartment in the opposite corner holds propellers, while that next to it is for rubber motors. The fifth compartment holds dope, tools, winder, and other necessary materials.

CHAPTER 6

METAL FITTINGS

THE construction of a model airplane requires metal parts which must be of such quality as to give the necessary strength and at the same time add a minimum amount of weight. Experimentation has proved that a high-grade piano wire has these qualities. All model stores handle this wire, but the purchaser should specify piano wire. Having an unusually great tensile strength, it allows the thinnest wire to be used and guarantees strength and lightness.

While all fittings are not made of this wire, the few exceptions are made from the lightest possible metals, as explained later. The diameter of wire is designated by a gauge number. There are times when it becomes necessary to know the actual diameter of the wire in inches, which the gauge number represents. The most common sizes are:

GAUGE NUMBER	WIRE DIAMETER
5	0.014″
6	0.016″
7	0.018″
8	0.0197″
9	0.022″
10	0.0236″
11	0.026″
12	0.0283″
13	0.031″
14	0.033″
15	0.035″
16	0.037″

For the average model work, Nos. 6, 8, 10, 12, and 14 will be all that the builder will require. Bending of wire parts is difficult. All the various parts shown in Figs. 16 and 17 can be purchased from model houses, but their cost is far greater than the price of the wire, and the types of fittings available are limited. An end hook may be purchased, but seldom more than

one type will be available, so if you wish another form of end hook you must bend your own.

Special wire cutters should be purchased, as piano wire will ruin an ordinary pair of pliers in a short time. Round-nosed pliers should be used for bending piano wire, and two pairs will be useful. While one holds the end of the wire, the second can do the bending.

BENDING WIRE

FIGURE 14

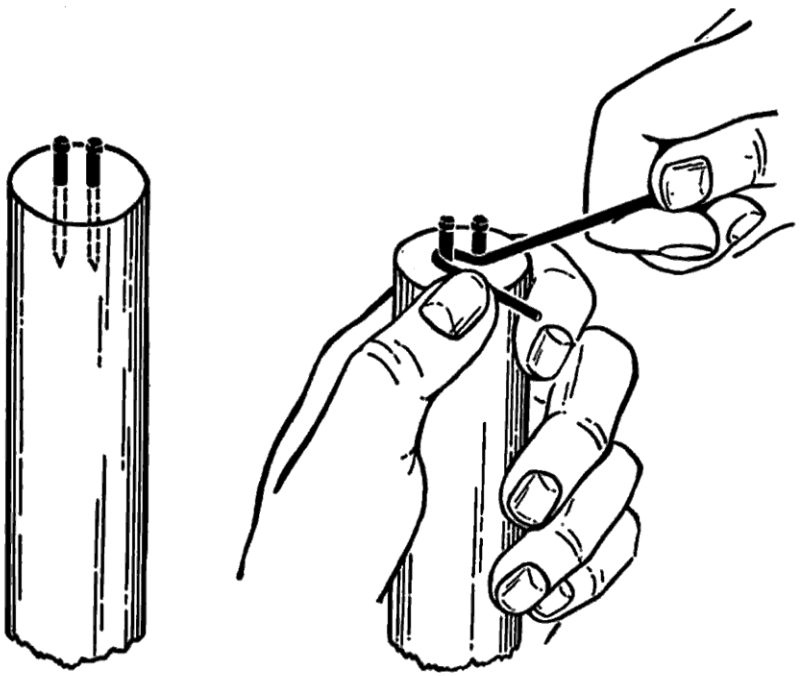
Fig. 14 shows the usual method of bending wire. The pliers hold the wire at the point of bend, while the hand or a second pair brings the wire over for the bend. Small circles can be made in this manner.

Fig. 15 shows a simple wire bender. It consists of a short length of 1″ dowel, or piece of broomhandle, into the end of which two small brads have been driven. The heads of the brads keep the wire in place. The illustration shows how the bender is used. Several of these benders can be made, each with nails of different diameters for bends of different sizes. The handle is 6″ or 8″ long.

