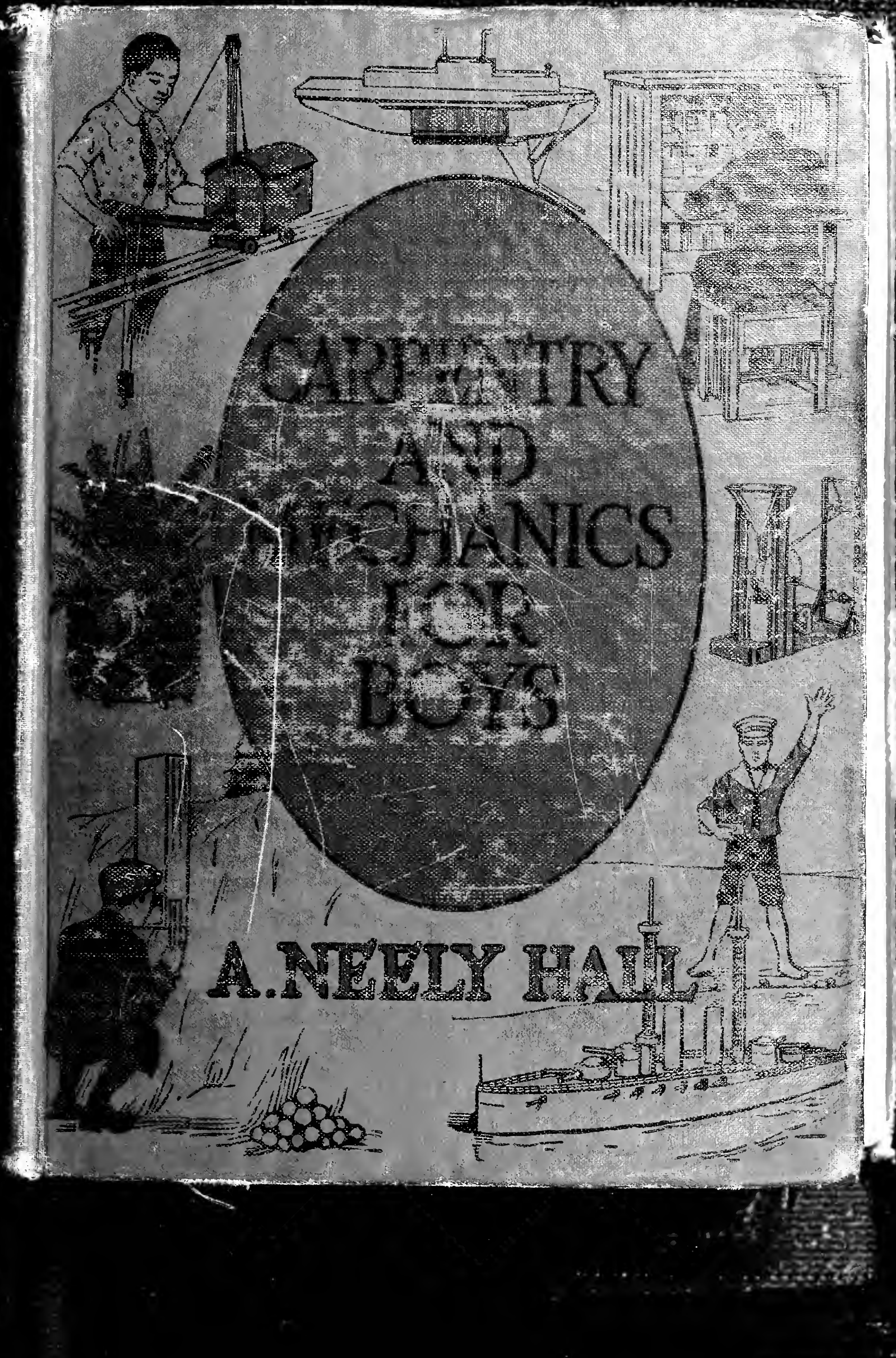
CARPENTRY
AND
MECHANICS
FOR
BOYS
A. NEELY HALL

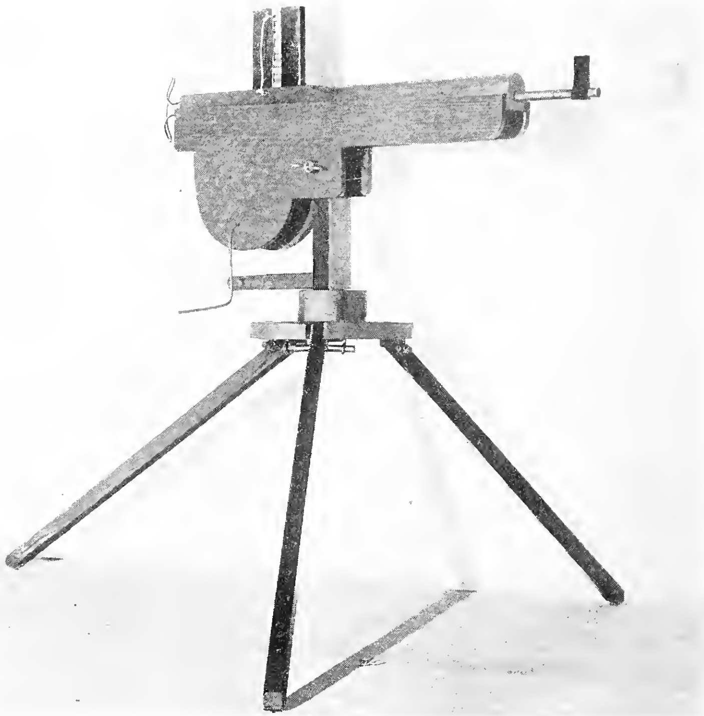

Fig. 408.—Toy Machine-Gun with Magazine that Holds Twelve Wooden Cartridges (See Chapter 17).

Fig. 409.—Squad with Toy Machine-Gun. The Helmets are Made of Tin Wash-Basins.

CARPENTRY & MECHANICS FOR BOYS

CARPENTRY & MECHANICS FOR BOYS

Up-to-the-minute Handicraft

By A. Neely Hall
Author of "The Boy Craftsman", "Handicraft for Handy Boys," "Home-made Toys for Girls and Boys," "Handicraft for Handy Girls," "The Handy Boy" Etc.

With over seven hundred illustrations and working-drawings by the author and Norman P. Hall

BOSTON
LOTHROP, LEE & SHEPARD CO.

Published, December 1918.

Carpentry and Mechanics for Boys

A boy with a hobby learns independence of thought and action.

INTRODUCTORY NOTES

When the author produced "The Boy Craftsman," "Handicraft for Handy Boys," "The Handy Boy," and "Home-made Toys for Girls and Boys," he presented his latest developments in handicraft. These books have been recognized generally as the most up-to-date publications of their kind. Boys' handicraft, however, has felt war's influence as has everything else. Wireless telegraphy, that most popular of boys' hobbies, has been shelved for the duration of the war, because of Government restrictions, and other activities have suffered on account of the scarcity as well as the cost of materials. But new fields of endeavor have been created. Aircraft, sea-craft, undersea-craft, and land-craft are being reproduced in miniature; in fact, there is no phase of modern warfare which boys are not investigating. With universal military service for young men established in this Country, and strong prospects of its becoming a permanent institution, junior war mechanics is a hobby likely to be perpetuated.

Because of boys' interest in these new lines of handicraft, the author has been persuaded to bring out "Carpentry and Mechanics for Boys." In this volume will be found plans for toy battleships, a submarine, airplanes, miniature warfare, toy artillery, a machine-gun, drill-guns, periscopes, etc. In addition to the war mechanics, Part I presents workshop ideas, including plans for household conveniences, furniture, and novelties. Part II presents plans for mechanical toys, and Part III plans for backyard and camp.

Gardening has received an impetus never before known, as the result of the food situation created by the war, so a number of chapters have been devoted to plans for making garden accessories. Bird-house building in which there is an ever increasing interest, is treated in six chapters.

A boy's earning capacity never has been so great as at the present-time, nor has it been of so great importance. Many practical suggestions for earning money will be found in this new book of handicraft.

All ideas in "Carpentry and Mechanics for Boys" have been carried out successfully by boys, a test which the author requires of material used in his handicraft books. Much of the material has appeared in the author's handicraft department of "The American Boy," other material has been published in "St. Nicholas," "The Ladies' Home Journal," "Woman's Home Companion," "Suburban Life," in newspapers, and in Sunday school weeklies.

Following the plan of his former volumes, the author has utilized for the construction of work described in "Carpentry and Mechanics for Boys" such materials as can be picked up at home, or procured for little or nothing. The value of encouraging boys to reduce the cost of their work to a minimum is three-fold. Of first importance, it teaches the boy to conserve material. Of second importance, it teaches him to be self reliant, to keep his material costs within his earning capacity. His handicraft activities do not become an endless drain upon father's pocket-book. Of third importance, it teaches him resourcefulness, which will be valuable to him in business life. Whether he becomes builder, manufacturer, engineer, architect, mechanic, or a follower of any one of hundreds of occupations, his success will depend largely upon how well he can utilize material, upon how much he can produce with the least expense.

Providing the boy with books that show how to make things he is interested in, is undoubtedly the solution of the problem of training him to be industrious. Following the suggestions presented, he becomes handy with tools, learns to convert raw materials into finished products, gets the knack of combining brain work with hand work, develops initiative.

It is gratifying to the author to hear of his readers' success after they have entered business life, and it interests him to note the large percentage of readers who follow an occupation which served as a school-day hobby. At the present writing, thousands of grown "boy craftsmen" are in the service of the Government, helping win the great war overseas. The author regrets that a list of the names of these lads is unavailable, and that it is thus impossible to fly a service flag with a star thereon for each reader serving with the colors. And to the lads who have laid down their lives in the just cause for which they have fought, he wishes that he might do fitting honor.

The author is always glad to hear from his readers, and will place upon his mailing-list the names of those who make the request, that they may receive information from time to time relating to handicraft activities.

A. N. H.

Elmhurst, Illinois,
May 31, 1918.

PART I

THE HOME WORKSHOP

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CHAPTER VIII

CHAPTER IX

PART II

WAR TOYS AND MECHANICAL TOYS

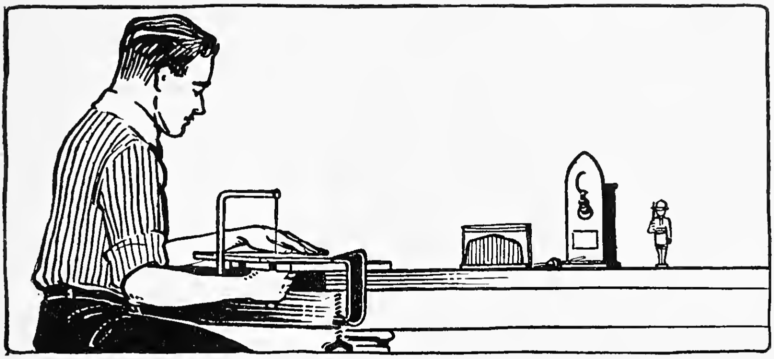
CHAPTER X

CHAPTER XI

LIST OF HALF-TONE ILLUSTRATIONS

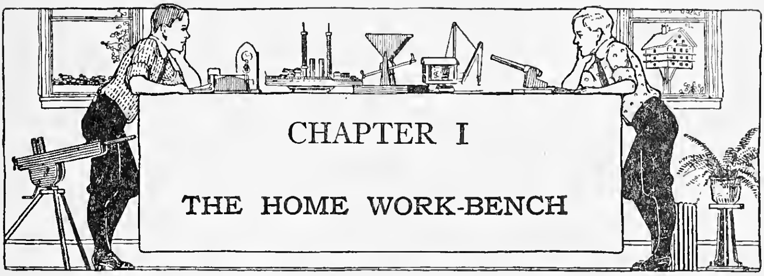
(In addition to more than 700 text illustrations)

PART I



PART I

For Workshop and Home



CHAPTER I

THE HOME WORK-BENCH

It has been the author's custom to begin his handicraft books with several chapters on the selection, care and handling of tools, the construction of cabinets and chests to hold them, the making of handy shop equipment, the preparation of work, and the finishing thereof. In fact, boys who own all of the volumes have in their possession the equivalent of a school course in manual-training.

If you want to know about different forms of tools, what operations they are intended for, and what tools you will require for home carpentry, you will find the information in Chapter II of Handicraft for Handy Boys, you will learn how to handle tools properly by reading Chapter II of The Boy Craftsman, you will discover handy methods of doing things in Chapter III of The Handy Boy. Chapter III of Handicraft for Handy Boys will give you instruction in manual-training problems, Chapter IV of the same volume will tell you about wood finishing, and Chapter V will show you how to prepare working-drawings. The making of tool-chests, tool-cabinets and work-benches is described in The Boy Craftsman, Handicraft for Handy Boys, and The Handy Boy, and the last named volume contains plans for building a small backyard work-shop.

The author knows that most of you readers of Carpentry and Mechanics for Boys will not be satisfied until you have added one or more of his other books to your library, and, therefore, in writing this book, he has touched but lightly upon subjects contained therein. The subject of work-benches has not been exhausted, however, so further suggestions have been brought together in this first chapter.

To accomplish anything worth while in carpentry or mechanics, you must have a means of holding your work securely for planing, sawing, drilling, and other operations — a work-bench. Possibly there is no space at home available for a work-shop, possibly you are denied even enough working space in which to set up a permanent work-bench, because of living in an apartment building. Under these conditions you need not be deterred from doing home carpentry, however, even though you may have to work under difficulties. You can provide yourself with

An Improvised Work-Bench like one the author used when he lived in an apartment. This bench, shown in Figs. 1 and 2, requires the use of mother's kitchen table, but the table is not altered or injured in any way, so there should be no reason for your not requisitioning it when it is not in the service of the culinary department, if mother does not object to your working in her kitchen. I believe that after you have demonstrated once or twice that you can and will clean up your scraps of wood, shavings, and sawdust when you are through working, leaving the kitchen as tidy as it was before you began to work, mother will have no objection.

You can make the work-bench attachment quickly, and

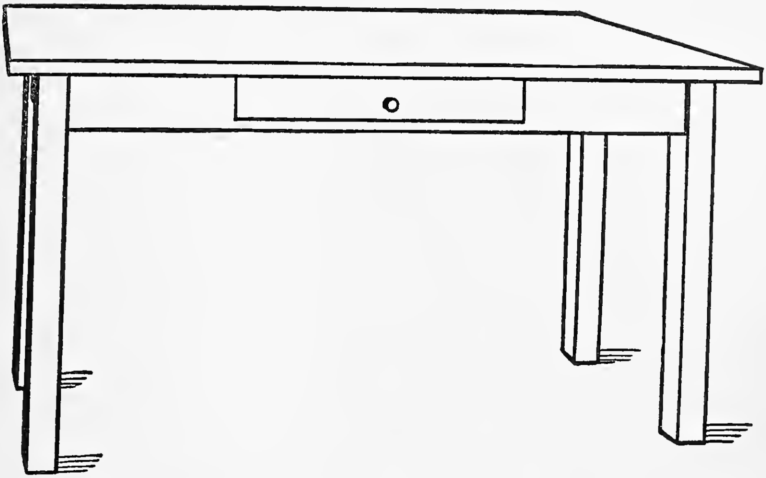


FIG. 1. — You Must Have a Work-Bench if that Bench be nothing more than a Kitchen Table

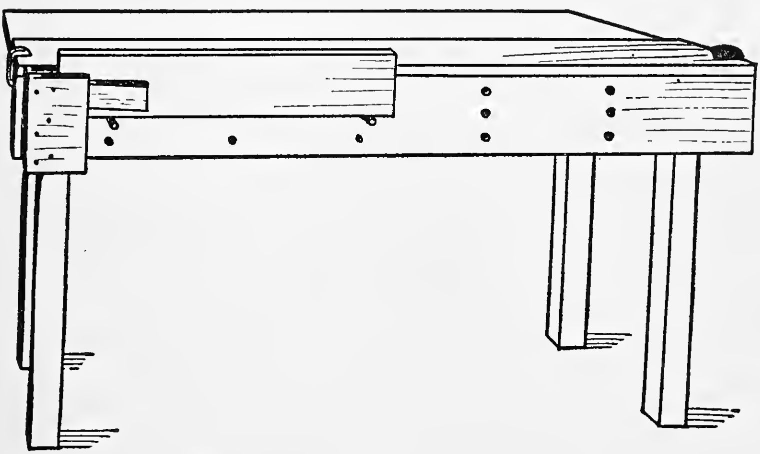


FIG. 2. — A Kitchen Table with its Improvised Bench-Top Clamped on

it requires but an instant to attach and detach it. Once father discovers its convenience, he probably will make constant use of it when tinkering.

Figure 3 shows .

The Bench-Top. This is built to set over the front edge of the table (Fig. 2), and is held in position with a pair of iron *curtain-stretcher clamps* (Figs. 6 and 7). Make top *A* and *apron B* of boards 10 inches wide by the length of the table. Bore four or five rows of holes ¾-inch in diameter through apron *B* (Fig. 4). Space the rows about 12 inches apart. To get the holes in straight rows, rule lines across the board on which to locate the hole centers. The holes are provided for wooden pegs *G* (Fig. 3). These pegs can be adjusted to the right heights and to the right distances apart, for supporting pieces of work of varied lengths (Fig. 2). Blocks *C*, nailed to the back of apron *B* at the ends (Fig. 4), should be cut of a thickness equal to the amount of projection of the table-top, so that when top *A* is nailed to the edge of apron *B*, and the two are slipped over the front edge of the table, blocks *C* will rest against the front table legs.

The Bench-Vise fastens to the left of the apron. It is built of pieces *D* and *E* (Fig. 5). Cut strip *D* 3 inches wide and 10 inches long, and nail it to apron *B*, then cut *jaw block E* 6 inches long and 10 inches wide, bevel its inner right-hand edge as shown, and nail it to strip *D* with the beveled edge turned in and projecting. Cut the pieces with the grain running as indicated. You will see by Fig. 2 how pieces *D* and *E* form a *pocket* into which to slide the ends of pieces

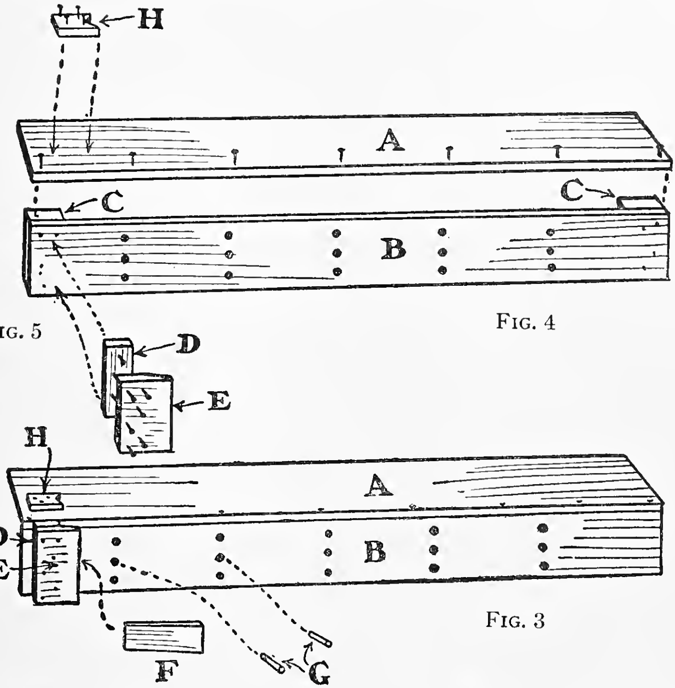


FIG. 5

FIG. 4

FIG. 3

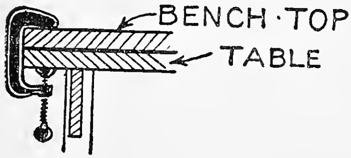


FIG. 7

FIG. 6

FIG. 3. — Make the Detachable Bench-Top for the Table Work-Bench, like This

FIG. 4. — This is how the Bench-Top is Built Up

FIG. 5. — Detail of Vise

FIGS. 6 and 7. — The Ends of the Bench-Top are Clamped to the Table of work, and how the work is wedged in with a *beveled* block *F* (Fig. 3).

Block *H* (Figs. 3 and 4) is a

Bench-Stop to push work against when working on the top of the bench. Make a "V" cut in the right-hand end as shown.

In Fig. 8, a corner of the author's work-shop, is shown.

A Work-Bench With an Adjustable Vise. If you have room for a permanent bench, this is the right kind to build. Details of its construction are shown in Figs. 10 to 17.

MATERIAL		
PIECES	DIMENSIONS	PARTS
4	2" x 4" x 2'-4"	LEGS A
2	" x " x "	CROSSPIECES B
2	1" x 4" x "	RAILS C
7	1" x 4"s	BRACES D & G
1	1" x 10" x 5'-6"	APRON E
2	1" x 4" x 4'-0"	RAILS F
3	2" x 10" x 5'-6"	TOP H
1	2" x 6" x 2'-4"	VISE JAW I
1	3/4" x 3" x 18"	SLIDING-STRIP J

FIG. 9.— Bill of Material for Work-Bench

A Bill of Material is given in Fig. 9. Several small pieces in addition to this material will be needed, but you can probably pick these up in the kindling-wood pile. Maple makes the best top, but you will find, as the author has found, that a pine top is plenty good enough, and of course it is much less expensive. Be careful not to cut up the surface with sharp-edged tools, and the pine top will keep in good condition for a long time. You will appreciate a

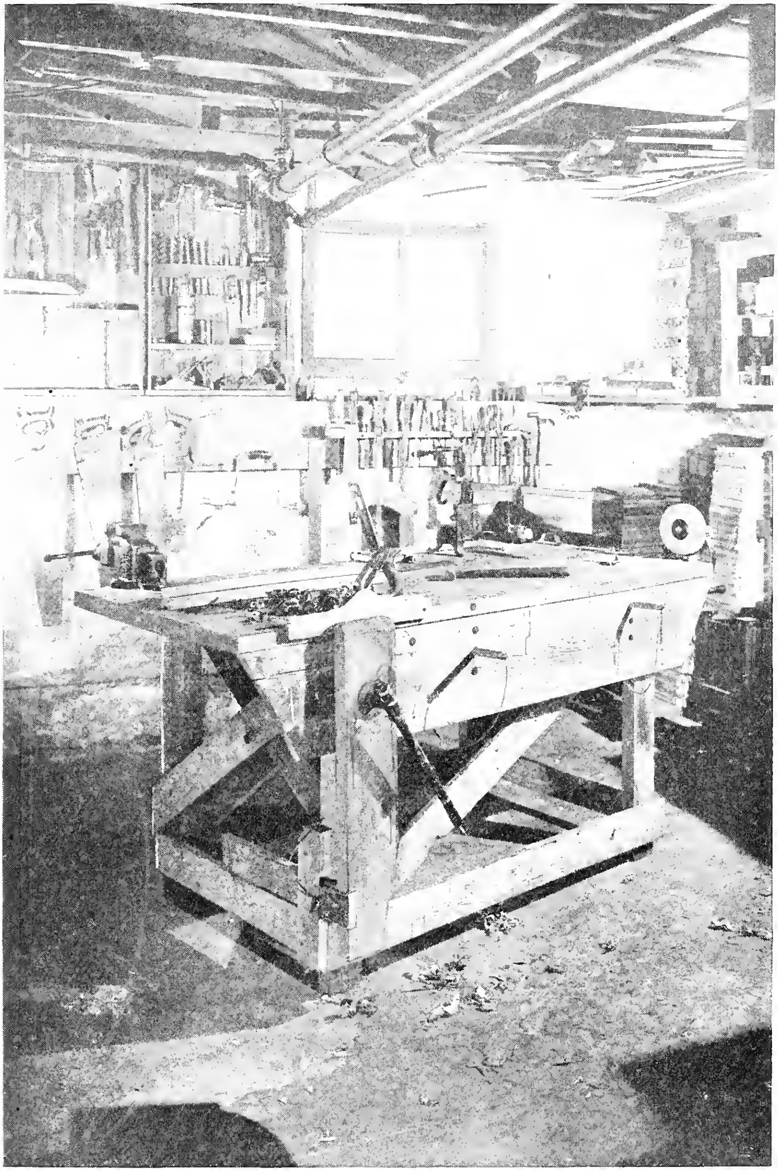


Fig. 8.—Corner of the Author's Work-Shop, Showing the Right Kind of Work-Bench for a Boy to Build.

soft wood top many times when you have occasion to drive in a nail for a temporary *stop* or for some other purpose.

If there is no lumber yard or mill nearby, get acquainted with a carpenter and have him buy the material for you. Or, if a new building is being erected in your neighborhood, go to the carpenter foreman and see if you cannot buy from

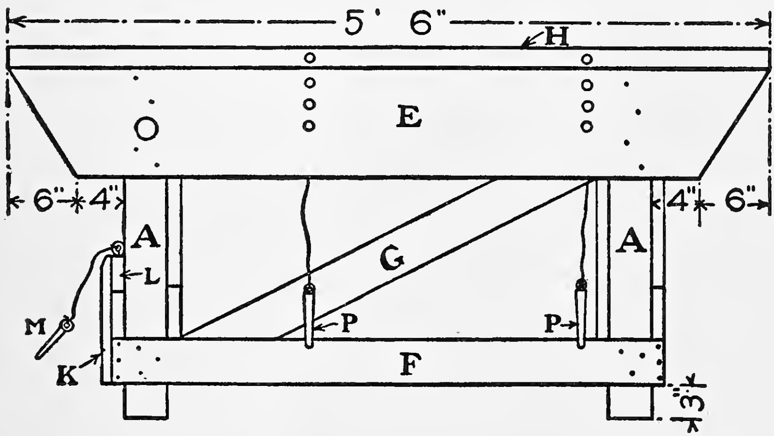


FIG. 10. — Front View of Work-Bench

him what is needed. Two-by-ten floor joists will be just the thing for the top planking.

The Framework is shown in Fig. 13, a front view of the completed bench is shown in Fig. 10 and an end view in Fig. 11. If you are less than 4 feet 6 inches tall, I would suggest that you make your bench 28 inches high instead of the height given in Fig. 11. This will mean cutting the legs 4 inches shorter than the given dimensions.

The end frames of the framework should be constructed first (Fig. 12). Spike crosspieces *B* to the top of legs *A*, and nail rails *C* to the side of the legs 3 inches above the bottom. Test the corners formed by legs *A* and cross pieces *B*, and when they prove to be exact right angles, nail on the diagonal braces *D*. Cut these braces longer than is necessary, so that after nailing them in position you can saw off their ends flush with the sides of the legs. Having completed the frames, cut rails *F* and nail them to the legs on a line with lower rails *C* (Fig. 13). Then measure the distance between the frames at their tops, nail a board across crosspieces *B* to hold the tops at exactly the same distance apart as the lower ends, and after testing the end frames to see that they stand perfectly vertical, nail on the diagonal braces *G*.

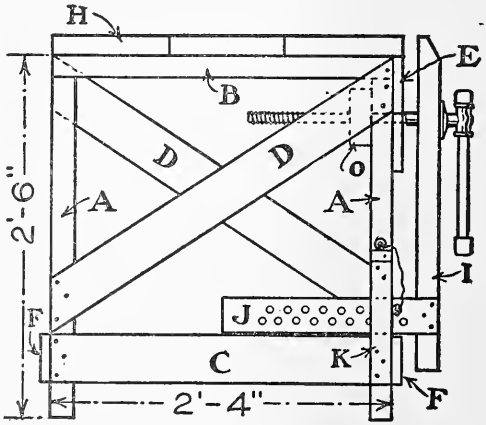


FIG. 11. — Left-End View of Work-Bench

Ten-inch stuff planed upon all edges usually measures between 9½ and 9¾ inches in width. Therefore, three pieces placed side by side, with the front plank projecting ⅞ inch over the end frames, to allow for the thickness of *apron E* (*H*, Figs. 10 and 11), will be of just the right width for the bench-top. Make the projections over the ends of the framework equal, and spike the planks to crosspieces *B*. Drive the nail heads about ½ inch below the surface, so your edge tools will not come in contact with them. Figure 10 shows how the ends of apron *E* should be trimmed off. Nail the apron to the bench legs.

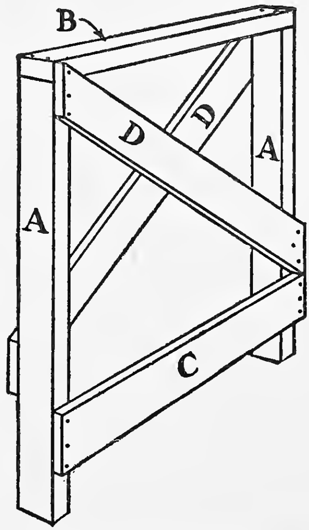


Fig. 12.—Detail of End Frame

The Bench-Vise is the next portion to construct. You need an iron *bench-screw* like that in Fig. 15 for the vise. This can be purchased at the hardware store. You can make the rest of the vise by following the details of Figs. 11, 14, 15, 16, and 17.

The *jaw* (*I*, Fig. 14) is a piece of 2 by 6. Mark it out as shown in Fig. 17, with the lower end drawn so as to be sawed off on a diagonal, the left-hand edge so as to be notched to receive the *sliding-strip J*, and the top so as to be beveled on the face side. The sliding-strip *J* is a guide for the lower end of the vise jaw. With a peg to fit in its holes, this strip provides a means for keeping the bottom of the jaw directly under the top. Without this attachment, it would be impossible to clamp work in the vise, because the jaw would push in at the bottom, and could not be made to set squarely against your work. The holes in the sliding-strip should be 3/8 inch in diameter, and they should be staggered as shown, with their centers placed 1 1/2 inches

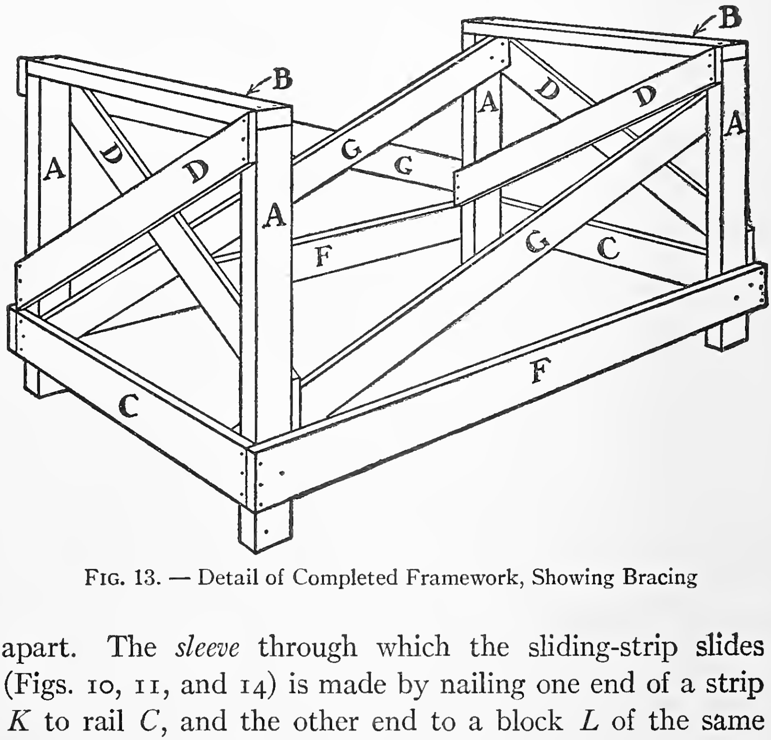


FIG. 13. — Detail of Completed Framework, Showing Bracing

apart. The *sleeve* through which the sliding-strip slides (Figs. 10, 11, and 14) is made by nailing one end of a strip *K* to rail *C*, and the other end to a block *L* of the same thickness as *C*, fastened 3 1/4 inches above rail C. Suspend a peg (*M*, Fig. 14) from block *L* by a cord tied to screw-eyes screwed into the end of the peg and block *L*.

To Attach the Bench-Screw, slip sliding-strip *J* through its sleeve and push the jaw up against apron *E*; then, 7 inches below the top of the jaw, mark the center for the hole through which the bench-screw is to turn, and cut a hole at this point through the jaw, through the apron and through the bench leg. This hole should be 1½ inches in diameter.

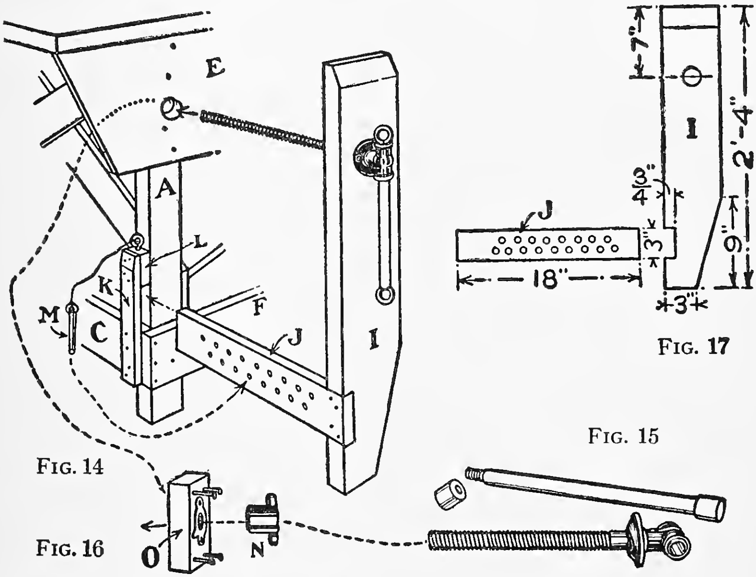


FIG. 14. — Completed Bench-Vise
FIG. 15. — Iron Bench-Screw
FIG. 16. — Threaded Iron Socket and Wooden Block in which it is Mounted
FIG. 17. — Detail of Vise Jaw and Sliding-Strip

If you haven't an *expansive-bit* which can be set to cut a hole of this diameter, bore several small holes, and with a chisel connect them, making one large hole. The iron *socket* which comes with the bench-screw (*N*, Fig. 16) must be fastened to the back of the bench leg. If the threads on the bench-screw run close to the handle end as shown in Fig. 15, the hole in the bench-leg can be enlarged and the socket set into the hole, but the threads upon some bench-screws stop 3 inches from the handle end, and, if you get one of these, it will be necessary to set the iron socket into a wooden block (*O*, Fig. 16), and spike this block to the back of the leg (Fig. 11); if this is not done, the vise jaw cannot be screwed up close to the face of the jaw, and the vise cannot be closed. Screw the iron *collar* on the handle end of the bench-screw to the face of the jaw.

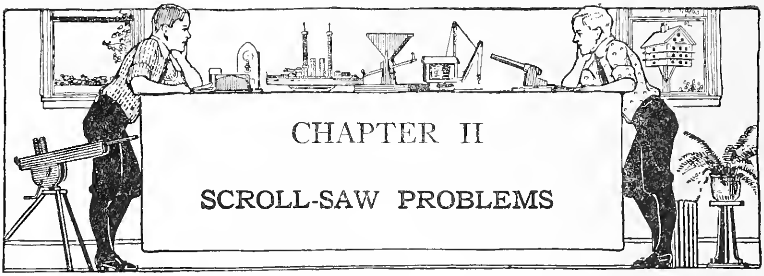
The wooden *handle* that comes with a bench-screw (Fig. 15) is not of much account, because the constant sliding through the iron sleeve, from end to end, loosens the ends, making it necessary to glue them on every now and then. A better handle is a piece of broom-handle 16 inches long with a large screw-eye screwed into each end, like that shown in Fig. 14. The author uses a handle of this form on his vise, as you will see by Fig. 8.

Peg Supports for Work. Upon the front of the bench apron *E*, two rows of holes about ¾ inch in diameter should be bored, as shown in Fig. 10, and a peg (*P*, Fig. 10) should be whittled to fit each row. Suspend the pegs by cords, so they will always be within reach when wanted. The purpose of these pegs is to support the right-hand end of long pieces of work; they can be adjusted to the holes which will suit the width of the piece of work placed in the vise.

A Bench-Stop on the top of the bench is very useful to push the end of work against when you cannot or do not wish to place the work in the vise. A block of wood screwed to the bench-top will do (*H*, Figs. 3 and 4), but an *adjustable iron stop* can be purchased at the hardware store which will be handier.

You will get some ideas for the arrangement of

Tool-Cabinets and Tool-Racks from the photograph of the author's shop (Fig. 8), but, as stated at the beginning of this chapter, you are referred to THE BOY CRAFTSMAN, HANDICRAFT FOR HANDY BOYS, and THE HANDY BOY for instructions for making them.



CHAPTER II

SCROLL-SAW PROBLEMS

It is not necessary to have a *scroll-saw* for the scroll-saw problems illustrated and described in this chapter. In fact, most of the scroll-saw work now done by boys is with a *hand bracket-saw* like that shown in Fig. 18, or with the

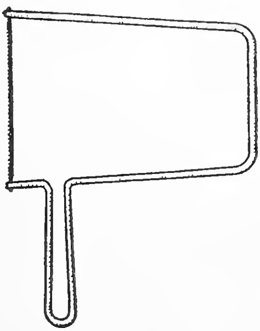


Fig. 18.—
A Bracket-Saw

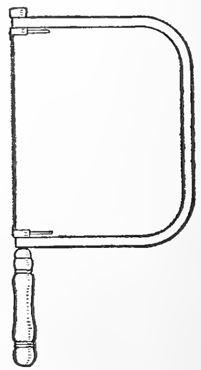


Fig. 19.—
A Coping-Saw

slightly different form of saw shown in Fig. 19, known as a *coping-saw*. The cheaper makes of bracket-saws can be purchased for 10 cents, and a dozen saw blades — you will need a dozen as they are slender and easily broken — cost 10 cents. A good coping-saw costs in the neighborhood of a dollar, and the blades, which are usually not as delicately made as bracket-saw blades, cost 5 cents apiece. A foot-power scroll-saw costs between $8 and $10.

Scroll-saw work may be done outside of a workshop, if

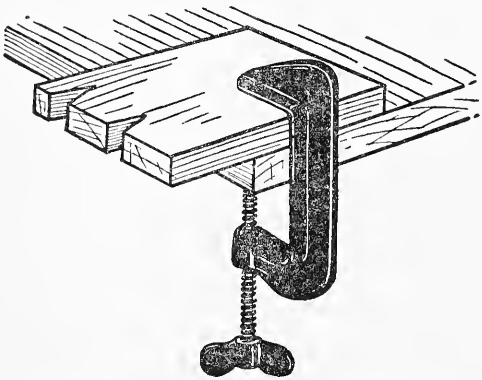


FIG. 20. — Board Protection for Table-Top

papers are spread to catch sawdust and wood scraps. You can use

A Table to Cut Upon. The surface must be protected of course, so there will be no danger of sawing into it, and Fig. 20 shows how to protect it with a board clamped to the table top. An iron *G-clamp*, such as is sold for curtain-stretchers can be purchased for 5 cents. Cut two notches in the front edge of the protection board, as shown. The purpose of the notches is to provide openings for the saw. With the block to be sawed placed upon the board, the saw can be worked up and down in one notch or the other

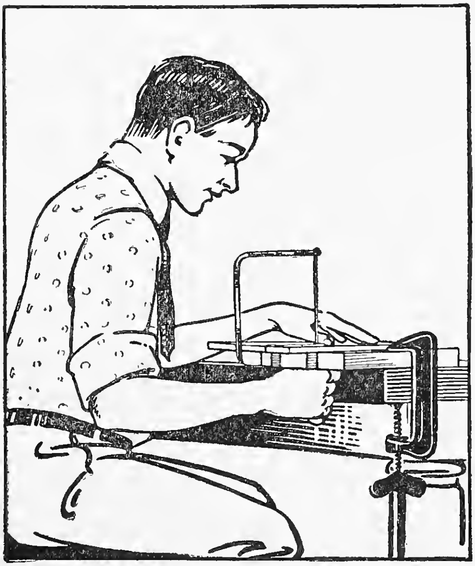


FIG. 21. — Correct Method of Using the Bracket-Saw

without danger of splitting the work, because the block will be supported each side of the point of cutting. Figure 21 shows the correct position for sawing. Turn the piece of work with the left hand as the cutting progresses.

If you use your work-bench vise to hold your work, you can place the work in a vertical position, and saw horizontally instead of vertically.

One of the most popular scroll-saw stunts at the present time is the making of

Jig-Saw Picture Puzzles, a form of puzzle with which you probably already are acquainted — thin pieces of board with pictures mounted upon them, cut up into small irregular-shaped pieces, which are mixed up, then fitted together in the proper manner to make up the picture. They are called *jig-saw puzzles* because, when made in quantity, a number of thicknesses of wood are cut at one time, and a *jig-saw*, or form of scroll-saw built for cutting thick material, was originally used for the purpose. The modern *band-saw* has superseded the jig-saw almost universally.

The Best Wood for scroll-saw work is white-holly veneer ⅛ inch thick, but it is expensive, costing about 15 cents a square foot, and the wood is not easy to obtain. Next to

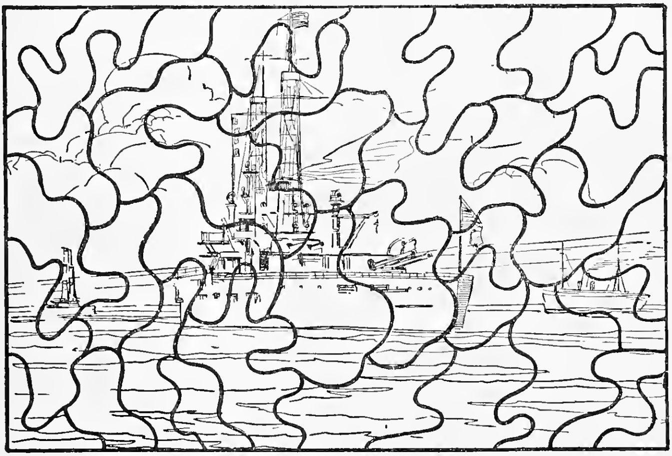


Fig. 22. — How to Cut up a Picture Puzzle

white-holly, basswood is to be preferred. You can get this wood 3/16 inch thick at most planing-mills at 4 or 5 cents a square foot, and often you can pick up waste scraps which the mill-man will let you have for little or nothing.

The size of wood you can get for picture puzzles will determine the size of pictures you can use, and, likewise, the size of suitable pictures that you find will determine the size of wood mounts. Since picture blocks may warp, and large blocks will warp to a greater degree than small ones, I would advise the making of small blocks. A standard size for store puzzle blocks is 3 by 5 inches, which is large enough to cut into as many as twenty-five parts, if you cut the pieces small.

You will have no difficulty finding good

Picture Material in magazines. Pictures in color are preferable to those in black and white. If those you select are not printed in color, you can try your hand at painting them with water-colors, or tinting them with colored crayons.

Mounting. Mount a picture upon each side of the blocks. This will make the puzzles more difficult to assemble and the paper will hold the wood flat and prevent its splitting. If you mount paper upon only one side, the wood will warp. For this reason, it is best to mount paper upon both sides of the blocks, even though the paper on one side is a blank piece. Use glue or shellac for mounting. Coat the surface of the block copiously, put the picture in position, press it down, and weight it until dry. To smooth out wrinkles, lay a clean piece of paper over the mounted piece, and rub the edge of a ruler over the paper. This will squeeze out surplus glue.

Figure 22 suggests

How To Cut Up a Picture Puzzle. You can draw out the *cuts* upon the mounted picture, or you can decide upon the shapes of the cuts as you work, if you wish. The saw teeth will leave a rough edge to the cuts, on one side of the block, you will find. To prevent the roughness, which would spoil the picture upon that side, back the block with another thin piece of wood, and hold the two pieces firmly together while you cut.

While making puzzles, let us make a model of

The T-Puzzle, a famous old puzzle that is more difficult to assemble than it looks. Figure 23 shows it put together. The key to the solution lles in properly placing the irregular-shaped block at the intersection of the vertical and horizontal members of the ietter. Once you get the position of this, the other pieces are easily assembled.

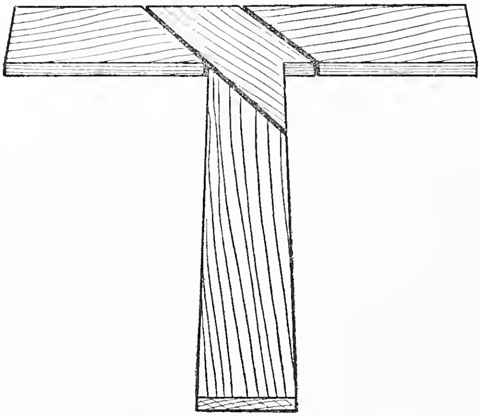


FIG. 23. — The T-Puzzle

Full-Size Patterns of the four blocks are given in Fig 24.

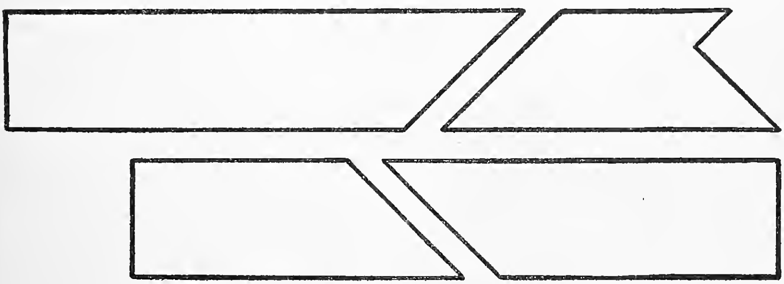


FIG. 24. — Full-Size Patterns for the T-Puzzle Blocks

Make a careful tracing of them upon thin paper, and transfer the tracings upon a strip of wood. Cut out the pieces care-

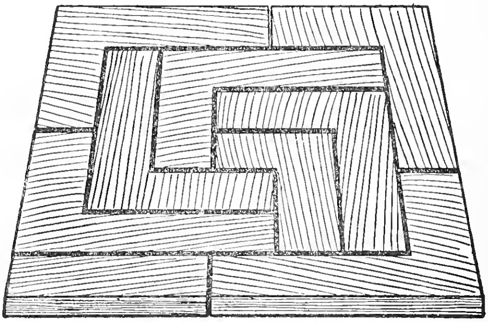


FIG. 25. — The Square Puzzle

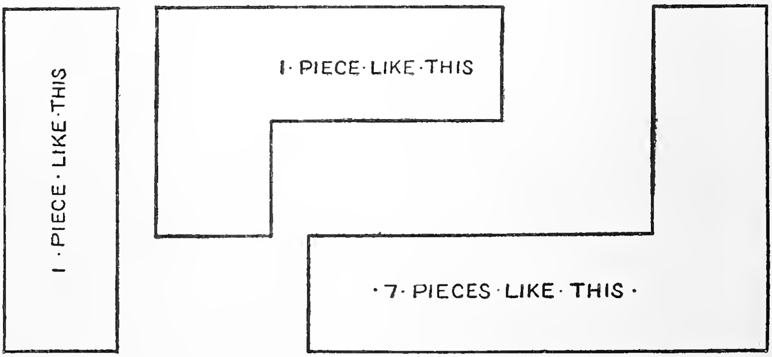


FIG. 26. — Full-Size Patterns for the Square-Puzzle Blocks

fully, and smooth the edges with sandpaper, then fit them together, and trim up all ends and edges that require it.