TAIL SKIDS. In Fig. 16 six popular tail skids are shown. These are bent to shape and cemented to the under side of the fuselage or motor stick.

It will sometimes be necessary to strengthen the connection by binding the wire with silk thread, after which it should be given a coat of cement.

"S" HOOKS. These are bent in the form of a letter "S." They are used as a connecting link between rear hooks, as well as nose hooks, and the rub-



WIRE BENDER

FIGURE 15

ber motor, as in Fig. 16 B. Such hooks are necessary only when the motor carries a number of strands. Their main use is to give the strands a loose connection on which to turn. The rubber strands are looped over one half of the hook, while the other half is connected to the nose or end hook. For especially large motors, the hook for the rubber is made larger than the connecting hook, as shown by A. B shows the most commonly used "S" hook, while C, D, and E show various forms of it. The builder can make his own choice of these, as they all function alike.

METAL FITTINGS

CLIPS. There are four main uses for clips. The wing and elevator clips hold these parts in place on the motor stick or fuselage. The rudder clip holds that member in position, while the motor stick clip holds the motor stick in position in the fuselage.

A in Fig. 16 shows a popular wing clip for single stick endurance models. It can be used on models carrying the wing above or under the motor stick, as the small squared portion at the top is bent to fit the width and thickness of the motor stick. With such a clip, the wing can be hung from the stick or supported above it. Two are required for each wing. A large one is used on the leading edge, while a small one is cemented to the trailing edge, as shown in B. The type of clip shown by B is possibly the most common on stick models where the wing is above the motor stick. The view shown is from the under side of the wing. Two of these clips are used for each wing, as in the case of the A clip.

The clip marked C is another form of B clip, with the bend in front of or behind the main supporting wires rather than at their sides.

Both these clips are used as motor stick clips inside a fuselage model where cross top struts or cross bottom struts have the clips cemented to them. If these clips are attached to top struts, the motor stick becomes a "hanging" stick, while it is called a "supported" stick if the clips are attached to bottom struts. Another clip is shown by D. This has a small saddle bent in it, which serves as an extra support along the motor stick. A single wire support often allows the wing to "rock" on the stick, but the saddle on this one prevents this because of the surplus purchase it has on the stick.

For twin stick models, the wire clips shown by E make splendid wing fasteners. These are bent to fit around the members of the A-frame, and the wing is held with a single rubber band stretched across the top surface of the wing and held by the small hooks of the clips. Four such clips are necessary for each wing, two being placed as shown on each beam.

The odd-shaped clip shown by F can be used for motor sticks as well as rudders. The ends of the wire fit over the bottom rib of the rudder, where they are cemented in place, while the lower portion is bent to the size of the motor stick, fuselage longeron, or the center rib of the elevator. For motor sticks, the ends are cemented to the top center stringer, while the lower portion is bent to fit the motor stick tightly. This clip can be used only for hanging motor sticks.

Clips A, B, C, and D can be used for elevators on single stick models. They are made proportionately smaller than when used for wings.

CAN HOOKS. These are used for a two-fold purpose on all models having strong rubber motors. They keep the rubber in place on the stick, and