The Square Puzzle, shown correctly assembled in Fig. 25, is another interesting puzzle to make. It requires nine blocks. Figure 26 shows

FIG. 27. — Cut the Square Puzzle Blocks out of a Strip like this

The Patterns. If you will trace off the patterns as shown in Fig. 27, with the blocks placed end to end, you can prepare a strip of the right width to take in the blocks and then saw it up. These blocks must be carefully finished so they will be of exactly the right size, or they will not fit together nicely to make the square.

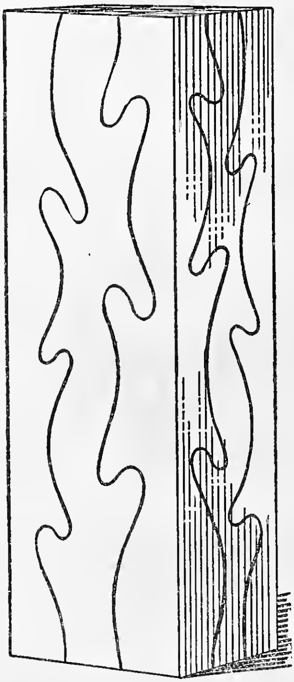


FIG. 28. — The Prism Puzzle

The Prism Puzzle presents one of the most interesting of the simpler scroll-saw problems. It is easy to make.

The first thing to do is to prepare a stick 1½ inches square. The length of the finished block will be 4⅜ inches, but do not cut the block to this length until after the rest of the cutting has been done (Fig. 28). If you do separate it, there will be no way of keeping the parts together while cutting, and there will be nothing to hold the block by.

Plane the sides of the stick square and smooth, and square off one end. Mark off the distance of 4⅜ inches from the squared end, upon each side of the block. Then draw the curves shown in Fig. 29 upon two adjacent sides of the block, making a tracing of the pattern and transferring it to the block.

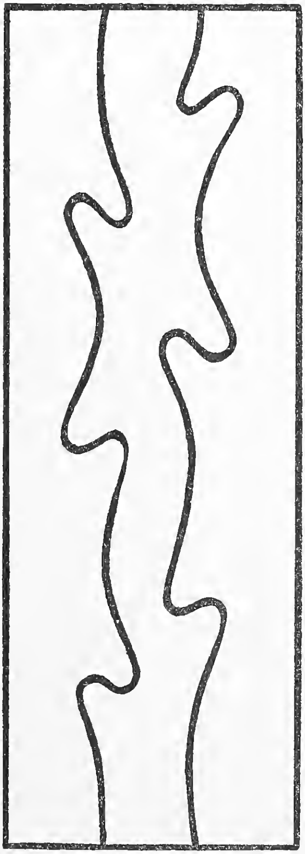


Fig. 29.—Full-Size Pattern for Cutting Prism Puzzle Blocks

In cutting, it will be best to support the block in a vertical position, and cut down as shown in Fig. 30. There are two important things to do. Hold the saw so that the blade will cut horizontally and always parallel to the sides of the block, and cut exactly upon the lines.

Figure 31 shows the nine blocks into which the block is separated in the process of cutting. The center piece is the only piece that is irregularly shaped on all four sides; therefore, this is the piece to begin with in assembling the block. Find two pieces that will fit upon opposite sides of it, and fit the three pieces together. Then find three pieces that will fit together each side of the center three pieces, slip them into position, and the block will be put together. There is a trick to locking the pieces one inside another, even when the correct positions have been discovered You must get the knack of putting them together through experimenting.

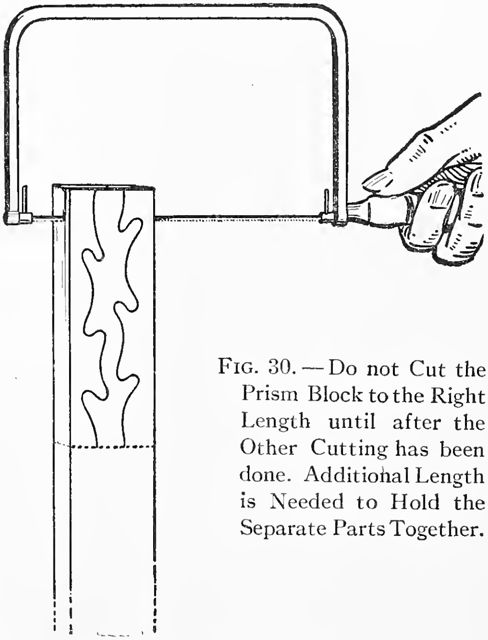


Fig. 30. — Do not Cut the Prism Block to the Right Length until after the Other Cutting has been done. Additional Length is Needed to Hold the Separate Parts Together.

A Seven-Piece Set of Doll Furniture. You would hardly imagine that out of the little block of wood shown in Fig. 32, a seven-piece set of doll-furniture can be cut by making six saw cuts, yet this is the way the doll furniture shown in Figs. 37 to 43 was prepared. Stand the pieces of furniture upon a table, and ask a friend to fit them together so as to form a symmetrical block, and the friend will think that you are joking. By comparing the letters on the pieces of furniture, with the letters on the block shown in Fig. 32, you will see how the pieces fit within one another.

The block should be free from knots and cracks. White pine is best, but other clear wood will do. Cut the block to the dimensions shown in Fig. 33, planing its surfaces

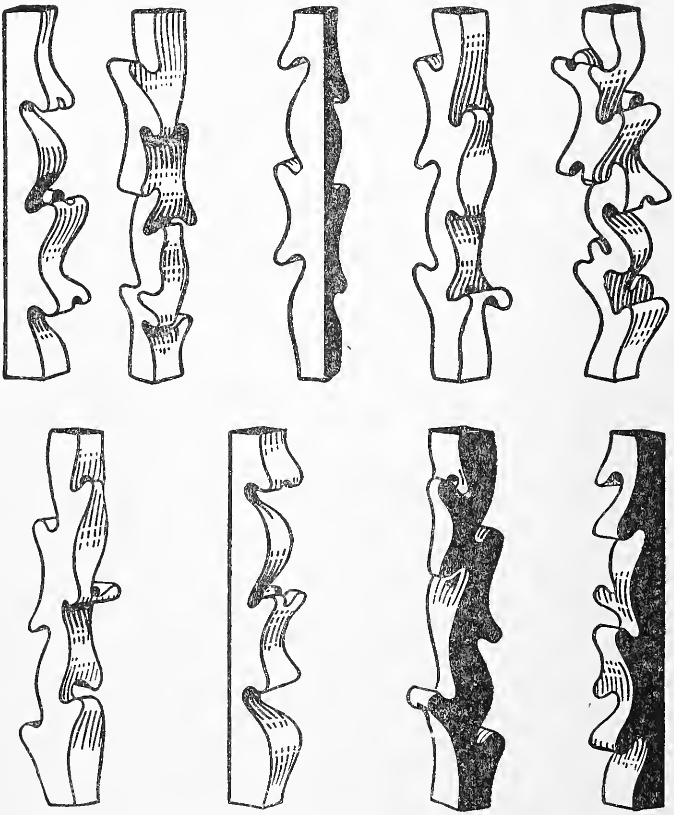


Fig. 31. — The Nine Blocks into which the Prism is to be Cut

straight and smooth. Then upon the two faces and the two sides mark off the lines on which to cut. Draw these lines exactly as indicated. The corners of the cuts are shown rounded, because it is necessary to round them in turning the corners with the saw blade.

The first piece to cut out is the table (Fig. 37). Figure 34 shows how this is removed from the block. The next step is to separate the remainder of the block into two equal parts by sawing along the heavy line indicated in Fig. 34, which will give you the two blocks shown in Fig. 35. By now cutting from each of these blocks first the block *C* (Fig. 36), then the block *D*, you will have produced the two chairs *B* (Figs. 38 and 41), the two stools *C* (Figs. 39 and 42), and the two tabourets *D* (Figs. 40 and 43). In Figs. 34 and 35, only one cut is indicated on each, the lines of the other cuts being omitted to save confusion of lines.

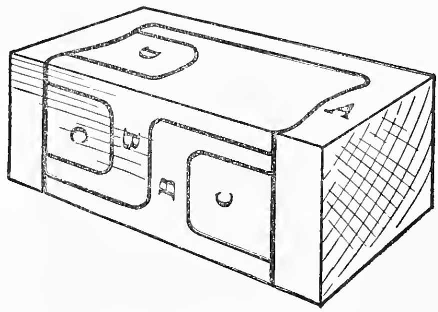


Fig. 32. — Saw the Block along the Heavy Lines; and you will have the Seven-Piece Set of Doll Furniture Shown in Figs. 37-43

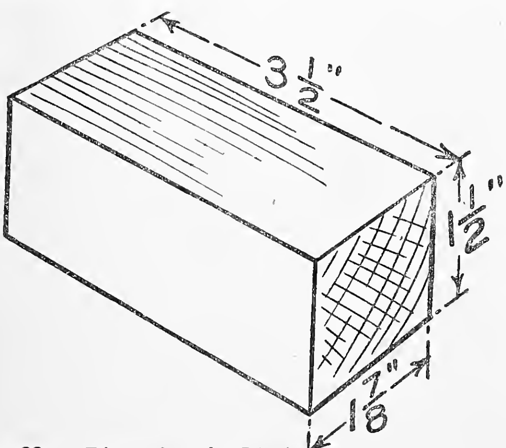


Fig. 33. — Dimensions for Block

Unless you do the marking and sawing very accurately, you will find it impossible to interlock the pieces except when they are turned in the direction of the positions

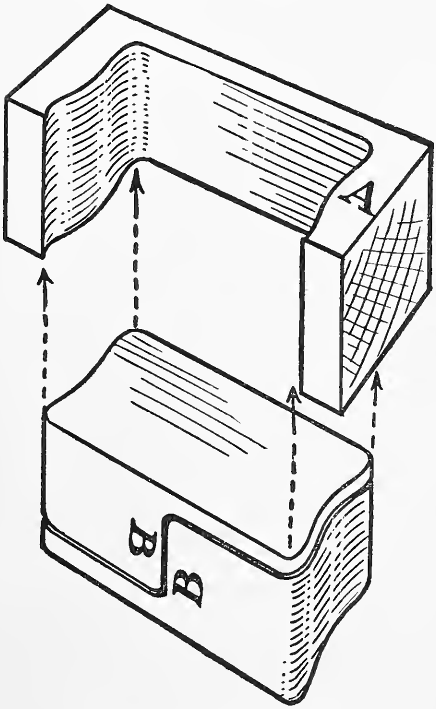


FIG. 34. — The First Cut. Block A is the Table

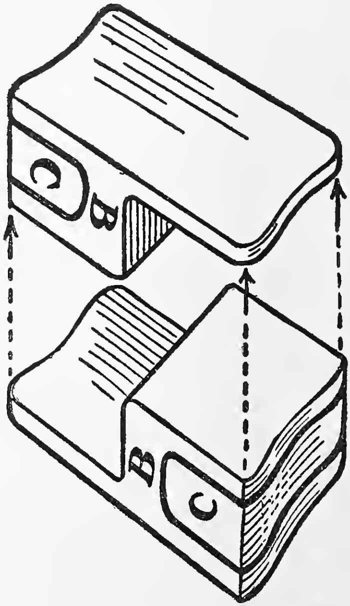


FIG. 35. — The Second Cut. Blocks B are Chairs

originally occupied. Although it is well to do the cutting as accurately as possible, if the pieces will fit only one way you will have a puzzle all the more difficult to assemble.

A fad for one's room is to have brightly colored

Bird and Animal Cut-Outs perched upon embroidery-hoop swings. Figure 44 shows a monkey-in-swing cut-out and Fig. 45 a parrot-in-swing cut-out, both of which are easily prepared.

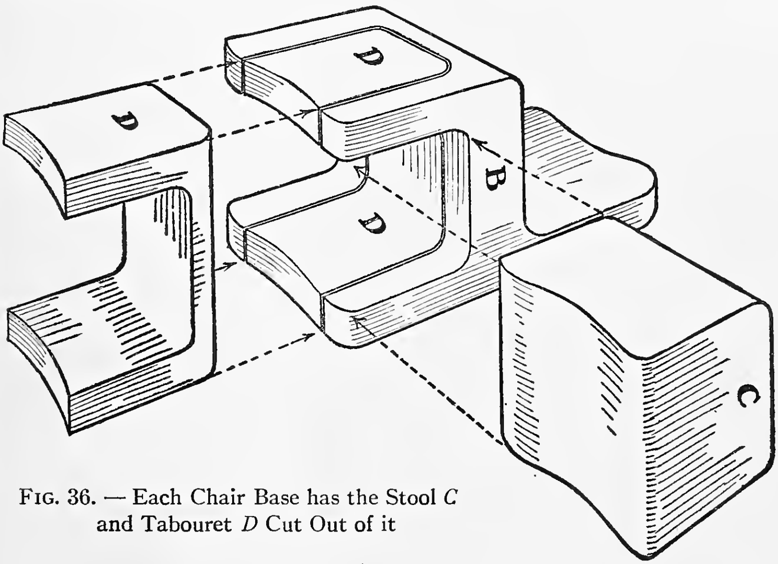
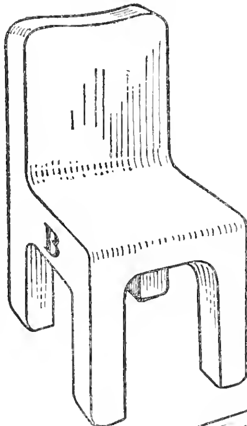


Fig. 36. — Each Chair Base has the Stool *C* and Tabouret *D* Cut Out of it

To simplify the work of drawing the parrot and monkey, patterns are shown in Figs. 46 and 47, that can be reproduced easily to the size desired by the process of *enlarging by squares*. Take a piece of wrapping-paper, and cut it exactly 7½ inches wide by 11 inches long, being careful to get the corners square. Then with a ruler mark off ½-inch divisions along each edge, and connect opposite division points with straight lines. Your sheet of paper will now be filled with squares similar to the diagram of Figs. 46 and



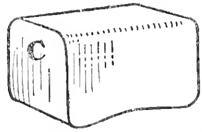


FIG. 39

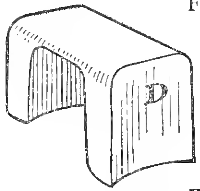


FIG. 40

FIG. 38

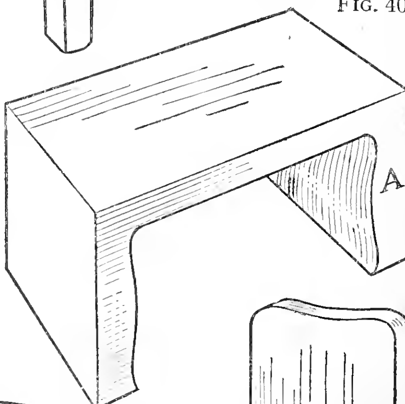


FIG. 37

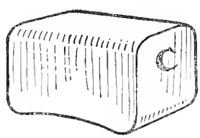


FIG. 42

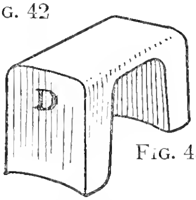


FIG. 43

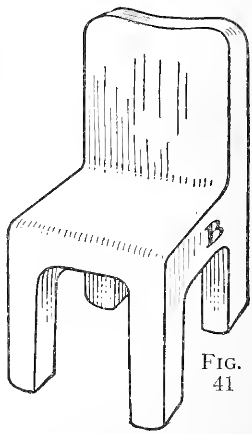


FIG. 41

FIGS. 37-43. — The Seven-Piece Set of Doll Furniture Completed

FIG. 44. — The Monkey-in-the-Swing Cut-Out

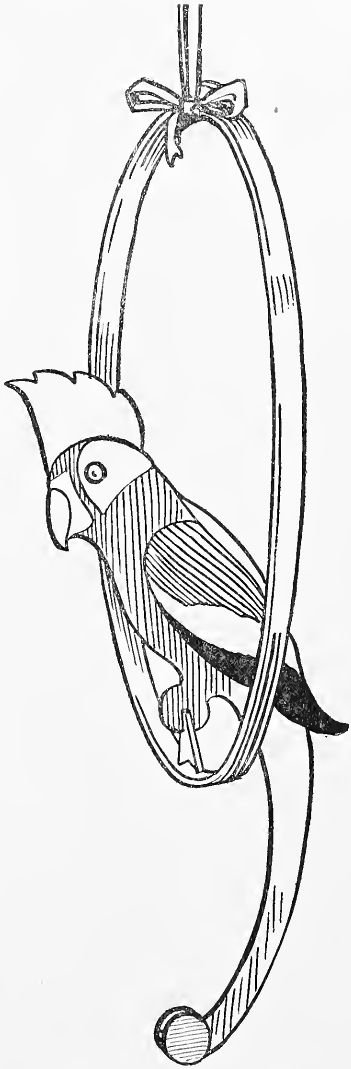


FIG. 45. — The Parrot-in-the-Swing Cut-Out

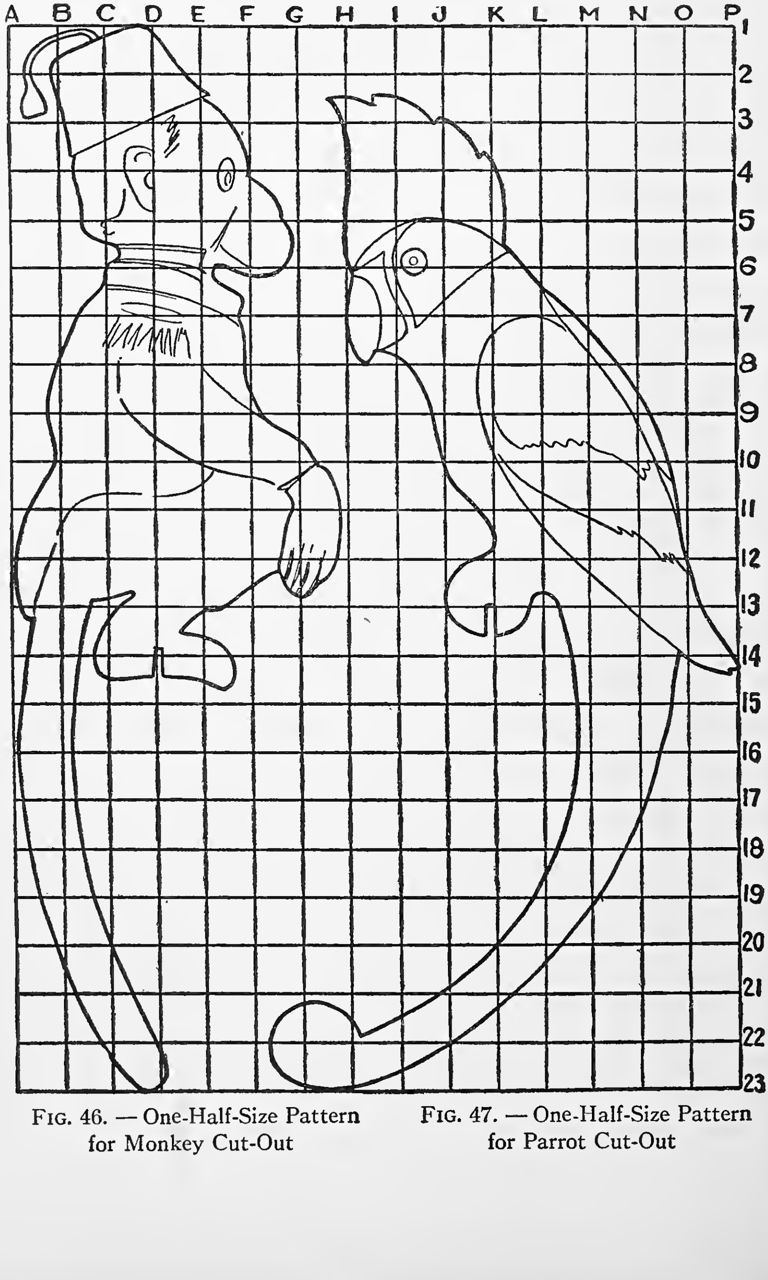


FIG. 46. — One-Half-Size Pattern for Monkey Cut-Out

FIG. 47. — One-Half-Size Pattern for Parrot Cut-Out

47. There will be exactly the same number of squares, but they will be twice the size of those in the diagram. Letter the vertical lines across the top edge, and number the horizontal lines along one side, as shown. With the sheet thus prepared, it will only be necessary to locate within

FIG. 48 FIG. 49

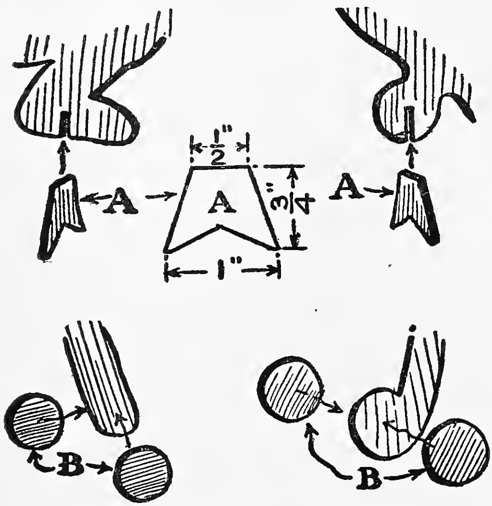


FIG. 51 FIG. 52

FIGS. 48 and 49. — How the Monkey's Feet and the Parrot's Claws are Supported in the Swing
FIG. 50. — Pattern for Balancing Points
FIGS. 51 and 52. — How the Tails are Weighted

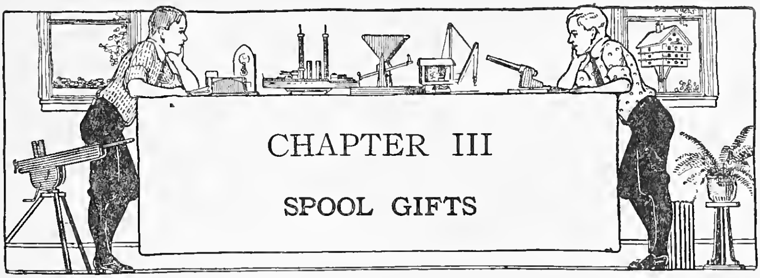
the squares what is indicated within corresponding squares on the diagram.

When the large patterns have been drawn, cut them out, and trace them off upon the wood they are to be cut out of.

In sawing out the pieces, care must be taken not to split off small projections. After cutting, sandpaper the edges.

Buy 12-inch oval embroidery-hoops for swings, and use ribbon to suspend them by. The monkey's feet do not stand upon the hoop. The balancing block *A* (Figs. 48 and 50) is inserted in a notch cut in the feet, and the points of this piece of wood rest upon the hoop. To make the monkey balance upon the perch, the tail must be weighted, and the best way of weighting it is by gluing a No. 3 skirt-weight to each side (*B*, Fig. 51). The parrot's claws grasp a balancing block (*A*, Fig. 49), which rests upon the hoop, and the tail is weighted like the monkey's (Fig. 52).

Paint the monkey and parrot in bright colors, also the hoops. *Enamel* paint in colors, prepared for this sort of painting, can be purchased at paint stores, and this is preferable to *flat* paint.



CHAPTER III

SPOOL GIFTS

Every boy has right at hand the materials necessary for making splendid Christmas gifts, in the empty spools from mother's work-basket, boards from grocery boxes, nails, and one or two other things that are to be found in every household.

A handful of spools of assorted shapes and sizes will suggest a hundred possibilities for suitable gifts for each friend and relative whom you wish to remember. The illustrations in this chapter show a variety of useful articles, in the making of each of which one or more spools were used, and, once you start work upon duplicating these, you will discover quite as many more ideas for simple gifts.

The Candle-stick in Fig. 53 is made by mounting a small silk-thread spool upon the end of a large ribbon spool, then mounting the ribbon spool upon a small square block. The base block may be cut from a box board. Make it about 1 inch wider each way than the diameter of the spool end, and nail it to the end of the spool as indicated in Fig. 59, with an equal projection all around the spool. Fasten the small spool to the end of the large spool with a short piece of pencil, or a round peg whittled to the same size. Coat this piece of pencil or peg with glue, than push it through the hole in the small spool and down into the hole in the large spool, allowing about ½ inch of its end to project above the top of the short spool. A hole just large enough for this peg to fit snugly in must be cut in the end of the candle (Fig. 59). Heat the top of the pencil before pressing the candle upon it, to make the candle stick.

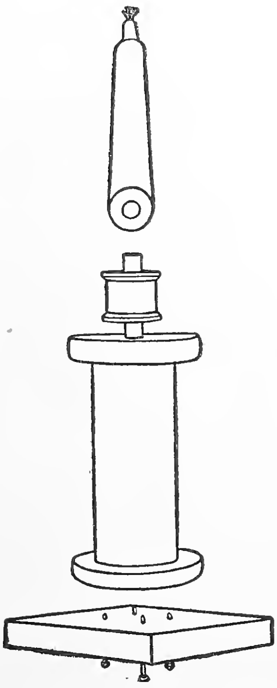


Fig. 59. — How the Candle-Stick is Put Together

Finishing. A brown stain produces a pretty finish for articles made of spools. A small quantity can be purchased from a paint dealer for ten or fifteen cents. Follow the directions that accompany it. An application of nothing but boiled linseed oil also makes a pretty finish.

After staining the candle-stick, glue a piece of felt to the under side of the base to prevent its scratching surfaces that it is placed upon.

The Desk Calendar shown in Fig. 54 requires a small calendar-pad, a block upon which to mount the

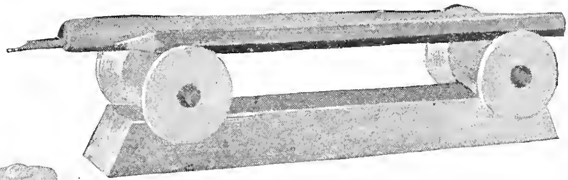


Fig. 56.—A Pen-Rack

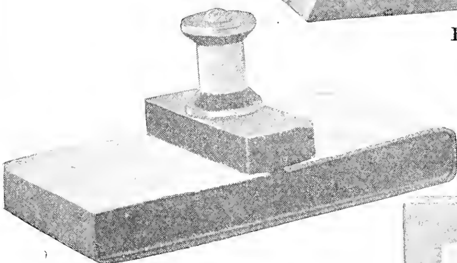


Fig. 57.—A Desk Blotter

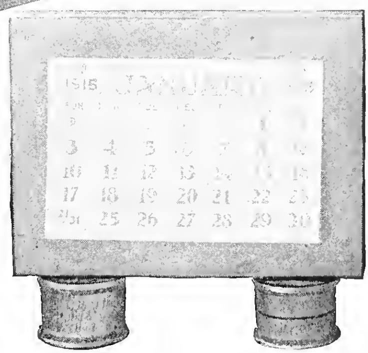


Fig. 54.—A Desk Calendar

Fig. 58.
A Paper-Knife

Fig. 53.—A Candle-Stick

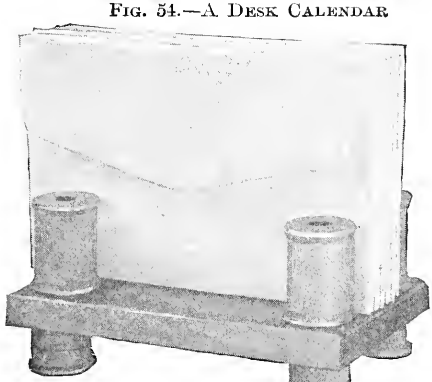


Fig. 55.—A Stationery-Rack

pad, and two short silk-thread spools for feet. A calendar-pad 2 inches wide and 3 inches long will cost five cents.

Cut the back block out of a box-board, enough larger than the pad to make a ½-inch margin all around it. Nail spool feet to the lower edge of the back (Fig. 60), and fasten the calendar in place with small tacks.

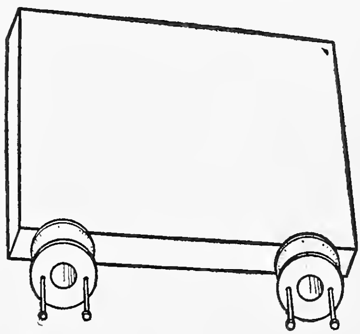


Fig. 60. — How the Spool Feet are Attached to the Calendar Board

The Stationery-rack (Fig. 55) is built up of four cotton-thread spools of equal size, four short silk-thread spools of equal size, and a piece of a box board 3 inches wide by 5 inches long. First, nail the piece of board to the ends of the four long spools, then nail the four short spools to the other side of the board, directly under the long spools, for feet. Bits of felt may be glued to the under side of the feet, to prevent them from scratching.

The Pen-rack shown in Fig. 56 is made of a strip of wood 6 inches long, ¾ inch wide, and ¾ inch thick (Fig. 61), with a medium-sized spool mounted upon each end. Cut the strip slanted on the ends, and nail to the sides of the spools in the manner shown in Fig. 61.

Only one spool is used for

The Desk Blotter (Fig. 57), that one forming the handle (*A*, Fig. 62). The base block (*B*, Fig. 62) is a piece of a box-board 2½ inches by 5 inches in size, and the block *C* is 2½ inches long and 1 inch wide. Get a screw long enough to extend through

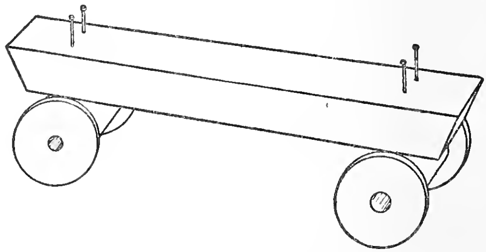


FIG. 61. — Nail the Base of the Pen-Rack to the Sides of the Spools, like this

handle *A*, through block *C*, and part way into base block *B* (a screw with a round head will look neatest,) and screw the three pieces together. If the screw-head is smaller than the hole in the spool handle, support it by a small metal washer slipped over the screw.

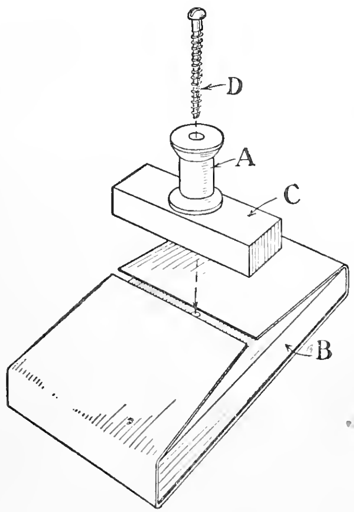


FIG. 62.—Block C holds the Blotter of the Blotter-Pad in Place

Figure 62 shows how the blotter is cut to fit the bottom of the base block, and folded up over the end to the center of the top.

The ends are held to the base by block *C*. To release the ends for changing the blotter, it is only necessary to give block *C* a half turn, so that it extends lengthwise of the base block. Pad the blotter with an extra piece of blotting-paper slipped between it and base block *B*.

One end of the spool used for the handle of

The Paper-knife (Fig. 58) must be whittled down until even with the sides. Cut the knife blade from a stick, and make it about 7 inches long and ½ inch wide, with its edges whittled thin and sharp. Cut the handle end to fit the hole in the spool handle, and fasten it in this hole with glue.

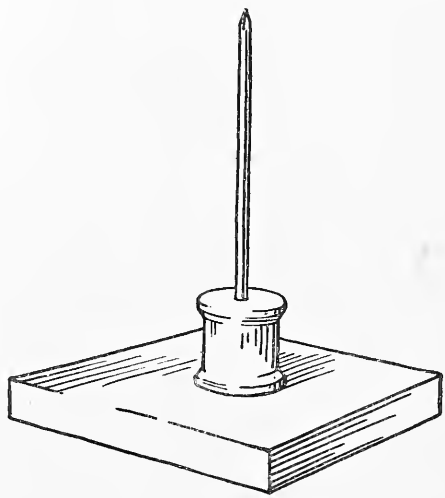


FIG. 63. — A Paper-Spindle

The Paper-spindle (Fig. 63) is of a convenient size for a desk. A 4-inch wire nail, a short silk-thread spool, a base block 2 inches square, and a piece of felt for the under side of the base, are the materials you need to make it. Enlarge the opening in one end of the spool so the head of the nail will fit down into it. Then drop the nail through the hole, nail the base to the under side of the spool, and glue the felt to the base.

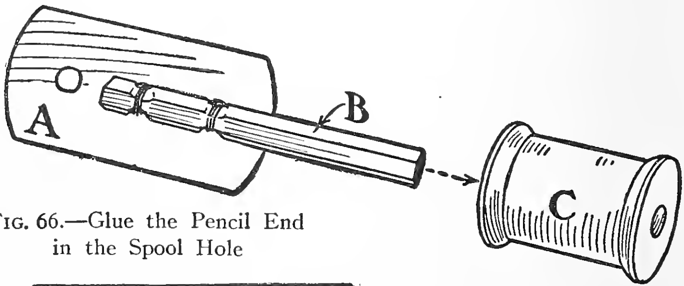


FIG. 66.—Glue the Pencil End in the Spool Hole

FIG. 67. — Bind the Razor-Blade Between the Pencil Halves

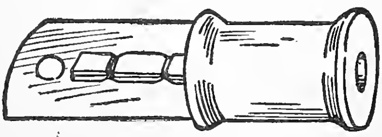


FIG. 65 — The Ripper

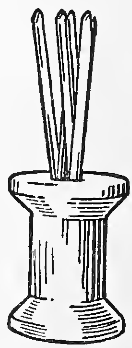


FIG. 64 — A Toothpick Holder

The Toothpick Holder (Fig. 64) is large enough for eight or nine toothpicks. After staining the spool, glue felt or cardboard to one end to form a bottom to the holder.

Every woman needs

A Ripper for the sewing cabinet, and Fig. 65 shows one that is easily made. One of father's safety-razor blades, a short piece of pencil, and a spool (*A*, *B*, and *C*, Fig. 66) are required to make it.

Split the pencil into halves, remove the lead, and notch the edges in two places near one end, spacing the notches the same distance apart that the holes in the razor blade are spaced (Fig. 67). Slip the blade between the pencil halves, and bind in place with strong linen thread passed through the holes and around the notches in the pencil. Then glue the free end of the pencil into the hole in the spool handle, and the little knife will be ready for use. The end hole in the blade may be used as a means of hanging the knife on a nail in a sewing cabinet.

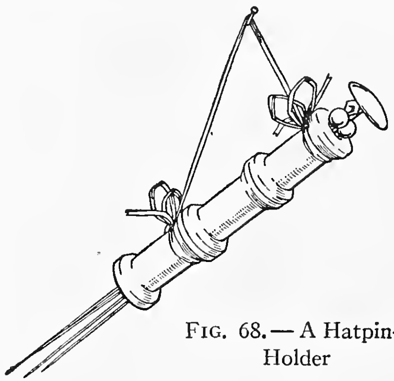


Fig. 68. — A Hatpin-Holder

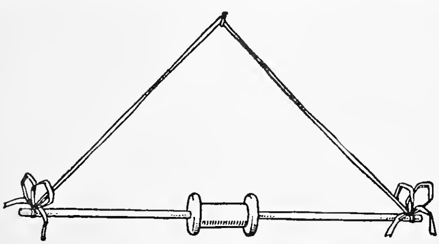
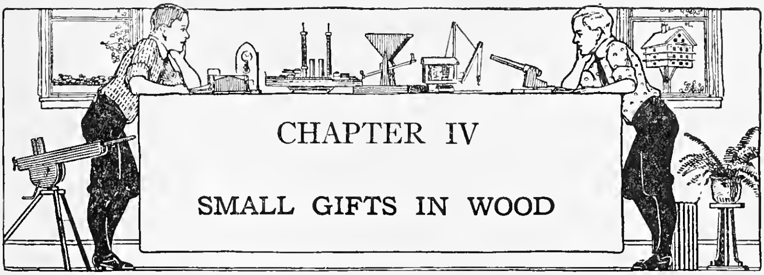


Fig. 69. — A Necktie-Rack

The Hatpin-Holder illustrated in Fig. 68 is made of three spools of equal size, fastened end to end with brads. Tie a loop of narrow baby ribbon to the top spool, in the manner shown, to provide for hanging the holder upon the wall.

The Necktie-rack (Fig. 69) is made of a ribbon spool slipped over a stick 16 inches long, with a piece of ribbon tied to each end of the stick. The stick will be held far enough away from the wall by the spool flanges, so that neckties can be slipped over it easily.



CHAPTER IV

SMALL GIFTS IN WOOD

It is well to select small articles for Christmas gifts, if you are going to make a lot of them. Make articles that will require little time and material. Then the work will not become tiresome nor be expensive. The articles illustrated in this chapter have been selected with these points in view.

Much of the

Material to be found in a carpenter's waste pile is good stuff, too small perhaps for him to bother with, but large enough for your purpose. Go to the nearest carpenter shop and see what you can get. A friendly sort of carpenter will give you his wood scraps, and sell you such larger pieces as you may need. White pine, whitewood, basswood, cypress and oak are easy to work. Most of the articles illustrated on the following pages were made of oak.

A Stain and Wax Finish is prettiest for small articles. Stains in a variety of colors can be purchased in small quantities at the paint store, and prepared wax can be obtained there, also. Complete instructions for applying wood stains accompany them.

Before finishing the wood, all surfaces must be free from saw, chisel and other tool marks, and they must be carefully

of the upright piece of the calendar-board can either be cut with a chisel or be filed round. The bevel on the top edge of the base block can be made with a plane or chisel. Center the upright piece on the base block, and fasten with brads driven through the base block.

The *calendar-pad* should be 2 inches wide and 3½ inches long, a standard size that can be purchased at two for five cents at stationery stores. The brass *screw-hooks* which screw into the front edge of the base block, to form the pen-rack, should be ¾ inch long. The wood should be stained and waxed before the pad and the hooks are attached. A strip of light-weight felt, broadcloth, or other

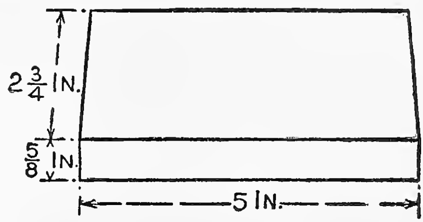


FIG. 78. — Base of Post-Card Rack

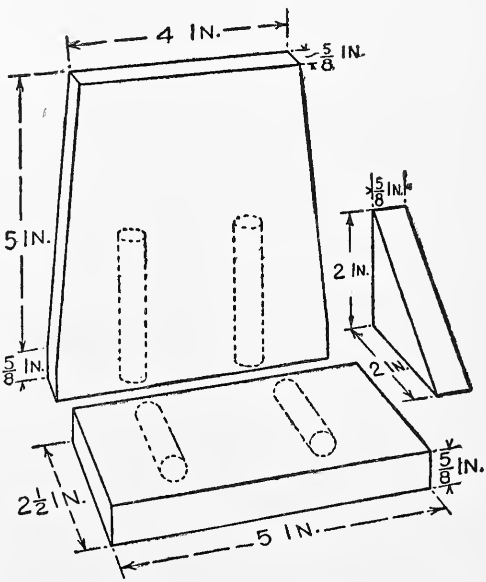


FIG. 79. — Parts of the Book-Ends Shown in Fig. 72

heavy cloth, glued to the bottom of the base, to prevent the base from scratching surfaces it is stood upon, will complete the gift.

The Post-Card Rack, shown in Fig. 71, has a pair of ends of the same shape and size as the upright of the calendar-board (Fig. 76), but its base is shorter and wider than the calendar-board base. The base is shown in Fig. 78. It is fastened between the end pieces.

The Book-Ends shown in Fig. 72 make an excellent rack for a few books to stand on the library table or the top of a desk. There is not much cutting to be done. Figure 79 shows dimensions for the base, upright and bracket pieces that make up an *end*. The dotted lines shown on the base and upright pieces in the diagram, represent holes. These should be bored as indicated, and filled with melted lead, before the pieces are assembled. The purpose of the lead is to make the book-ends heavy enough so the pressure of the books between them will not upset them. Nail the upright piece to the edge of the base piece, and the triangular bracket pieces to both the base and the upright. Use 1-inch nails for nailing. Before nailing, coat the edges of the pieces with glue.

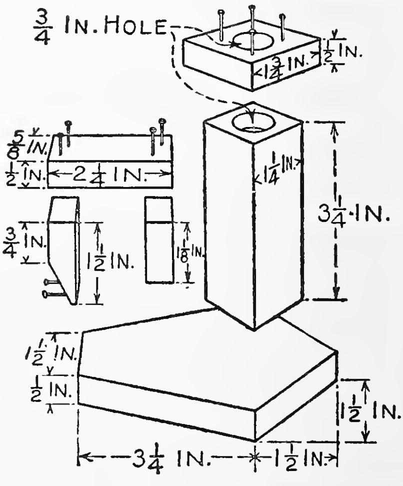


Fig. 80. — Parts of the Candle-Stick Shown in Fig. 73

The Candle-Stick shown in Fig. 73 is made up of six blocks of wood of the shapes and sizes shown in Fig. 80. The hole for the candle should be bored through the cap block and part way in the top of the upright block, before the pieces are cut down to the finished dimensions, so there will be little danger of splitting the wood.

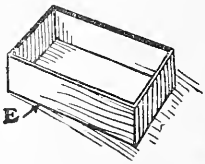
Use glue and ¾-inch and 1-inch brads for assembling the pieces. Nail the base block to the under side of the upright block, and the cap block to the top; then nail the three handle pieces together and fasten them to the base block.

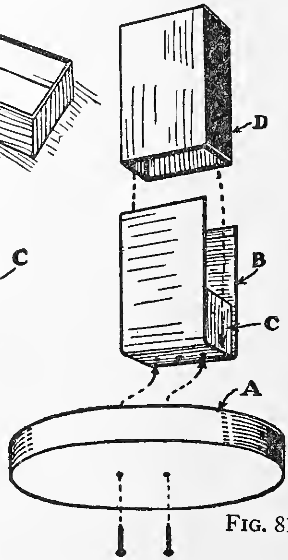
The tray of

The Match-Holder and Tray shown in Fig. 74 is a tin can cover 4 inches in diameter. The author is wandering from his chapter subject "Small Gifts in Wood," in presenting this here, because it is made of tin, but he believes that the nature of the article warrants his including it among the small gifts. A coffee-can cover is of about the right size for the tray (*A*, Fig. 81). The match-holder consists of a U-shaped piece of tin (*B*, Fig. 82), a wooden block (*C*), and the sleeve cover of a safety-match box (*D*). The sleeve cover of the match-box slips between the uprights of tin strip *B*, fitting down over block *C*. Then the safety-matches removed from the box are dropped into the open top of the sleeve, as shown in Fig. 74.

Figure 82 shows the pattern for tin strip *B*. With an old pair of scissors, or tin-snips, cut off the ends of a tin can, then cut through the can sides, cutting parallel with the side seam, and bend out the tin into a flat strip. Upon the strip mark out a piece of the dimensions given in Fig. 82. The dotted lines of the diagram indicate where the tin is to be folded. The ends are to be turned over upon themselves and hammered down to make stiff upper edges, the folds at the center are to be right-angle folds. In making the center folds, bend the tin over a box edge or other sharp edge. Be careful to make the distance between the center folds exactly ⅞ inch, as shown.

Figure 83 shows the dimensions of block *C*. This block is of just the right size for the match-box sleeve-cover to slip over. Fasten it to tin strip *B* with tacks, placing it halfway between the tin uprights. After fastening strip *B* to block *C*, place the holder on the center of the tray *A* and fasten with two short nails, as shown.





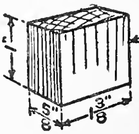


FIG. 83

FIG.82

FIG. 81

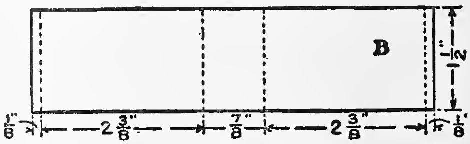


FIG. 81. — Parts of the Match-Holder and Tray Shown in Fig. 74

FIG. 82. — Pattern for U-Shaped Support

FIG. 83. — Pattern for Base Block

To complete the match-holder and tray, give it a coat of radiator bronze or aluminum paint.

The Egg-Rack shown in Fig. 75 will go in mother's refrigerator, or will stand upon her pantry shelf. Figure 84 shows a side view of the rack, Fig. 85 shows a plan of the shelf *B* which supports the eggs, and Fig. 86 shows one of the end pieces *A*.

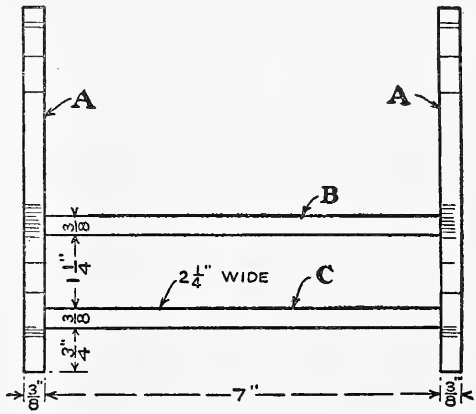


FIG. 84. — Side View of Egg-Rack Shown in Fig. 75

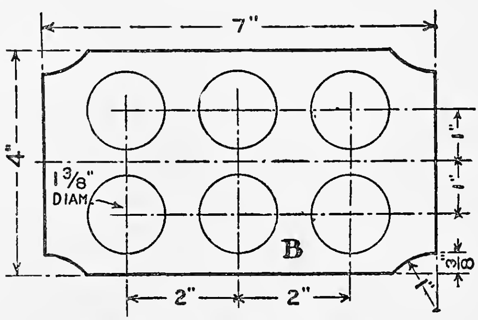


FIG. 85. — Diagram of Shelf

Prepare end *A* first. To save you trouble in marking out the ends, a pattern of the hen is shown in Fig. 86, one-half full-size. It will only be necessary to reproduce this twice the size shown. The squares drawn checker-board fashion upon the pattern will make enlarging easy. Rule off upon your working material a similar series of squares, but make them ½ inch square instead of ¼ inch. Letter the top ends of the vertical lines, and number one end of each horizontal line, as shown. Then, upon the enlarged squares reproduce the lines exactly as they are shown upon the small squares. The letters and numbers will help you locate quickly the large squares that correspond to the small squares. Cutting out these pieces makes a good scroll-saw exercise. If you haven't a scroll-saw, a hand bracket-saw (Fig. 18) or coping-saw (Fig. 19) will do the work nicely. Basswood is good material to use for these pieces, but you can use any other firm piece of wood that will hold together without splitting or chipping.