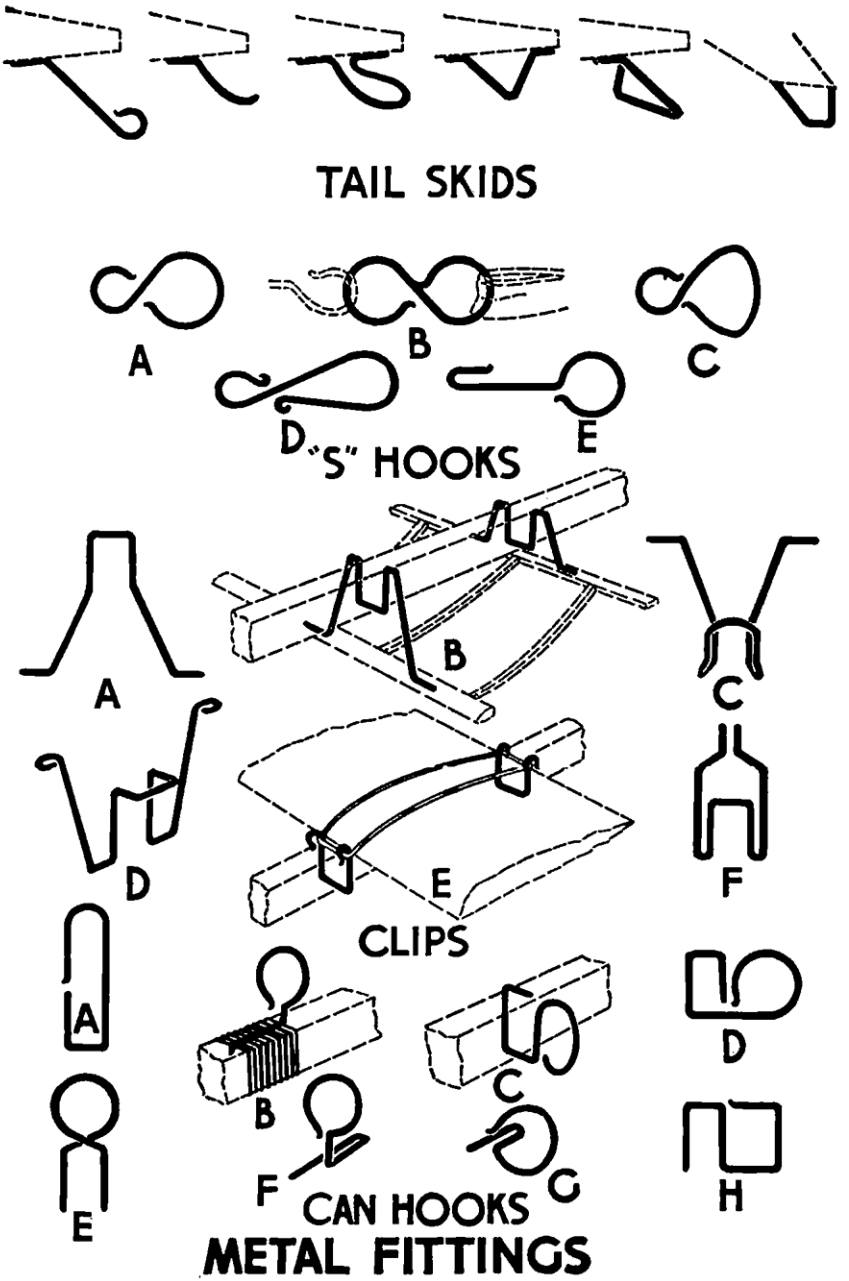

TAIL SKIDS
A
B
C
D
E
"S" HOOKS
A
B
C
D
E
F
CLIPS
A
B
C
D
E
F
G
H
CAN HOOKS
METAL FITTINGS

FIGURE 16

aid in distributing the tension of the wound motor. Practically all outdoor endurance models are equipped with one or more can hooks, depending on the length of the motor stick. For short sticks carrying only two or three strands of rubber, one is placed at the center of the stick. When more are used, they should be equally spaced.

Can hook A, Fig. 16, is bent to fit over the motor stick on its top or bottom, the lower bend being made to fit around the stick, where it is cemented in place. B may be attached to the stick on either side, top or bottom, where it is cemented and bound with silk thread. Can hooks C and D show two side hooks of common variety, while E shows a top or bottom can hook of simple lines. This is made with its ends crossed and then bent to fit the motor stick, where they are cemented in place.