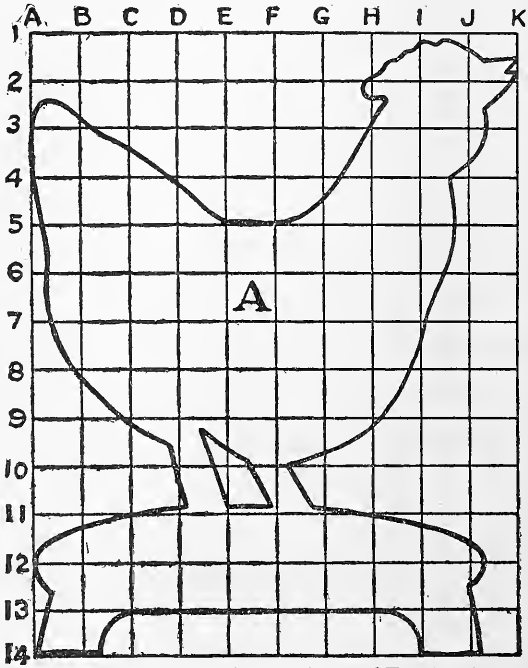


Fig. 86.—Pattern of End-Pieces of Egg-Rack Shown in Fig. 75

Figure 85 shows a diagram of the upper shelf of the rack. If you haven't a bit large enough for boring holes of the required size, bore a ring of holes with a small bit, split out the wood between the holes with a chisel, and trim up to

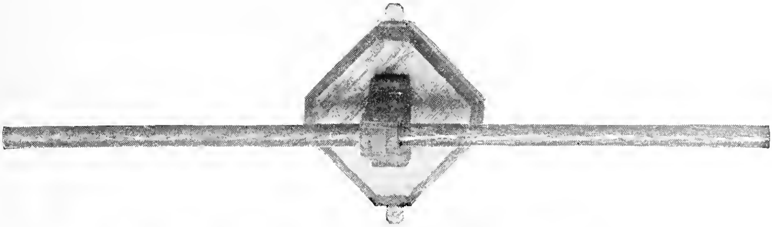


Fig. 88.—Necktie-Rack.

Fig. 87.—Telephone-Directory.

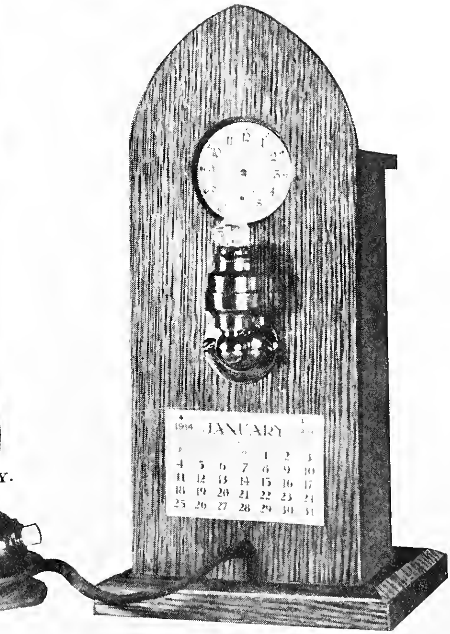


Fig. 90.—Electric-Lighted Watch Base.

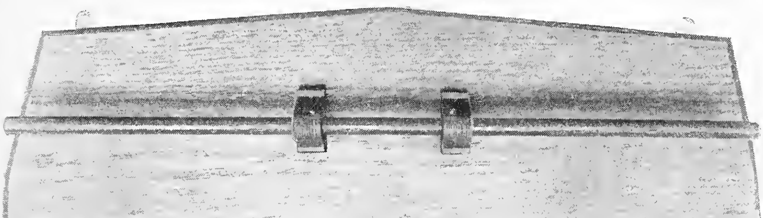


Fig 89.—Necktie- or Towel-Rack.

the circumference of the large hole with a chisel or jack-knife; then smooth up the hole with a *rat-tail file* and sandpaper. The lower shelf or brace (*C*, Fig. 84) need not be more than 2¼ inches wide.

Fasten together the pieces with glue and finishing-nails. en sandpaper all surfaces carefully, and give the rack a uple of coats of shellac.

Figure 87 shows **A Desk Tele-one Directory** at is handy for ping in readi- for instant ence, in al-betical order, names and tel-ione numbers persons called e or less fre-ently, and num-s subject to call mergencies.

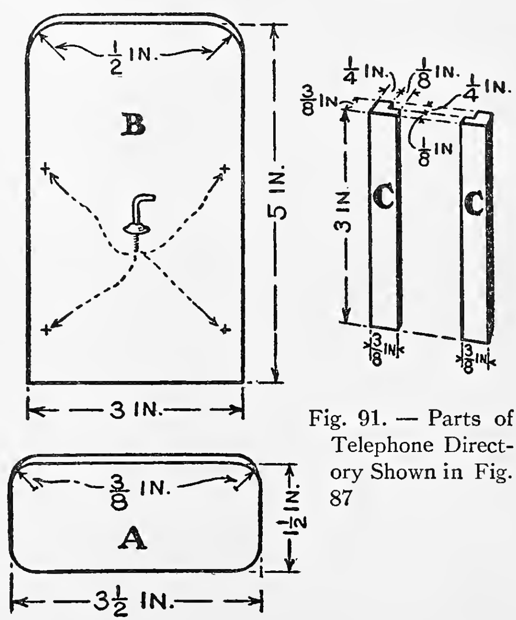


Fig. 91. — Parts of Telephone Directory Shown in Fig. 87

Figure 91 shows ase *A* of the card-ack, upright *B*, nd the groove strips *C* which form the card pocket. Pieces *A* and *B* can be cut out of material ¼-inch thick. Cut the rabbets in the edges of strips *C* with a chisel. Fasten upright *B* to the center of base *A* with glue and brads, and fasten strips *C* to upright *B* so the lower ends rest on base *A*, and so the groove rabbets are 2⅜ inches apart, which will allow plenty of clearance space for the directory cards.

Figure 92 is a diagram of the twenty-four directory cards. It shows the size of each card, and how to cut the index tabs. If you cannot get light-weight cards for the directory, cut up stiff writing-paper as a substitute. The twenty-four cards must be enough less than ⅛ inch thick so they will slip in and out of the rack easily.

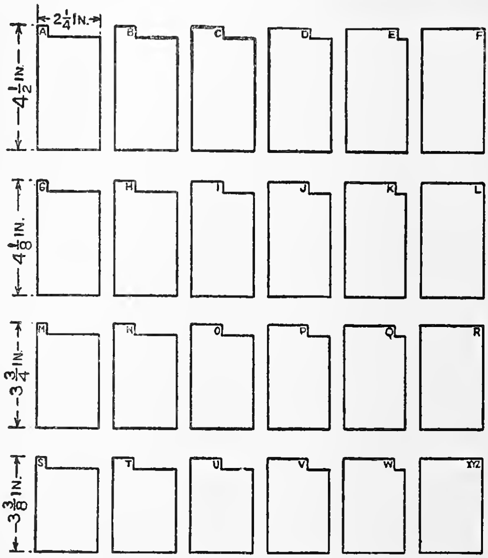


Fig. 92. — Cards for Telephone Directory Shown in Fig. 87

This same form of rack can be used for

A Time-Card Rack, to hold suburban time-cards for handy reference. Instead of preparing strips for the card pocket, you can screw four brass screw-hooks into upright *B* at the points indicated in Fig. 91. The hooks will hold the edges of one or two time-cards as satisfactorily as the strips would.

A Wall Telephone Directory, or a wall *time-card rack,* can be made by reducing base *A* to a width of 1 inch, and fastening a *hanger* at the top of upright *B* and another at the bottom, for fastening to the wall.

The Necktie-Rack shown in Fig. 88 is an improvement upon the usual form of rack, because there is only one center support for the tie-rod, which leaves the ends open, and makes it easy to slip ties on and off the rack.

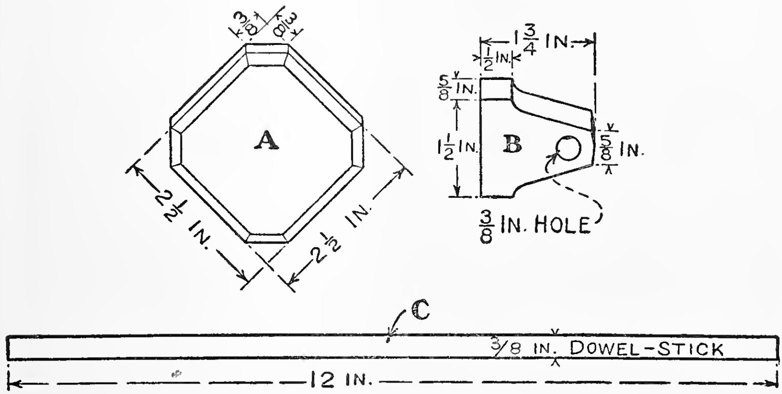


FIG. 93. — Parts of Necktie-Rack Shown in Fig. 88

Figure 93 shows diagrams of back block *A*, bracket block *B*, and tie-rod *C*. A carpenter's dowel-stick is required for rod *C*. The bevelled edge of back block *A* can be cut either with a plane or a chisel. Fasten the rod in the bracket hole with glue, being careful to center it exactly, and fasten a hanger to the top of back block *A* and another to the bottom. Small screw-eyes will do for hangers. Regular picture-frame hangers can be bought at the hardware store.

The Necktie- or Towel-Rack shown in Fig. 89 has a 16-inch tie-rod, and this is supported by a pair of brackets, each made like bracket *B* (Fig. 93). The back board is shown in Fig. 94, and the centers for the bracket blocks indicated on it.

An Electric-Lighted Watch Base like the one shown in Fig. 90 makes an attractive little clock for chiffonier or dresser. It was designed to hold a watch from bed-time till get-up-time. A small electric-lamp, operated by a dry-battery, and controlled from the bed by a push-botton

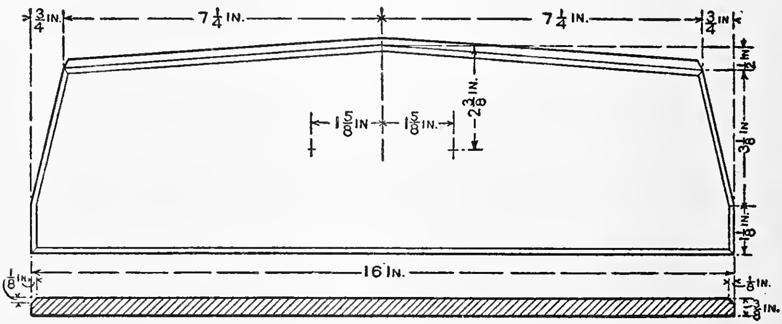


FIG. 94. — Back for Necktie or Towel-Rack Shown in Fig. 89

illuminates the watch-face. With the addition of a calendar mounted beneath the electric-lamp socket, this little sentinel stands in constant readiness to give information as to the time of the day, and the day of the week and the month.

Working-drawings of the parts of the battery-case are shown in Figs. 95 and 96, and Fig. 97 shows how the parts are assembled. Front piece *A* (Fig. 95) is *grooved* near the side edges to receive the edges of side pieces *B*. If you haven't an *expansive-bit* with which to cut the watch-face opening, bore several small holes, split out the wood between

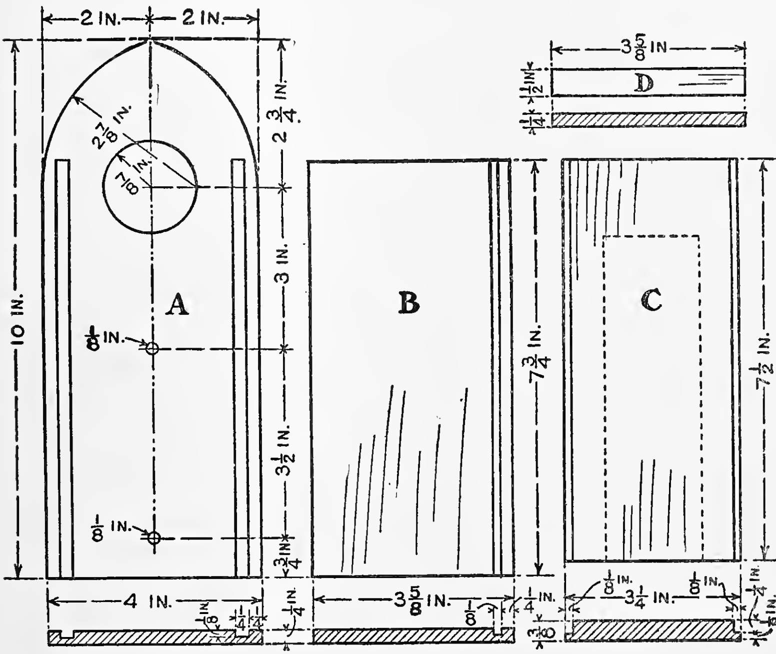


FIG. 95. — Front A, Sides B, and Back C, D of Electric-Lighted Watch Base Shown in Fig. 90

the holes, and trim up to the circumference of the 1¾-inch opening with a chisel. Side pieces *B* are *grooved* near the rear edge to receive the sliding-back *C*. The edges of sliding-back *C* are *rabbeted* as shown in the cross-section of

Fig. 95, to slide in the grooves in sides *B*. Strip *D*, nailed to the top of sliding-back *C* (Fig. 97), forms a lift for raising the sliding-back. Strip *D* and piece *E* form the top to the case. Dimensions for top piece *E* are given in Fig. 96, as are also dimensions for base block *F*. Base *F* is grooved to receive the lower ends of front *A* and sides *B*. The

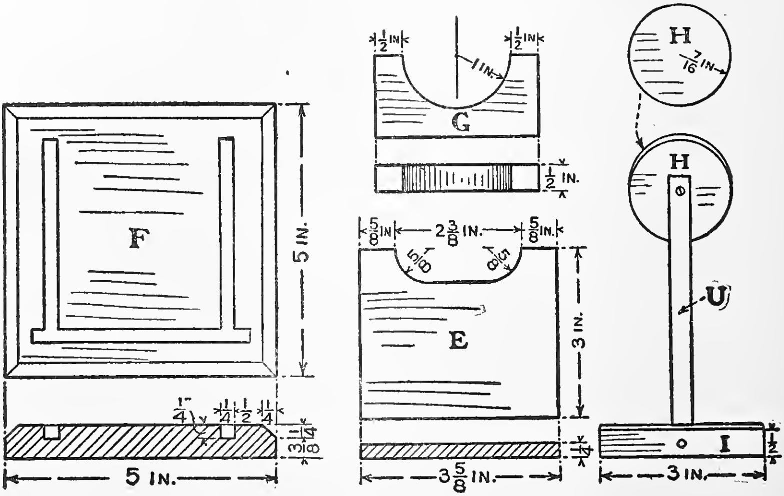


Fig. 96. — Top E, Base F, Watch Support G, and Spring Attachment H, I, U, of Electric-Lighted Watch Base Shown in Fig. 90

cross-section drawing in Fig. 96 shows the size of the grooves. Cut all grooves with a small chisel.

Block *G* (Figs. 96 and 97) forms the bottom of the watch pocket. Fasten it below the opening in the watch front, as shown in Fig. 97. The back of the watch-pocket is a circular piece of wood (*H*, Fig. 96). In order to keep the

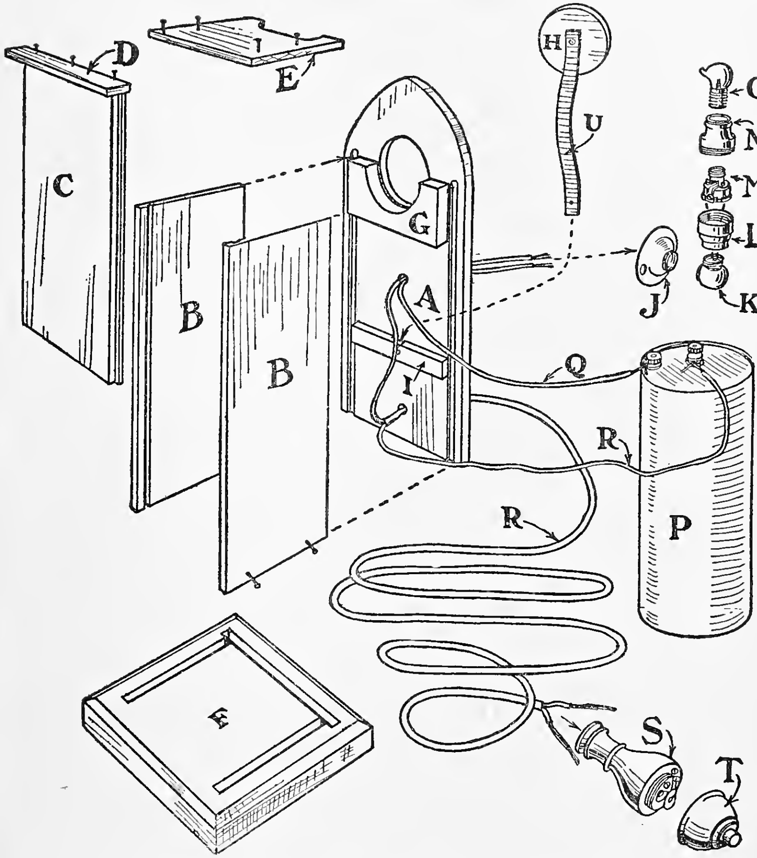


FIG. 97. — Detail Showing How Watch Base is Assembled; also Battery, Lamp, Push-Button, Cord, and Connections of Same

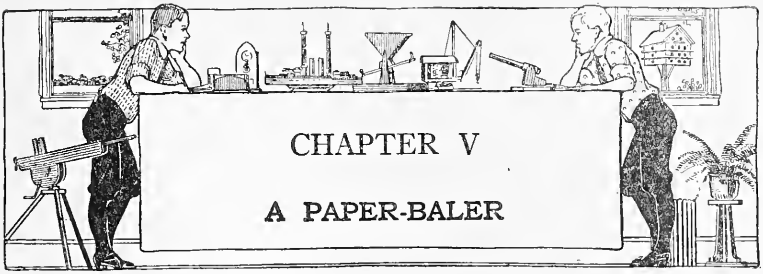
watch close to the front of the case, there must be a spring back of it. Use a piece of the main-spring of an old alarm-clock (*U*, Figs. 96 and 97). Fasten one end of the spring to the back of block *H*, the other end to a strip *I*. Fasten strip *I* to the inside of front piece *A* (Fig. 97), at the right height to bring disk *H* directly back of the watch opening.

Having grooved and rabbeted the parts as shown, it is not much of a trick to assemble the battery-case. Glue alone will suffice to hold grooved joints, but a brad or two in addition will not go amiss. Drive in the brads carefully, and drive their heads slightly beneath the surface of the wood so they can be concealed later with putty.

After you have completed the case, it is well to put the finish on the wood before installing the lamp, battery, etc. When the finish has been applied, glue a piece of light-weight felt, or heavy cloth, to the under side of the base, as a protection to surfaces on which the watch-base will stand.

The Electric-Light Attachment requires a *miniature brass wall-plate* (*J*, Fig. 97), *a brass right-angle nipple* (*K*), *a miniature lamp-socket* (*L*, *M*, *N*), *a 1½-volt mazda lamp* (*O*), *a dry-battery cell* (*P*), 3 *yards of flexible silk-covered double-conductor lamp-cord* (*Q and R*), and a *pear-shaped push-button* (*S*, *T*). The manner in which the connections are made is shown in Fig. 97. Two small holes must be bored through the front of the battery-case, as shown, the upper hole for the wires connected with the lamp to run through, the lower hole for the wires leading from lamp and battery to push-button, to run through.

If your battery dry-cell fits too snugly in its case, hollow out the inside face of the sliding-back *C* a trifle, as indicated by dotted lines in Fig. 95.



CHAPTER V

A PAPER-BALER

THE ease with which waste-paper can be baled with a home-made paper-baler like that described in this chapter, recommends its use in every home. The baler compresses paper into compact bales that require little storage space; therefore, a large enough number of bales can be accumulated, before calling in the junk-dealer, to make a sale that

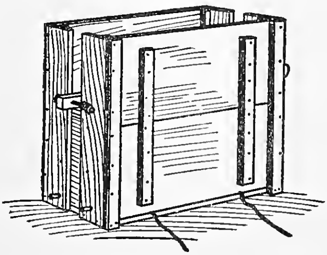


FIG. 98.— The Paper-Baler after Binding-Cords have been Adjusted, Waste Paper Thrown in, the Compressor Board Put in Place, and the Compressor-Lever Thrown over, Pushed Down and Locked

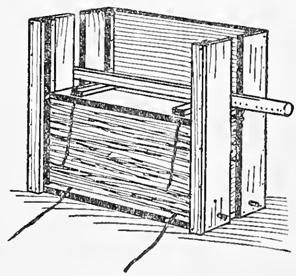


FIG. 99.—The Paper-Baler with Front Removed. The Bale is now Ready for Tying

will be worth while. The possession of a baler will encourage the conservation of waste-paper, will lessen the temptation to destroy it.

After you have built a paper-baler for home use, see if your neighbors would not like to have you make one for them.

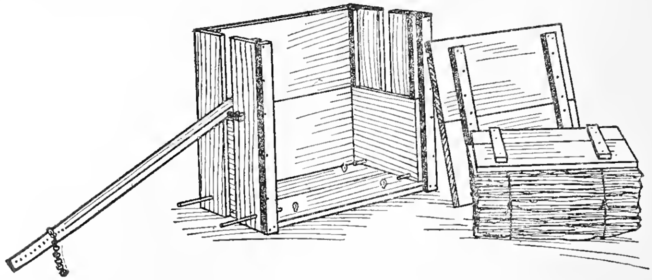


Fig. 100. — The Paper-Baler with Lever Raised and the Bound Bale Removed

Figure 98 shows the baler after the binding cords have been adjusted, waste-paper has been thrown into the receptable, the compressor board placed on top, and the compressor lever thrown over, pushed down and fastened. Figure 99 shows the baler with its front removed. The binding-cord should now be tied. Figure 100 shows the lever raised and the bound bale removed.

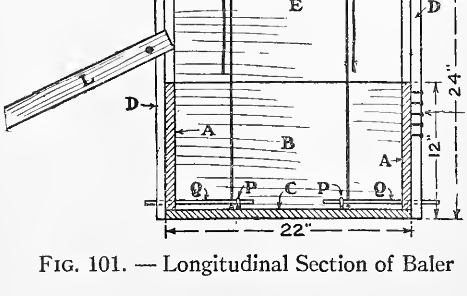


Fig. 101. — Longitudinal Section of Baler

Figure 101 is a *longitudinal section* through the baler, and Fig. 102 is a *cross-section*. Figure 103 shows the parts unassembled, with their relative positions indicated. You will find the dimensions upon Figs. 101 and 102.

Perhaps you can get a box of the right size for

The Base of the Baler, the parts of which are lettered *A*, *B*, and *C* in Fig. 103. This must be of the right size to hold newspapers folded in half. The bottom must project 1 inch beyond end pieces *A*, as shown. When these parts have been assembled, cut the four end strips *D*, and nail two to each of the end pieces *A*, placing the rear strips even with the back edge of board *B*, and the front strips with their front edge projecting 1 inch beyond end pieces *A*. Cut board *E* (Fig. 103) to fit between the rear pair of strips *D*. Cut the four strips *F*, 1 inch square, by a length equal to the width of board *E*, and fasten one in each of the corners formed by board *E* and strips *D*,

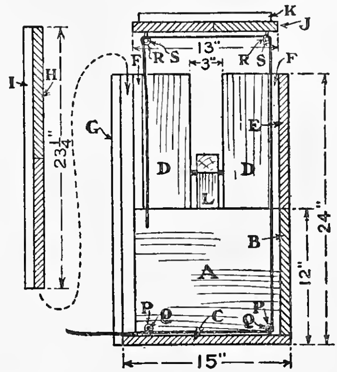


FIG. 102. — Cross-Section of Baler

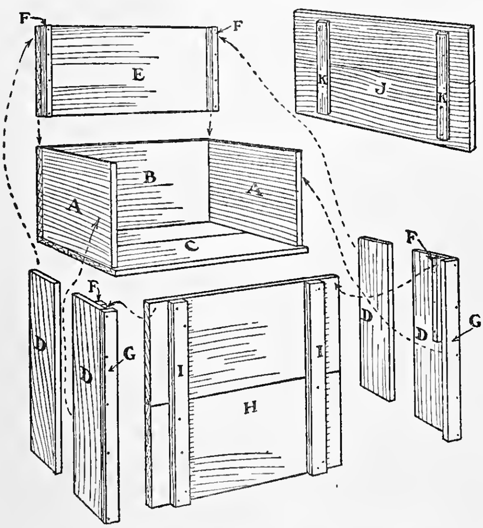


FIG. 103. — How the Parts are Assembled

and one to each of the front pair of strips *D* flush with the front edge of end pieces *A*. The latter pair of strips complete the inner face of the slide for sliding-front *H*; the slide is completed by strips *G*, nailed to the front edge of strips *D*. Make sliding-front *H* to fit loosely in the slides.

The Compressor Top (*J*, Fig. 103) is made of the right size to fit loosely between strips *F*. Fasten the boards together with a pair of battens (*K*).

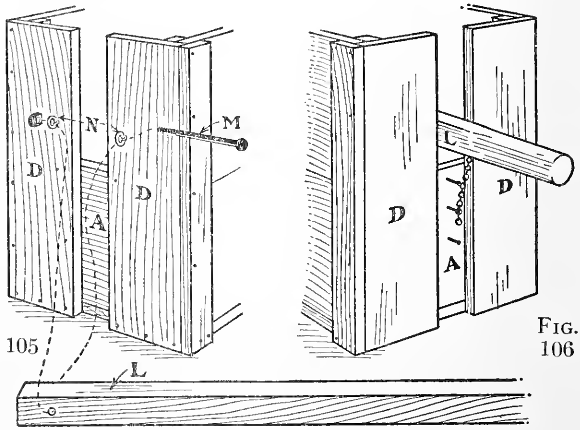


FIG. 105

FIG. 106

FIG. 104

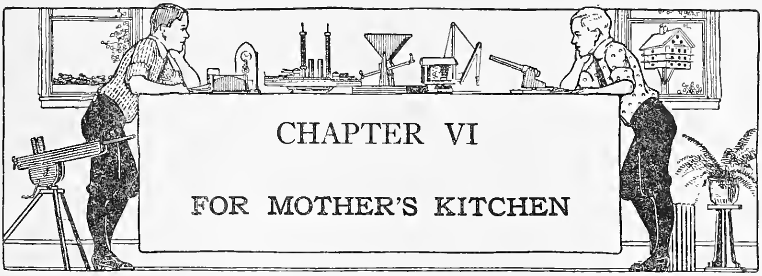
FIG. 104. — The Compressor Lever
FIG. 105.— How the Compressor Lever is Pivoted
FIG. 106.— How the Compressor Lever is Held Down

The Compressor Lever (*L*, Fig. 104) is a wooden bar 1¾ inches square and 3 feet long. Bore a ½-inch hole 2 inches from one end, and pivot the bar with a ½-inch carriage-bolt 6 inches long (*M*, Fig. 105), supported by a pair of screw-eyes (*N*) screwed into strips *D* 3 inches above the top edge of end pieces *A*. Round off the free end of the lever for a handle (Fig. 106), attach a short piece of chain to a screw-eye screwed into it, and drive several nails into the end of the baler box opposite to that on which the lever is pivoted, to hook the chain on to (Fig. 106). This holds the lever down when the paper has been compressed.

How the Paper-Baler is Operated. Cords for tying the bale of paper must be arranged inside of the baler before the paper is thrown in. These cords must be very strong so there will be no danger of their breaking. Pass the cords around rods *Q* in the bottom of the baler, and around rods *S* on the under side of the compressor top (Figs. 101 and 102). Rods *Q* slip through holes bored through the ends of the baler (Fig. 100), and the inner ends slip through screw-eyes *P* (Figs. 101 and 102); rods *S* are of the length of top *J*, and they slip through screw-eyes *R*.

After enough paper to make a bale has been compressed, and the compressor-lever has been fastened down, remove the sliding-front of the baler, and tie the binding cords, then withdraw rods *Q* (Fig. 101), remove the bale from the box, and withdraw rods *S*. The compressor top must be lifted out with the bale, because the rods *S* cannot be withdrawn until after the bale and top have been taken out.

Crushed paper, and torn bits of paper compress into a surprisingly small bulk. A dozen times, probably, you will put into the baler what you think is enough paper to make a bale, and even after the twelfth time find room for more. When small pieces of paper are being baled, a newspaper or other large piece of paper must be placed in the bottom of the baler, for the start of the bale, and another large piece must be placed on top, to hold in the small pieces. After a bale has been removed from the baler, tie a heavy cord around it endwise, to reinforce the other two bindings.



CHAPTER VI

FOR MOTHER'S KITCHEN

THE kitchen contrivances described upon following pages will be helpful to mother, and if they please her you will probably find that they will also please neighbors, and

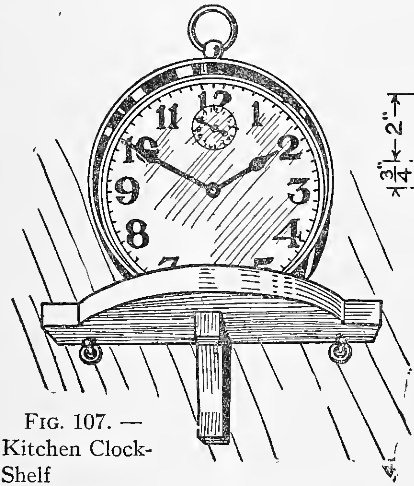


Fig. 107. — Kitchen Clock-Shelf

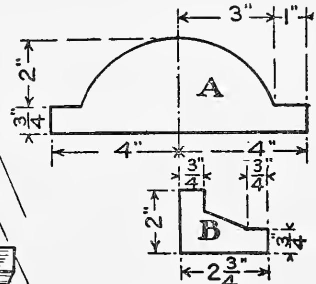


Fig. 108. — Diagram of Shelf and Bracket

right here open up possibilities for a profitable home manufacturing business. What you can make out of the work will depend largely upon how much ability you have as a salesman, but your craftsmanship will count for a great deal, because attractiveness in the appearance of articles goes a long ways towards helping sell them.

A Kitchen Clock-Shelf like that in Fig. 107 takes little time to make, and little material. It requires two pieces of wood (*A* and *B*, Fig. 108) 5/8 inch thick, by the other dimensions shown. Fasten bracket *B* to top *A* at the exact center of the length, with glue and finishing-nails.

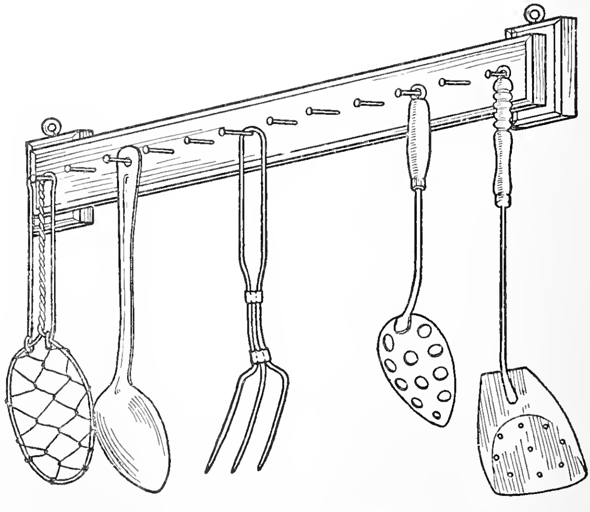


Fig. 109. — A Kitchen Tool-Rack

The Finish of the clock-shelf, and the following kitchen articles, is a matter to be decided by the person for whom they are made. The usual way is to shellac the surfaces, first, then apply one or two coats of varnish. But the wood can be painted with flat or enamel paint, or stained, or oiled. A stained surface should be protected with shellac and varnish, for kitchen wear.

The Tool-Rack in Fig. 109 is most convenient when hung directly over the kitchen work-table. The length of the *hook-strip* will be determined by the space in which the rack is to hang, and by the number of tools it is to accommodate. The rack's appearance will be improved by

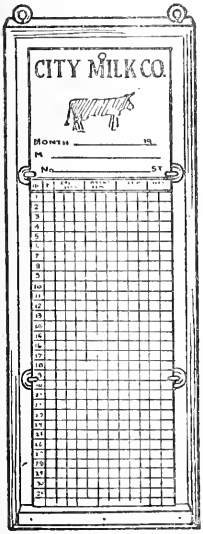


FIG. 110

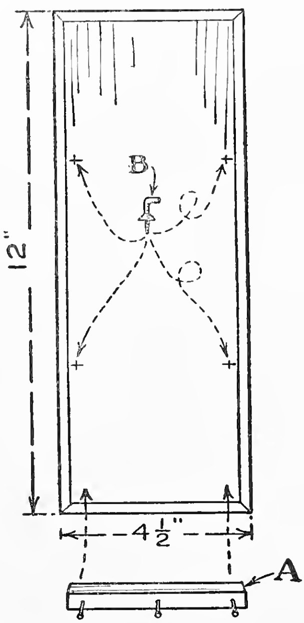


FIG. 111

FIG. 110. — A Milk-Card Rack
FIG. 111. — Detail of Rack

planing a bevel on the face edges of the hook-strip, also on the edges of the end blocks, as in the illustration.

Use round-head brass screws, screw-hooks, or nails for hooks, and screw a screw-eye into the top edge of each end block to hang the rack by.

The Milk-Card Rack shown in Fig. 110 is provided with screw-eyes to hang upon hooks outside of the kitchen door. Figure 111 is a pattern for the board, but because milk-cards vary in size, you had better measure the card for which the board is to be used, before you begin work. The margin around the card should be about as shown in Fig. 110, which allows for *beveling* the edge all around. Prepare strip *A* (Fig. 111), and fasten it with brads across the lower edge of board *B* for the milk-card to rest upon.

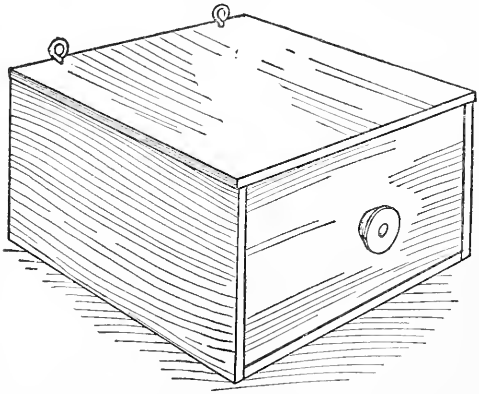


FIG. 112. — Recipe Cabinet

Screw four screw-hooks into the board at the points indicated in Fig. 111, just far enough apart for the milk-card to slip between, and screw a pair of screw-eyes into the top edge of the board for *hangers*.

There is no question but that

A Recipe Filing-Cabinet provides a handier method of keeping together recipe clippings taken from magazines and newspapers, than a scrapbook, and the envelope system used in the cabinet illustrated in Figs. 112 and 113 comes pretty close to being a perfect scheme. With an envelope provided for each group of recipes, there is no possibility of small clippings becoming lost, and when a recipe in one group is wanted, it is a simple matter to lift out the envelope bearing that classification.

The Cabinet can be made of cigar-box wood, the larger pieces, such as the top and bottom, of two strips glued together. As you can get cigar-boxes at any drug-store, for the asking, this material can be obtained easily. If you prefer to use oak, or a soft wood, and can procure thin stuff, 3/16-inch or 1/4-inch thick, well and good.

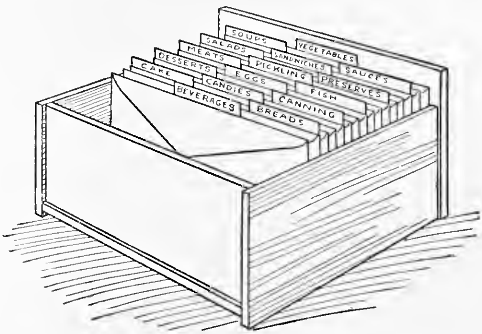


FIG. 113. — Drawer of Recipe Cabinet

Figure 114 shows a *cross-section* through the cabinet and drawer, and Figure 115 shows a *longitudinal section* through them. Upon these two drawings you will find every measurement necessary for marking out the pieces required.

The back (*A*, Fig. 115) is shown 1/2-inch thick. This will make a stronger cabinet than if cigar-box wood were used, and will provide a solid piece to screw the screw-eye hangers *J* into. Prepare back piece *A*, then sides *B*. Nail sides *B* to the ends of back *A*. Cut bottom *C* and fasten it between sides *B*, then cut top *D* and nail it to the tops of back *A* and sides *B*. To make a neat piece of cabinet work, it is necessary to cut the pieces with square corners and square edges; and to make them of the exact measurements given. It is also important to obtain square corners in assembling the pieces.

The Drawer front (*E*, Fig. 115) is the first part of the drawer to prepare, then the sides *F*, the bottom *G*, and the back *H*. Fasten the pieces together with glue and brads, but not until you know that the drawer is going to fit. You can tack the pieces together with a few brads, temporarily, until you are through fitting and trimming.

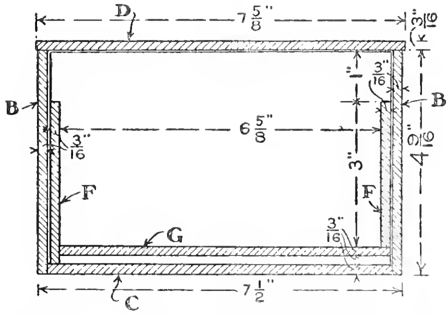


FIG. 114. — Cross-Section of Recipe Cabinet

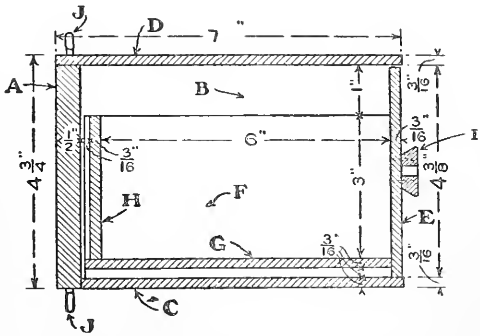


FIG. 115. — Longitudinal Section of Recipe Cabinet

The drawer-knob (*I*, Fig. 115) is a spool-end, fastened with glue and brads. Hangers *J* are screw-eyes.

For the Finish of the cigar-box wood cabinet, the author suggests several coats of boiled linseed-oil.

Figure 116 shows

The Envelope Containers for recipe clippings, and Fig.

117 shows how the tabs for classification are pasted to the face of the envelopes, in three positions. This cabinet was designed for business-size envelopes, which measure 3⅝ inches wide and 6½ inches long.

A Step-Ladder Stool (Fig. 118). The ladder is of just the right height for general household use, for washing woodwork, or for reaching upper shelves in the pantry. It also makes an excellent kitchen stool, the lower step serving the purpose of a foot-rest. When the ladder-stool is not in use, it may be folded into the compact form shown in Fig. 119, and stood behind a door or in some other out-o-he-way place.

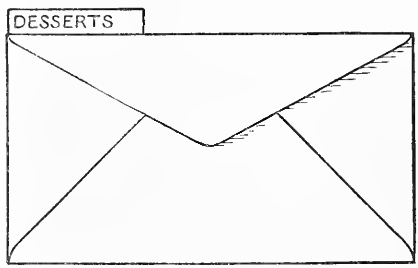


Fig. 116 — Indexed Envelope Container for Recipes

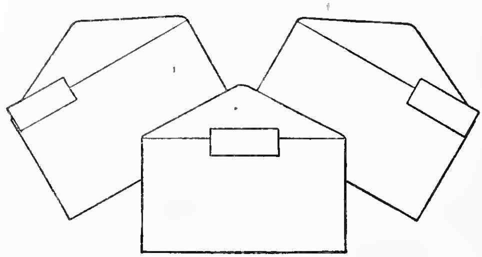


Fig. 117 — How the Envelope Index Tabs are put on

The Ladder consists of three portions, the steps (Fig. 120), the rear legs (Fig. 125), and the seat or top step (Fig. 128).

The Side Rails of the steps (*A*, Fig. 120) should be cut of the dimensions shown in Fig. 121. Mark the ends to be cut to the angle shown, the top to be notched to receive an end of the crosspiece *D* (Fig. 120). The diagram shows the positions for steps *B* and *C*. The steps must pitch at the same angle as the rail ends. Groove the side pieces to a depth of 3/8 inch, to receive the ends of the steps (Fig. 123). You will see by Fig. 120 that the sides of the grooves must not be cut down at right angles, but at a pitch corresponding to that of the side rails, to accommodate steps *B* and *C*.

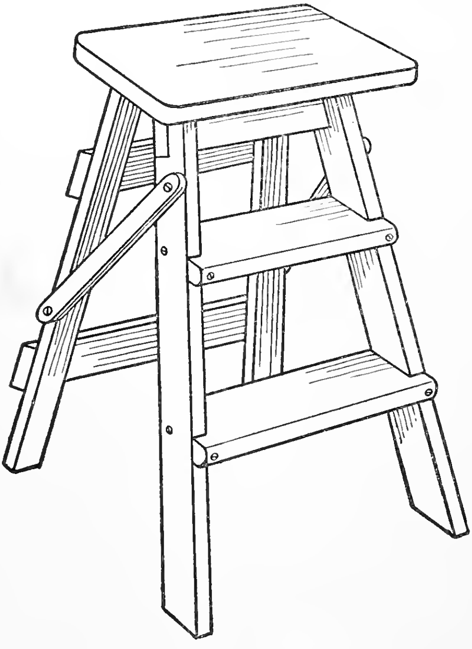


Fig. 118. — Step-Ladder Stool

Figure 122 shows dimensions for cutting

The Steps ***B*** **and** ***C***. The ends of these pieces must be beveled slightly to make them correspond to the angle formed by side rails *A*.

In assembling the rails and steps, first set the ends of the steps in the grooves in the side rails, and drive screws through the projections on the ends of the steps into the front edges of the side rails, also drive screws through the side rails into the step ends. Cut crosspiece *D* of the width and thickness of the notch in the upper end of side rails *A*, and of about the length of step *B*; slip it into the notches, nail it to the edges of side rails *A*, and saw off the ends flush with the outside face of the rails.

The Rear Legs (*E*, Fig. 125) must be spaced the same distance apart, and placed at the same angle, as the side rails *A* of the ladder. Cut the legs of the dimensions shown in Fig. 126, and the pair of crosspieces *F* and *G* of the dimensions shown in Fig. 127. Use the steps as a guide for fastening together legs *E* and crosspieces *F* and *G*, so as to get them of equal width.

With the steps and rear legs assembled, prepare

The Top Step or seat (*H*) by the pattern shown in Fig. 128. Then screw one flap of a pair of hinges (*I*) to the inner face of crosspiece *D* of the steps, the flap of another pair of hinges (*J*) to the outer face of rear legs *E*, and screw the other flaps to the under side of seat *H* in the positions shown in Fig. 124.

Fig. 119. The Step-Ladder Stool Folded

The Struts *K* prevent the legs from sliding farther apart when the ladder is opened to the position shown in Fig. 124. Cut this pair of strips of the size shown in Fig. 129, bore a screw-hole near each end, and screw the ends both to rails *A* and rear legs *E*, as shown in Fig. 118. If the struts have been adjusted carefully, the step-ladder will fold into the form shown in Fig. 119, but not while a weight is upon the steps. That is to say, the ladder will not fold up while you are standing or sitting upon it.

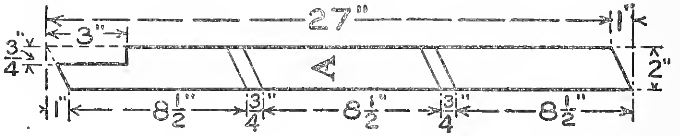
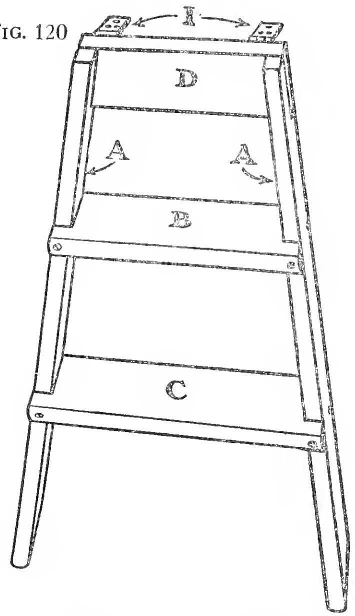


FIG. 121

FIG. 120



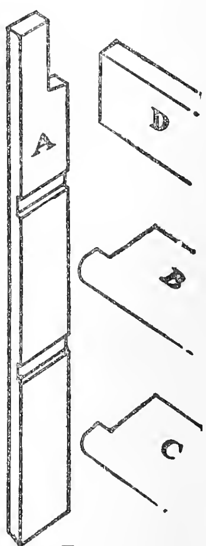


FIG. 123

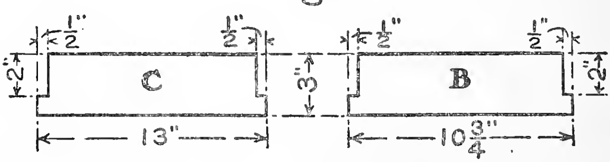


FIG. 122

FIG. 120. — Detail of Ladder Steps FIG. 121. — Dimensions of Side Rails
FIG. 122. — Dimensions of Steps
FIG. 123. — How Steps and Parts are Joined

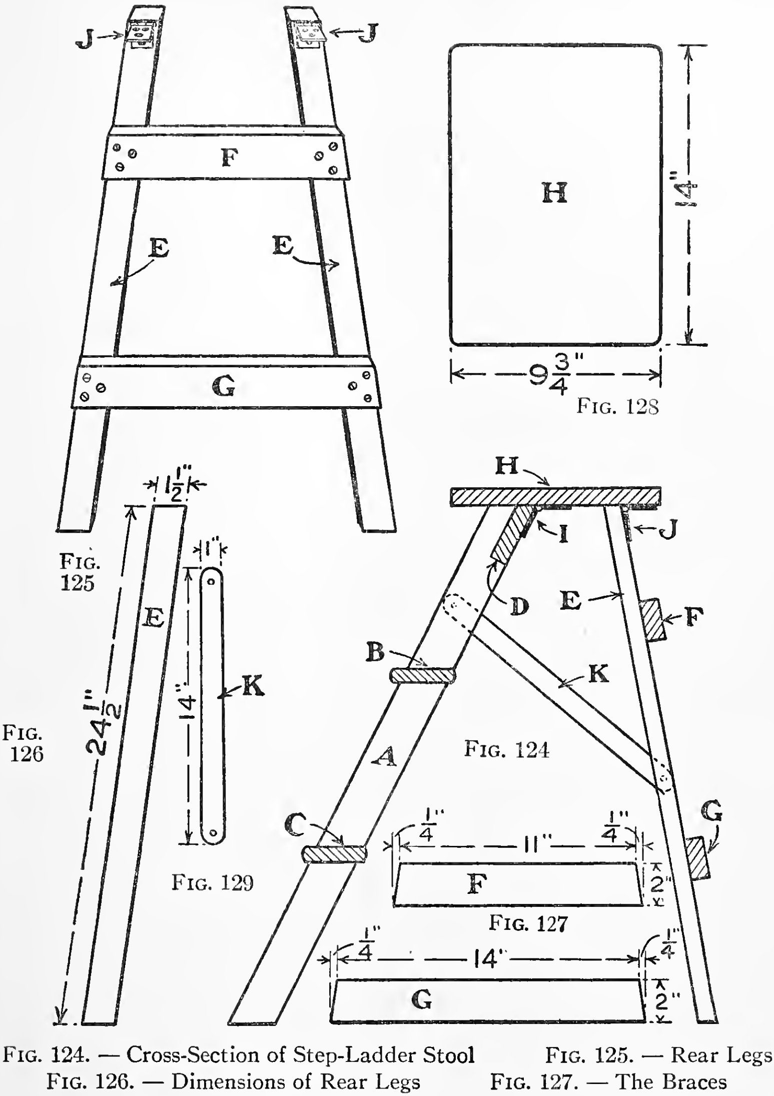


FIG. 124. — Cross-Section of Step-Ladder Stool FIG. 125. — Rear Legs
FIG. 126. — Dimensions of Rear Legs FIG. 127. — The Braces
FIG. 128. — Top Step or Stool Seat FIG. 129. — Strut

The Clothes-Line Reel in Fig. 130 is intended for use upon the kitchen porch (Fig. 131), in the kitchen, bathroom, or laundry. The reel screws to the wall, where it is always ready for instant use; and, because the clothes-line can be wound up out of the way after the dried clothes have been removed, the reel is very convenient for crowded quarters.