F and G are two side can hooks usually found on twin-stick pushers. The closely bent portion of the wire is cemented and lashed with silk thread against the side of the A-frame beam, allowing the large circle to extend out from it. F has a small extension which keeps the rubber well away from the beam. This is usually used on motors having a great number of strands. For smaller motors, the G hook will serve.

H is another side hook. The smaller square is cemented around the stick, while the rubber fits through the other square.

PROPELLER SHAFTS. Every propeller must have a shaft by which it is attached to the fuselage. This shaft should be of the same gauge wire used for the rear hook, which must be sufficiently strong to stand the strain of a wound motor.

From a length of piano wire a hook is bent as shown by Fig. 17 A. The straight end of the wire is then thrust through the center of the propeller's hub. When through the hub, the wire is bent around, as in B. The wire is then pulled back until its end is forced into the wood of the hub, where a drop of cement holds it tightly in place. Washers are then threaded over the hook, which in turn is passed through the hole in the propeller bearing, as in C.

PROPELLER BEARINGS. These are often called "thrust bearings," being the metal or wood part holding the shaft of the propeller in place on the motor stick or fuselage. A simple needle bearing is shown in Fig. 17 A. It does away with all drilling. For small indoor models, a $\frac{1}{32}$" diameter needle serves well, while a darning needle should be used for larger models. It will save time if a needle having an eye large enough to admit your propeller shaft is found. The temper must be taken out of the needle before it can be bent. Heat it to a white heat and allow it to cool naturally. Do not

place it in water. When cool, bend it to the required shape. If too long, it can be cut to any length with pliers or tin snips.

Try the propeller shaft through the eye. If the eye is too small, heat to a cherry red and while still red, force the shaft through. The needle must now be retempered. Heat it again to a cherry red and plunge it into a glass of cool water, continuing the process until it is a blue color; but do not temper it too much, as it will become brittle and break.

A propeller bearing can also be made with a nail. Cut the head from any nail of desired diameter. Place it on a steel block and hammer its end flat. A hole slightly larger than the diameter of your propeller shaft is bored through the nail, which is bent and cemented to the motor stick, shown by Fig. 17 B. If too long, it can be cut. Many builders prefer to substitute a cotter pin for the nail. When this is done, the cotter pin is broken in half, leaving a single flat length of metal, which is then bored and bent.

C shows a bearing made from piano wire, which can be used on small models. The wire is bent around a nail, its ends brought together and bent to form the bearing. This is then cemented to the motor stick. If further binding is desired, the ends of the wire can be bent down, forced into the wood of the motor stick and cemented and lashed.

On fuselage models having no motor stick, the bearing is made from a plug which fits into the end of the fuselage, or is cemented in place to the ends of the stringers, as shown in D. (See Chapter 35.) Through the center of the nose piece, a hole is made large enough to allow the propeller shaft to turn freely. Some fit a bushing eyelet into the plug. If this is done, it must have an inside diameter slightly larger than the propeller shaft, but not so large as to make the fit too loose, or the propeller will not turn true. This can be purchased at most model houses.

END HOOKS. End hooks are used on all tractor models powered with rubber. They form the rear connection for the motor. On most large models, the end hooks are equipped with "S" hooks (see Fig. 16), but those having small motors usually attach the rubber directly to the hook. These are sometimes called "Rear Hooks."

A in Fig 17 shows the most commonly used end hook. A short arm extends the hook above the top of the motor stick, while its end is bent and buried in the wood. Another is shown by B. Here the hook is bent around the end of the stick, making a strong connection. Such hooks are extensively used on fuselage models with removable motor sticks.

The double hook C is used on some commercial models. The extra hook extending out from the rear of the model allows the motor to be wound with a winder. The rear plug shown on the hook is removable, so that the

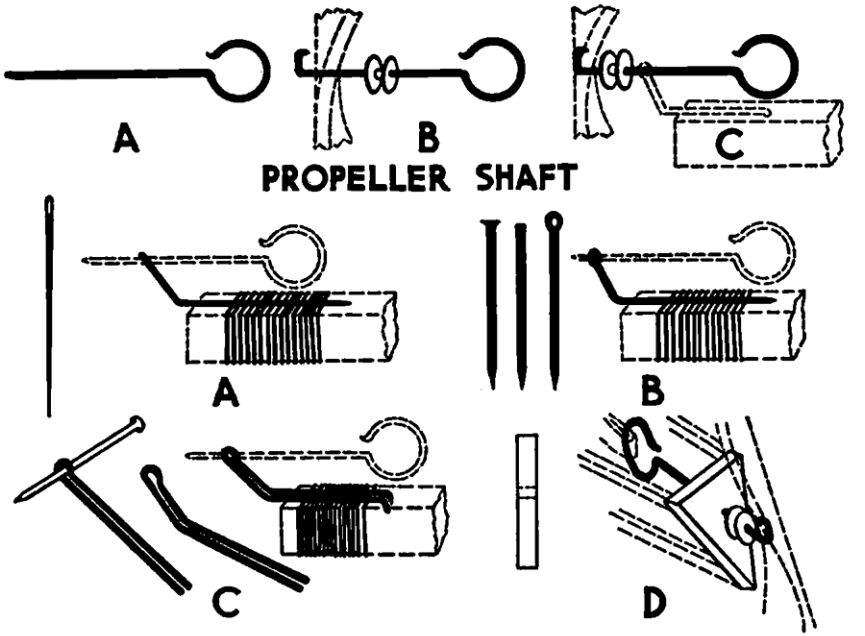

A
B
C
PROPELLER SHAFT
A
B
C
D
PROPELLER BEARINGS
A
B
C
D
E
END HOOKS
A
B
C
D
E
NOSE HOOKS
METAL FITTINGS

FIGURE 17

rubber can be stretched before winding. Such a hook is not cemented to the plug, as the pull of a wound motor will hold the plug in place, and at the same time pull the outside hook tightly against the outer side of the plug. (See Chapter 35.)

Sometimes solid blocks are used to plug the end of a fuselage. When this is done, a combination end hook and tail skid can be used, as shown by D. The wire is firmly cemented to the block through which it passes, one end forming the skid and the other the end hook.

Another combination end hook and tail skid is shown by E. While D is designed for fuselages without motor sticks, this fitting is expressly for single-stick models. One end forms the hook above the stick while the center of the wire is bent around the end of the motor stick, and the other end forms the skid. These are cemented and then lashed with silk thread.

NOSE HOOKS. Nose hooks hold the rear end of rubber motors on pusher models. On such models, the opposite end from the propeller becomes the nose of the model inasmuch as the propeller pushes the model in front of it.

The nose hooks shown by A and B in Fig. 17 are exact duplicates of those shown under the same letters for end hooks, so will require no further explaining. The double hook C is fashioned for single-stick, twin-propeller models. Few of these are made today, having been replaced by the twin-stick pushers, but are given for the builder wishing to experiment along this line.

The double nose hook D is a hook seldom used today. It is bent from a single length of piano wire with its ends brought together between the ends of the A-frame beams, which are cemented and lashed together.

The most popular nose hook for the twin-stick model of today is E. A single length of piano wire is bent in a "V" to conform to the angle made by the joining beams of the A-frame. Its ends are then bent to form hooks over which "S" hooks are placed. The hook is cemented and bound with silk thread to the beams, which holds it tightly in place and at the same time strengthens the joint of the A-frame.

WASHERS. Washers of various sizes can be purchased at all model supply houses or the builder can easily make his own. For this work an ordinary paper punch, which can be obtained at any stationery or five-and-ten-cent store, should be used. Such a punch will work on sheet tin or copper of the usual washer thickness. After punching out the washer, complete it by carefully driving a small brad through its center. Small beads or dress spangles also make excellent washers for propeller shafts. A spangle between two washers will be found the best combination.