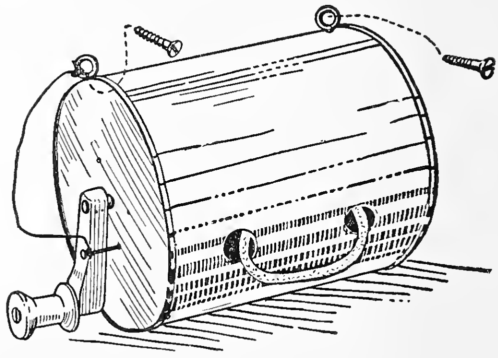


Fig. 130. — Clothes-Line Reel

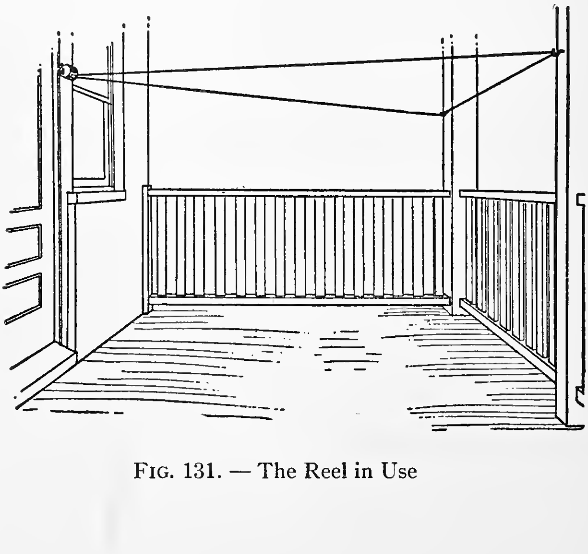


Fig. 131. — The Reel in Use

The Case of the Reel is a tomato can with both ends removed (Fig. 132). If the ends are clinched over the can sides, cut them away with a can opener. Start holes *B* with a nail, and enlarge with a rat-tail file until ½ inch in diameter. File the edges of the holes smooth, so they will not cut the clothes line which is to run through them.

Cut blocks *C* (Figs. 132 and 133) to fit snugly in the can ends. Use a scroll-saw or bracket-saw (Fig. 18, Chap. 2) if you own one; otherwise, cut the blocks roughly with a large saw, and finish up to the circumference with a chisel and sandpaper.

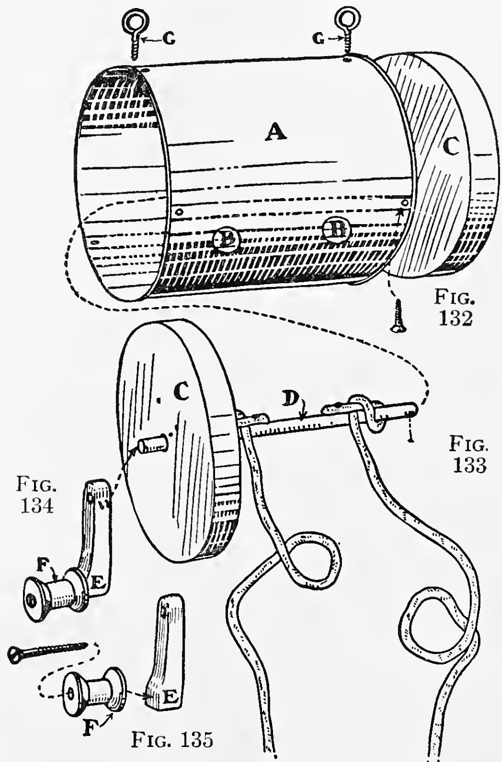


Fig. 132. — Case of Clothes-Line Reel
Fig. 133. — Detail of Winding-Stick
Figs. 134 and 135. — Details of Crank

The Reel. Winding-stick *D* of the reel (Fig. 133) is a dowel-stick ¼-inch or ⅜-inch in diameter. Its length should be 1 inch longer than the can. Bore a hole through the center of each end block *C*, for the stick to turn in. A brad driven through one end, and the crank-shaft tacked to the other end, will prevent the stick from pulling out of the holes (Figs. 133 and 134).

The Crank Shaft (*E*, Figs. 134 and 135) should be 2½ inches long, ⅝ inch wide, and ⅝ inch thick. To prevent its splitting, it is best to bore the hole for winding-stick *D*, and also to screw spool knob *F* in position, before shaping the block to its finished width and thickness.

The Clothesline should be of cotton, and should be 50 feet long. Slip the rope ends through holes *B* in the front of the tin can case, pass them around the winding stick *D*, as shown in Fig. 133, and fasten with tacks.

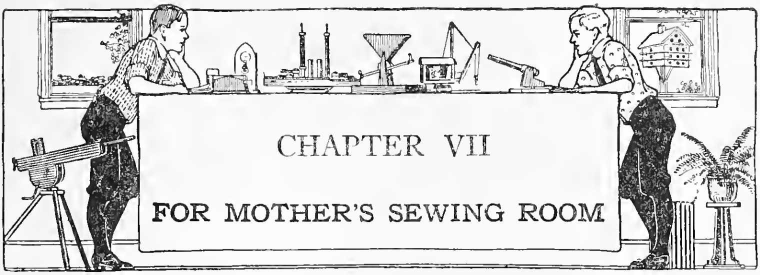
Fasten end blocks *C* of the reel case with screws driven through the can sides into their edges.

For Hangers screw the pair of screw-eyes *G* (Fig. 132) into end blocks *C*, as shown. Fasten the reel to a wall by driving screws through the eyes of the hangers into the wall (Fig. 130).

There must be a means for

Locking the Reel when as much line as is wanted has been unwound. Bore several holes through end *C* of the reel case (the end at which the crank is mounted), and provide a nail to stick into the holes for a locking-pin, to prevent the crank from turning. Hang the locking-pin from one of the hangers by means of a piece of string (Fig.130).

It is best to give the case of the reel two coats of paint, to keep the tin from rusting.



CHAPTER VII

FOR MOTHER'S SEWING ROOM

Mother will not want all of the sewing-room conveniences shown in this chapter; in fact, she could not very well use all of them because several are designed for a similar purpose. But let her choose from among the articles those that she likes best, and make them for her as your time permits. Some of the articles can be made up for Christmas gifts, some you may find an opportunity to sell. For the most part, the articles are inexpensively made; several require nothing but materials that can be picked up at home.

The Fancy-Work Frame shown in Fig. 136 hangs upon the wall. A couple of nails or hooks can be fastened securely in the wall to support it. When not in use, the drop-front is hooked up out of the way, and the contents thus made proof against dust.

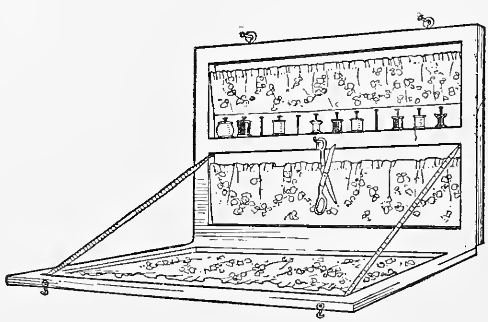


Fig. 136. — A Fancy-Work Frame

With the frame hooked together in this way, it can be carried conveniently, if it is desired to use it in another room or on the porch.

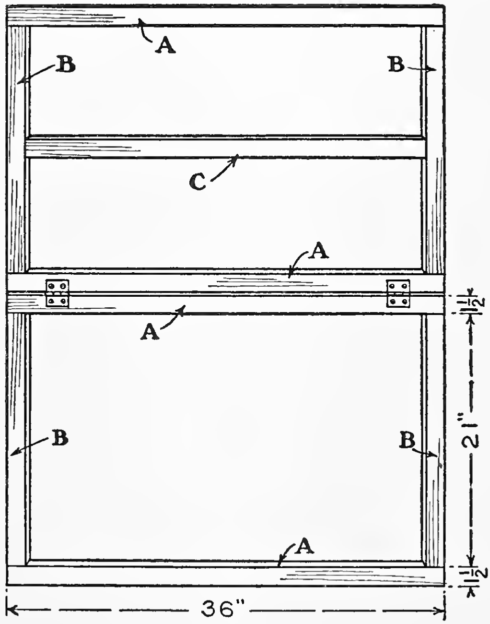


Fig. 137. — Detail of Framework

Fig. 137 shows the construction of the framework, with dimensions of all the parts. You will note that the front and back portions are identical, except that the back has an additional strip (*C*), fastened between end strips *B* midway between strips *A*.

Hinge the front and back together as shown, then cover all surfaces of the strips with cretonne, fasten a piece of cretonne over the back of the standing part of the frame, and over the front of the hinged part, and form three cretonne pockets in the places indicated. Drive nails into the upper edge of strip *C* for

Spool-Spindles, provide a hook for scissors, screw a pair of screw-eyes into the top of the back frame for hangers, and fasten a pair of hooks to the hinged front, for hooking it to the standing part. Tack the ends of a pair of heavy tapes to the hinged front and the standing part, to support the front when it has been opened.

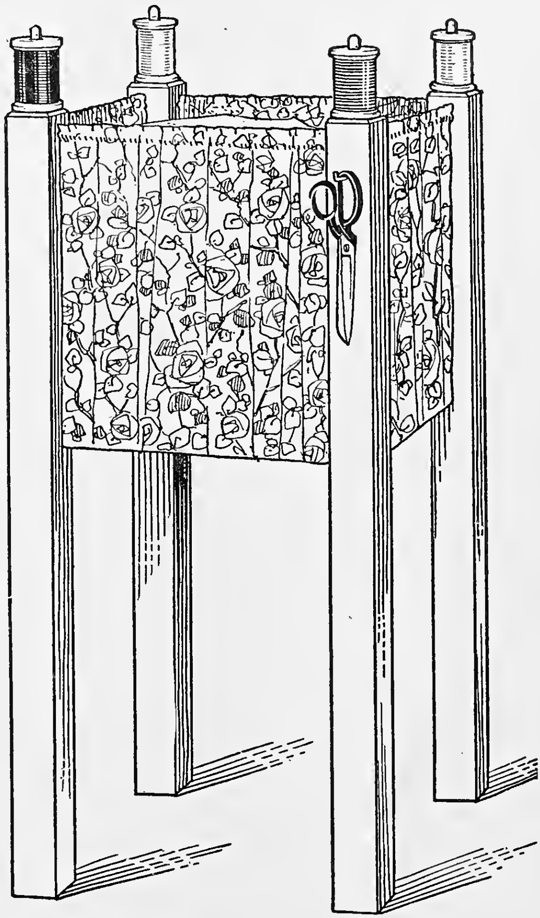


FIG. 138. — Sewing-Stand

The Sewing-Stand (Fig. 138) is a manual-training problem well adapted both to home and school work.

Four legs of the dimensions of *A* (Fig. 139), eight carpenter's dowel-sticks of the dimensions of *B* (Fig. 140), and four pegs of the length of *C* (Fig. 139), are the only pieces of wood required. For covering material, a square yard of cloth is needed.

For the legs, it is suggested that you use oak, chestnut, ash, pine, or cypress. For the round sticks, use oak or maple dowel-sticks. It does not matter whether the sticks are of the same wood as the legs or not, because they are to be concealed by the cloth covering of the sides. If you buy material at a mill for the legs, order an 8-foot piece 1¼ inches square, surfaced four sides.

Figure 139 shows a *cross-section* of the sewing-stand. Bevel the top of legs *A*, as shown, bore a pair of ¼-inch holes, ½ inch deep, in two adjoining sides of each leg, to receive the ends of connecting dowel-sticks *B* (Fig. 140), and bore a ¼-inch hole ½ inch deep in the top of each leg to receive the end of the spool spindle *C*. The holes must be bored accurately, otherwise it will be impossible to set up the framework square and plumb.

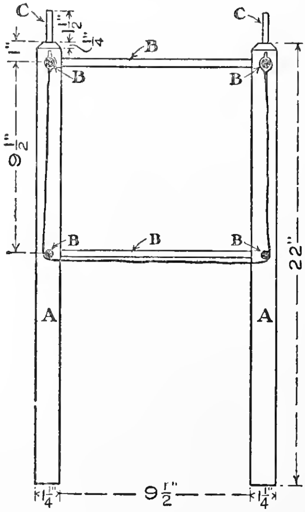


FIG. 139.—Cross-Section of Framework of Sewing-Stand

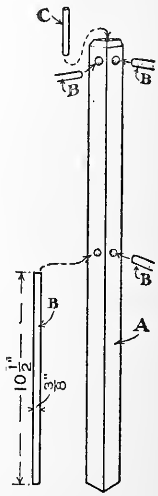


FIG. 140.—Details of Legs and Connecting Dowel-Sticks

Assembling. With the parts prepared, and sandpapered smooth, coat the ends of dowel-sticks *B* with glue, and drive them into the holes in legs *A*. Also coat the lower end of the spool-spindle pegs *C* with glue, and drive them into the holes in the tops of the legs.

The Woodwork Must Be Finished before the covering material is put on. It is suggested that you either stain the wood and then wax it, or that you white-enamel it.

A Cretonne or Denim Covering is best for the sides of the sewing-stand. A square yard cut in half, making two strips ½ yard wide by 1 yard long, is ample. Preparing this covering will be mother's work entirely. A double hem must be made along the ends of the strips, for the upper dowels *B* to run through. If you have glued up the framework these hems will have to be sewed over the sticks, of course. If you want to, you can wait until the strips have been hemmed before you glue together the framework parts. Run each strip from an upper dowel-stick down to and around the lower stick on the same side, then across to the lower stick opposite, and then up to the upper dowel-stick on that side. The

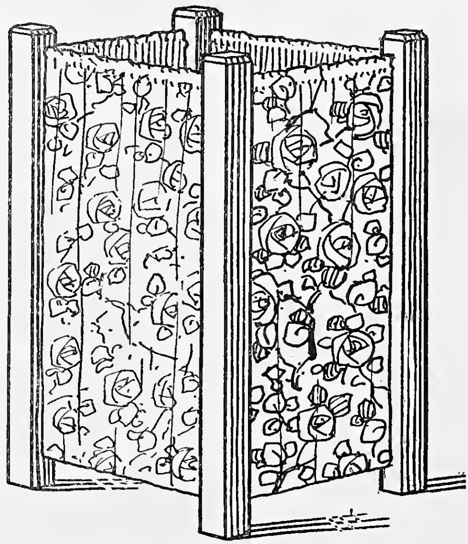


Fig. 141. — Waste-Basket

strips will cross each other on the bottom, therefore the sewing-stand will have a double bottom.

The Waste-Basket illustrated in Fig. 141 has the same framework construction as the sewing-stand. The framework is shown in Fig. 142, and a cross-section with dimensions of the parts is shown in Fig. 143.

For covering the waste-basket, you will require half a

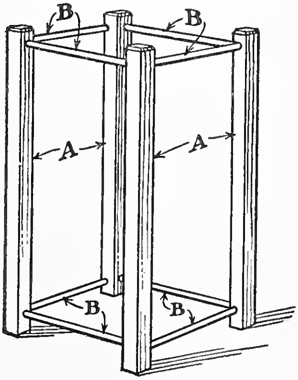


Fig. 142

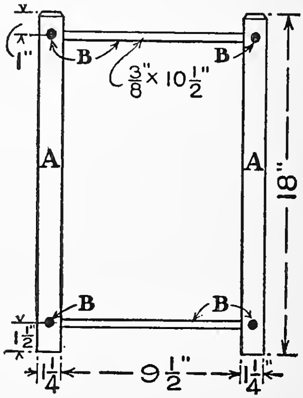


Fig. 143

Fig. 142. — Completed Framework of Waste-Basket
Fig. 143. — Cross Section of Framework

yard more material than was used for the sewing-stand. Cut the cloth into two strips, and put it on in the same way that the sewing-stand sides and bottom are put on.

A Work-Bag on a Folding Support, like that shown in Fig. 144, has several good points in its favor. When the frames are spread, the bag is held open so its contents can be reached easily; when the frames are folded, the bag is closed, and in this compact form the work-bag may be hung up in a clothes-closet, or stood behind a door or in some other out-of-the-way place.

The bag support (Fig. 145) is made of two frames (Fig. 146). One of these frames is enough smaller than the other to slip inside of it (Fig. 145). The frame diagrams (Fig. 146) show the dimensions for the strips required. Tack crosspieces *B* and *C* to sticks *A*, so the upper crosspieces will be ½ inch below the top of strips *A*, and so the lower crosspieces will be 8 inches above the bottom. Locate the exact center of the length of strips *A*, and at this point pivot the frames together on screws driven from the outer strips into the inner ones, as shown in Fig. 145.

Fig. 144. — Work-Bag on Folding Support

Figure 147 shows the piece of cretonne required for

The Bag. Cut the cloth 32 inches square, turn over two opposite edges to a depth of 2 inches, make a hem in each for a ribbon, and make a second hem to form a heading. To fasten the cloth to the support, tie the ends of the ribbons run through the hems, to the ends of upper crosspieces *B* and *C*. Then turn the unhemmed edges of the cloth over crosspieces *B* and *C*, make hems, and above each hem form a heading.

The Fancywork-Box shown in Fig. 148 requires little carpentry. After you have procured a box of the size

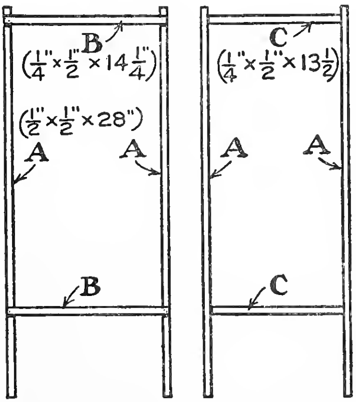


FIG. 145. — Folding Support of Work-Bag

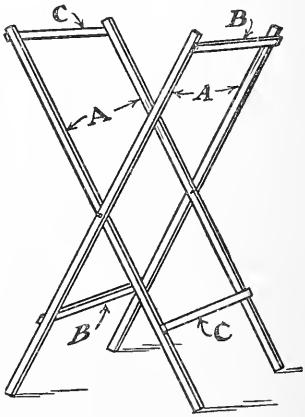


FIG. 146. — Details of Frames for Work-Bag Support

desired, all that it is necessary to do is fasten together the cover boards with a couple of battens nailed across them as shown in Fig. 150, unless the boards have been lost or broken, in which case you will have to make a new cover. Place the battens close enough to the cover ends, and make them of the right length, so when the cover is placed on the box the battens will prevent the cover from shifting lengthwise and crosswise. By making this provision, hinges will be unnecessary.

The Box Must be Covered to conceal the roughness of the boards. A pretty figured cretonne looks well for the outside, and a plain colored lining is best for the inside. Before putting the covering on, tack a layer of cotton wadding to the wood, for padding. Screw a brass handle to the center of each end of the box.

Figure 149 shows how to tack

A Cloth Pocket and Elastic Tapes to the inside of the cover; also how to make

Spool-Spindles by driving nails into the cover, and slipping rubber bands over the nail heads (Fig. 151) to keep the spools from dropping off.

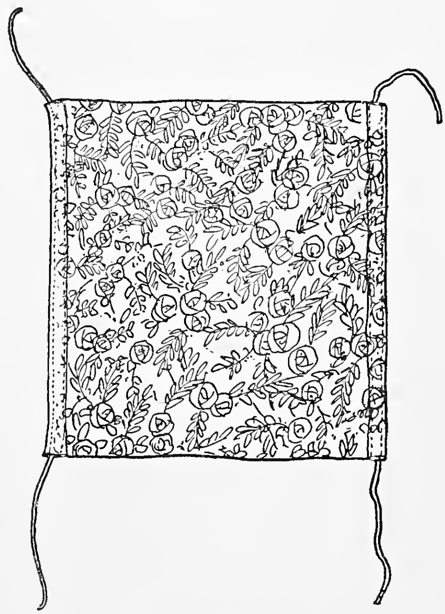


Fig. 147. — Cretonne for Work-Bag

The Fancywork-Box with Legs shown in Fig. 152 requires little more work to make than the box just described. The legs are strips 2 inches wide, 1 inch thick, and from 14 to 20 inches long according to the height of box you want. Sixteen inches is right if the box is to be used as a bench to sit on. The leg strips must be of equal length, and they must be nailed to the box corners so the tops are even with the top of the box (Fig. 153).

The cover of the fancywork-box should be wide enough and long enough to project ¾ inch over the sides all around. Therefore you must use the cover boards from a larger box. Nail a pair of battens across the boards to hold them together (Fig. 154). These strips can be placed upon the under side of the boards in such a position that they will keep the cover from slipping from side to side, and from end to end, when it is placed upon the fancywork-box. By making the cover to lift off, you will save yourself the trouble of putting on hinges.

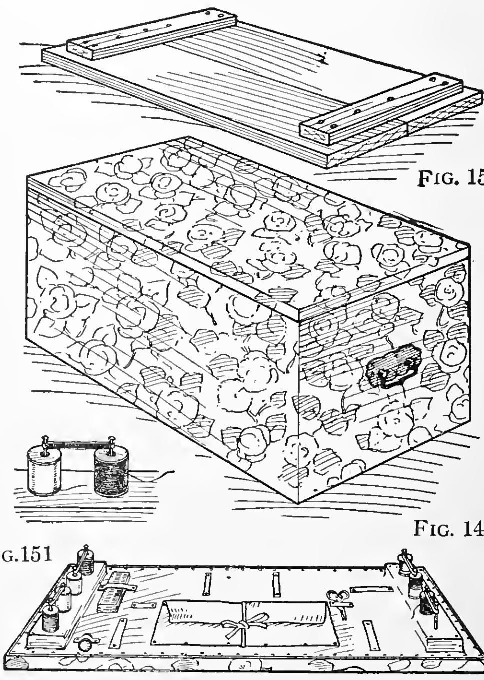


FIG. 150

FIG. 148

FIG. 151

FIG. 149

FIG. 148. —A Fancywork-Box
FIG. 149.—Arrangement of Pockets and Spool-Racks
FIG. 150.—How to Batten Together the Cover Boards
FIG. 151. — A Spool-Rack

The Cretonne Covering. Perhaps you can get a large enough remnant in cretonne for the fancywork-box. The care with which you put this on the box will determine whether or not the box will be a success. Perhaps you had better ask mother to help you. Because grocery boxes are more or less rough, and the boards are uneven, it is

FIG. 152. — A Fancywork Box with Legs

best to cover the wood with some other cloth first, for a foundation for the cretonne. Stretch the cretonne over each surface neatly, and use gimp tacks for fastening it. Line the inside of the box with plain colored cambric. Figure 155 suggests how the inside of the box may be divided into compartments by cloth partitions.

The Sammy Spool-Holder shown in Fig. 156 will be a delight to mother because of its novelty. Cutting out the figure of Sammy is a simple scroll-saw problem. Review what has been said about this work in Chapter II.

The patterns shown in Figs. 157 and 158 have been made full-size, for a soldier boy standing 6 inches high which is high enough for a spool-holder. You can take tissue-paper and make a tracing of the outlines, then transfer these on to your working material. Inasmuch as it was thought that you might wish to enlarge or reduce the figure, squares have been drawn checker-board fashion on the pattern.

When you cut out the figure, saw just as close to the outline as possible. Be careful not to saw over the line. After cutting, finish the edges with sandpaper. The upper portion of the body (*A*, Fig. 157) is connected with the lower portion (*B*) by means of a dowel-stick (*C*). Glue the upper end of the stick in a hole bored in the upper portion of the body, and whittle the lower end of the stick so that

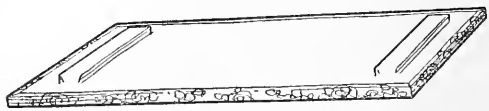


Fig. 154

Fig. 153

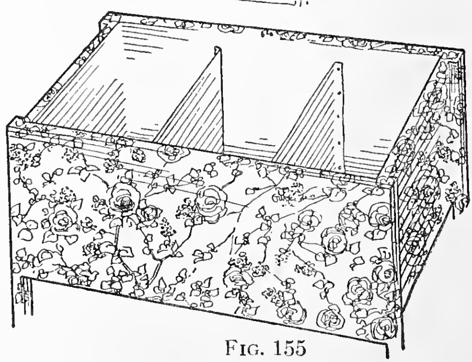


Fig. 155

Fig. 153. — How the Legs are Nailed to the Box Ends

Fig. 154. — The Completed Cover

Fig. 155. — How the Box is Partitioned off into Compartments

it will fit loosely in a hole of the same size bored in the lower portion of the body (*B*). Sammy's feet (Fig. 158) are made large enough to give him a solid footing to stand on. Cut a slot in this block and fit the end of the legs into it.

A Needle Forms Sammy's Bayonet, and a small hole must be drilled in the gun to stick it into.

Paint Sammy's Clothes khaki color, his gun brown; and mark his features, and outline his clothes, with black paint.

If mother knits, she will appreciate

A Yarn-Winder like that shown in Fig. 159. It does not take long to make one.

Fig. 156. — Sammy Spool-Holder

The winder *arms* are two wooden strips (*A* and *B*, Fig. 160), pivoted to the top of a base block (*F*, Fig. 165). The *fingers* at the arm ends are spools (*D*, Fig. 162).

Figure 167 shows a face and an edge of an arm strip, with dimensions for cutting. At the exact center of each strip, bore a ¼-inch hole for the pivot bolt. To make the top surfaces *flush* with each other, *halve* them at their centers — that is, cut a piece 1 inch wide by 3/16 inch thick from each strip, so the two will fit into one another. The

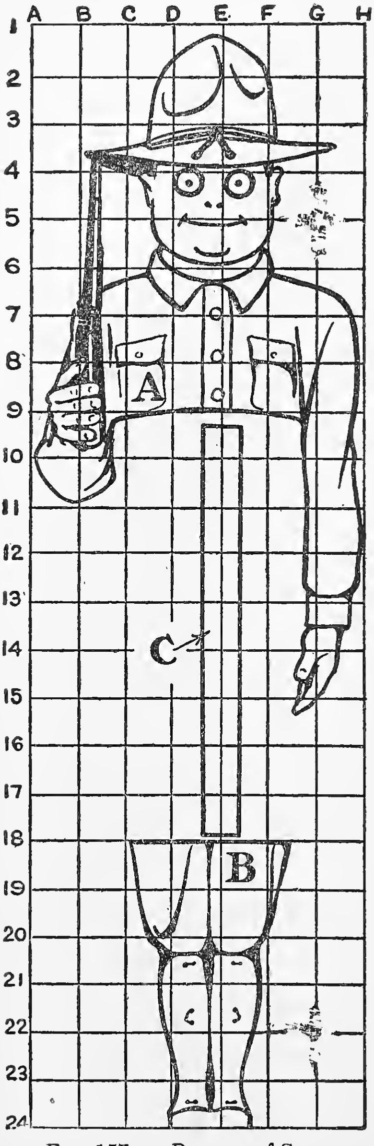


FIG. 157. — Pattern of Sammy

notches must be cut of the right width and depth, to make a neat joint, so mark them out carefully on the top and edges. Cut a trifle inside of the marks, using a saw to cut the ends of the notch, and a chisel to split out the wood between and trim up the ends.

The arm ends are slotted so the fingers may be adjusted for different sizes of skeins. Figure 167 shows dimensions of the slots. Bore a ¼-inch hole at the slot end, then saw from the arm end as far as the hole. Trim up the slots with a chisel, then smooth with sandpaper.

The end *fingers* (*D*, Fig. 162) are made of thread spools of the form shown in Fig. 163. You will need two spools for each finger. Whittle down the *flange* of one end of each spool, then glue together these ends of each pair of spools, and with your knife and sandpaper smooth the surface from which the flanges were removed. Stove-bolts or carriage-bolts ¼ inch in diameter and 3 inches long (Fig. 164) are required for bolting the fingers to the arm ends. If you will slip the bolt through the center hole of each pair, you can screw the bolt-nut tight against the lower spool end, and thus clamp the pair of spools together until the glue has set.

Fasten together the arm strips with a stove-bolt ¼ inch in diameter and 2 inches long (*C*, Fig. 161). Screw the nut close against the under side of strip *B*, as shown, to hold the strips together.

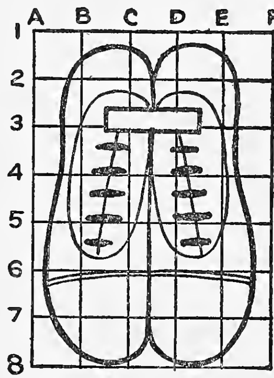


FIG. 158. — Sammy's Feet

Base *F* (Fig. 165), on which the arms are pivoted to turn, has a projection at its base to provide for clamping it to a table top (Fig. 159). Figure 168 shows its dimensions. Buy a 5-cent G-clamp for clamping the base (Fig. 166). Bore a ¼-inch hole in the top of base *F* for the bolt to turn in.

You may shellac the yarn-winder, shellac and varnish it, stain and wax it, or paint it.

If you want to make mother a pair of

Sweater Knitting Needles, get dowel-sticks 3/16 inch in diameter. Cut them into 12-inch lengths (Fig. 169), whittle one end to a point, and in the other end drive a brass tack measuring ⅜ inch across the head (Fig. 170). Drill a hole for the point of the tack, so it will not split the stick when you drive it in. Sandpaper the needles, then shellac and varnish them.

Sock Knitting Needles are shorter than sweater needles.

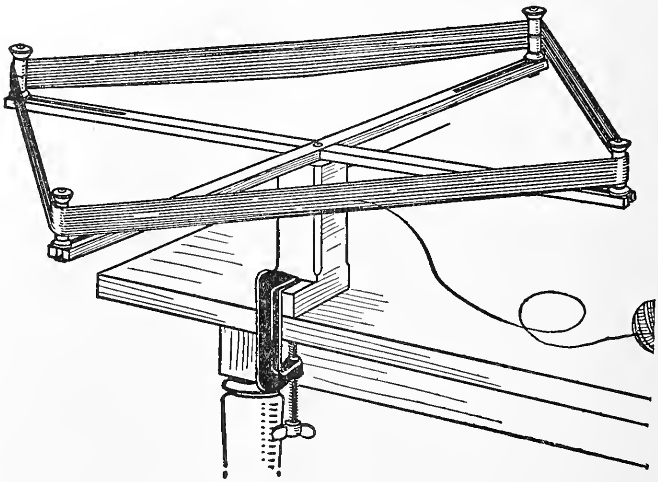


FIG. 159. — Yarn-Winder

Make them as shown in Fig. 171, 8½ inches long, with both ends pointed.

Figure 172 shows a pair of

Needle-Point Protectors, made of spools. Glue a coil of paper inside of the spool hole (Fig. 173), to make the hole small enough so the needle will fit snugly.

Every sewing-room has its whisk-broom, therefore

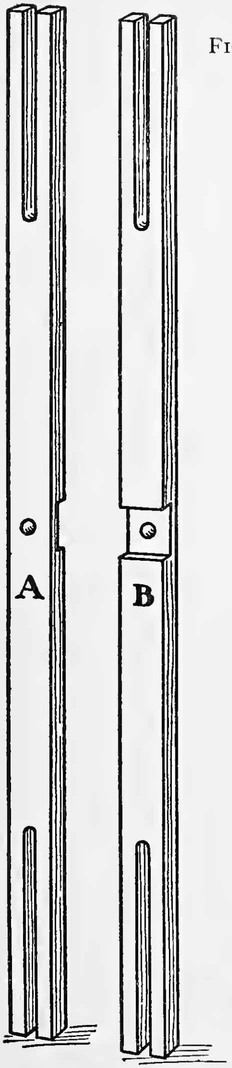


Fig. 160

Fig. 163

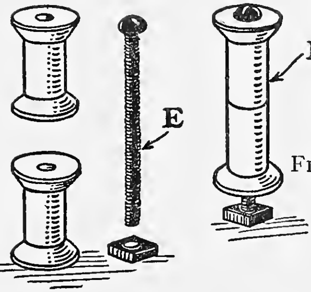


Fig. 162

Fig. 164

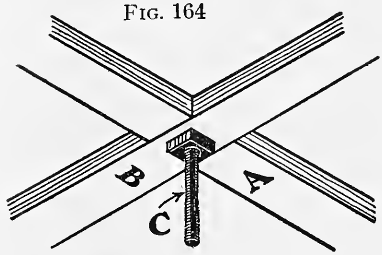
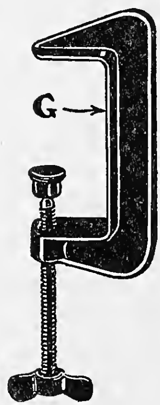


Fig. 161



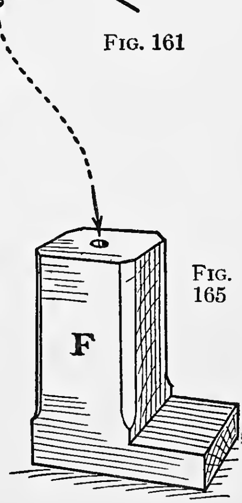


Fig. 165

Fig.166

Fig. 160. — The Winder Arm Strips Figs. 162-164. — Details of Fingers
Fig. 161. — Center Connection of Arm Strips
Fig.165.—The Winder Base Fig.166.—Clamp for Fastening Base to a Table

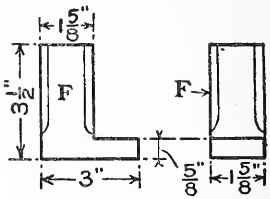


FIG. 168. — Detail of Winder Base

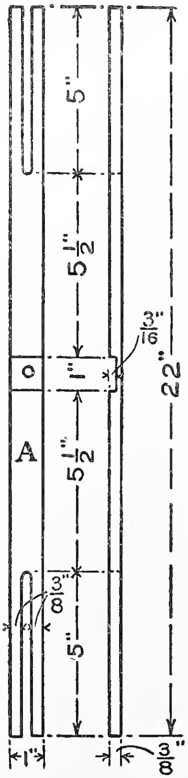


FIG. 167. — Detail of Winder Arm Strips

FIG. 173

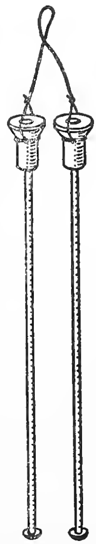


FIG. 172

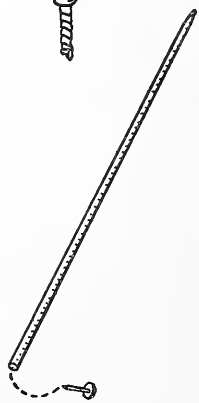


FIG. 170

FIG. 171

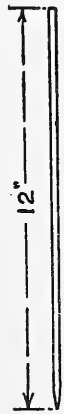


FIG. 169

FIG. 169. — Dowel-Stick Sweater Needle
FIG. 170. — A Brass Tack is Driven into the End of the Sweater Needle
FIG. 171. — Dowel-Stick Sock Needle
FIG. 172. — Needle-Point Protectors
FIG. 173. — Spool Point Protector

A Whisk-Broom Holder like that shown in Fig. 174 should be one of the things that you make for mother.

The holder illustrated requires a single board of the dimensions shown in Fig. 175. In laying this out, first draw a center-line upon the board, then lay off the measurements for one-half of the board to one side of the line, make

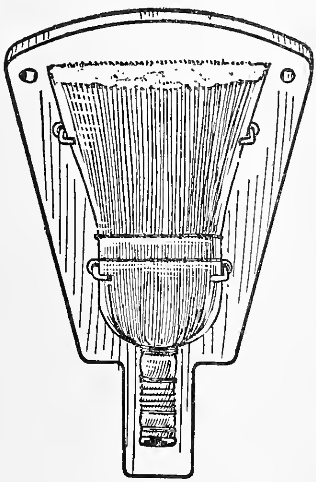


FIG. 174.—Whisk-Broom Holder

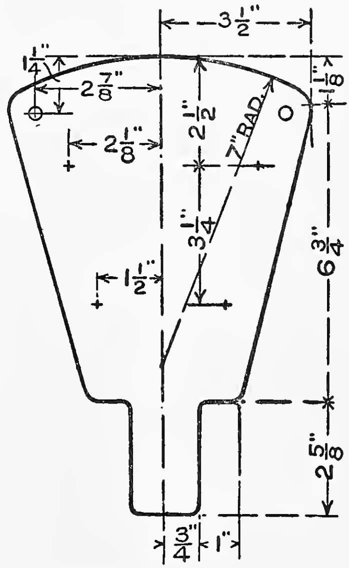
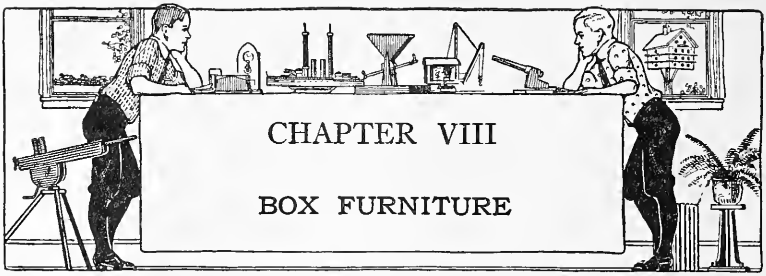


FIG. 175.—Detail of Board Back

a tracing of this half, reverse the tracing, and transfer the outline upon the opposite side of the center-line.

In cutting out the piece, saw a trifle outside of the outline, so that you will have enough margin for smoothing up the edge. Bore a pair of holes near the top of the board, in the positions shown, to slip over wall hangers.



CHAPTER VIII

BOX FURNITURE

HAVE you ever tried your hand at making box furniture? If not, you are unaware of the possibilities of such work. Every shape of box, every size of box, suggests some practical article. Material is easily obtained, because grocers generally have a good assortment on hand, and will be glad to let you have what you need at the price the second-hand man pays, which varies from ten cents to twenty-five cents, according to size.

As a suggestion as to what to make, a number of designs are presented upon the following pages, and the author knows that when you have made some of these pieces of furniture, other ideas will suggest themselves to you. Some of the pieces will be just the thing for the porch and garden.

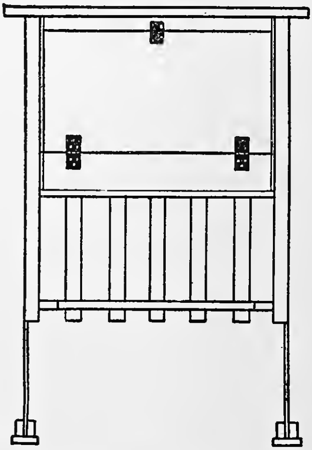


FIG. 179. — Front View of Desk Shown in Fig. 176

Every boy needs a desk. After a bed, chiffonier, and chair, the desk is probably the most essential thing to have in your

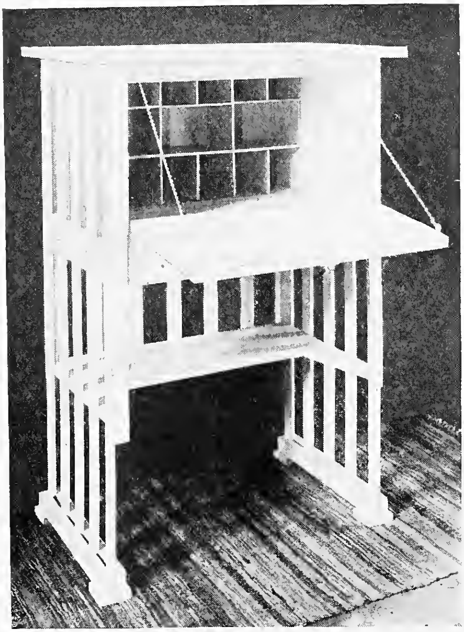


Fig. 176.—Desk Made of Packing-Box and Lattice-Strips.

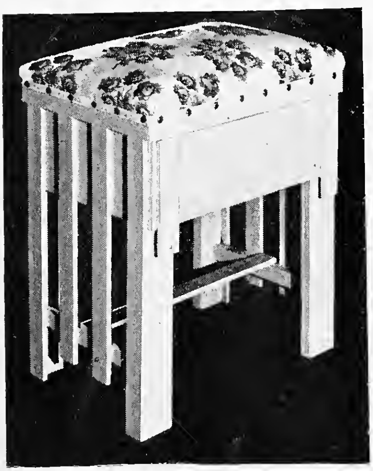


Fig. 177.—Desk Stool with Box Top.

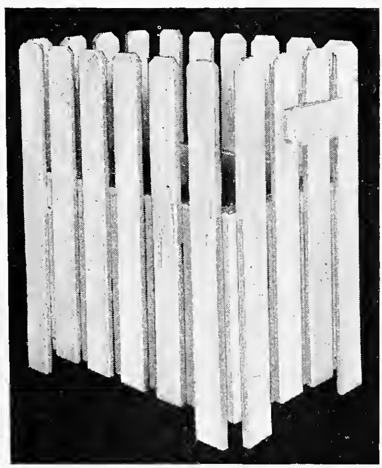


Fig. 178.—Waste-Basket with Box Base.

room. If you do not own a desk it is probably the first piece of furniture which you will be interested in making. Having learned from past experiences that the desk is among the most popular of furniture models, the author got to work the other day, and designed and built

The Packing-Box Desk shown in Fig. 176 with which to begin this chapter on box furniture.

You probably will not be able to find a packing-box of the exact dimensions of the box that was used in the model illustrated, but no matter. Get a box of approximately this size and alter the dimensions given (Figs. 182 and 183), to suit it. Don't use an ordinary grocery box. Get a heavier box than this; the kind with cross battens nailed to the ends is best (Fig. 184). In addition to the box, you will need several pieces of boards ⅞ inch thick, for *drop-leaves*, cross-strips, shelves, etc., a berry-case or two to provide thin wood out of which to construct *pigeon-*

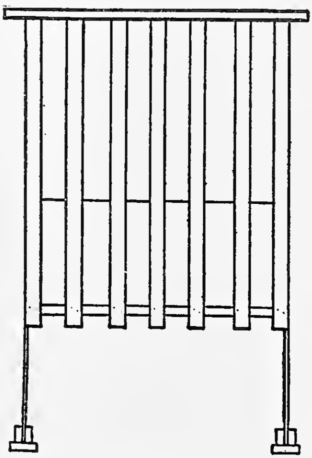


Fig. 180. — Back View of Desk

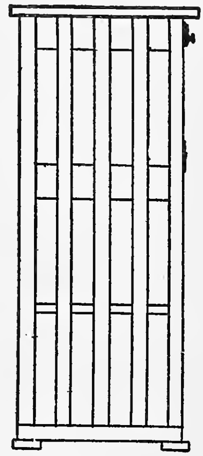


Fig. 181. — Side View of Desk

holes, and about sixty lineal feet of lattice-strip 1⅜ inch wide for enclosing the lower portion, and for the legs.

Figures 179 to 183 show, in order, a view of the front of the desk, the back, a side, and two cross-sections. Figure 184 shows the first step in preparing the packing-box, that of removing one side. When the side has been removed, cut strip *A* (Fig. 184) of the width shown in Fig. 183, and

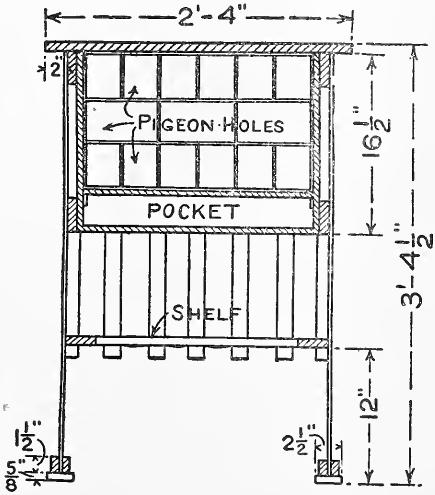


Fig. 182

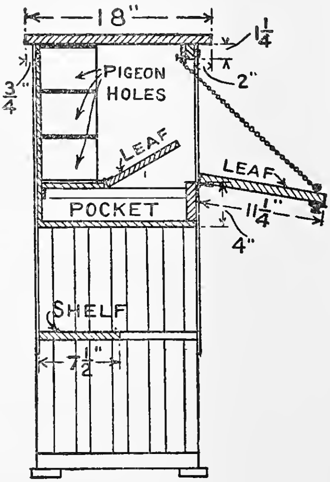


Fig. 183

Figs. 182 and 183. — Cross-Sections of Desk

fit and fasten it between the box ends as shown in Fig. 184; then cut strip *B* (Fig. 184) of the width given in Fig. 183, and fasten it between the upper end corners of the box. Drop-leaf *C* can be cut out of a 12-inch board, if your box is of the size of the box used in the model illustrated. Fit this drop-leaf now, and hinge it to strip *A* with 1¼-inch by 3-inch hinges, then remove it and put it aside until after the rest of the desk has been assembled.

A drawer is not the easiest thing in the world for a boy to fit properly, therefore in the desk a *pocket* in the lower portion has been substituted. This pocket, made the depth of board *A*, is covered by the boards *D* and *E* (Fig. 185). Hinge the two pieces together, the latter to open as a *hinged-leaf*. Fasten strips to the sides of the box (*F*, Fig. 184) for *cleats* to support boards *D* and *E*, and nail board *D* to the cleats. Bore a hole through board *E* near the front edge, for a *finger-hole*, by means of which to raise the leaf.

Figure 187 shows the battery of

Pigeon-Holes. These are built of strips of wood from a knocked-down berry-box. The best way to assemble the partitions between the pigeon-holes is to *halve* the two center vertical partitions with the two center horizontal partitions — that is, saw *slots* in their edges as shown in Fig. 188, so they will *interlock*. Nail the end, top, and bottom pieces to the ends of these interlocked partitions, and cut and fasten in position the remaining intermediate partitions.

Before putting on the desk-top, build the base. The packing-box's dimensions, and Fig. 182, will determine the size of this. Figure 189 shows the way to assemble the end lattice-work legs. When you have prepared the two sections, nail the upper ends to the ends of the desk. Care must be taken to get the legs of equal length, so the desk will stand evenly. Cut the lower shelf and fasten it between the lattice-strips as shown (Figs. 182 and 183), and cut and fasten the back strips to the back edge of the shelf, and to the back of the box. (Fig. 180). A strip corresponding to the back strips, lapped over the front edges of the desk, and the edges of the side strips (Figs. 176 and 179) will form a finish to the desk front. A block fastened between each of these strips and the bottom shelf, will give support to the lower end of the front strips, and will brace the side strips (Fig. 176).

After you have hinged the front drop-leaf in place, nail a strip to the inner face of strip *B*, allowing it to project as a stop for the drop-leaf to strike against. Attach a *spring-catch* to the center of the top of the drop-leaf, and attach a *check-chain* at each side of the drop-leaf, to screw-eyes (Fig. 183), to prevent the leaf from dropping farther than the position shown. The top boards should now be fitted in place. Cut them of the right dimensions to make projections of the width shown. (Figs. 182 and 183).

Finishing. Rub down all of the woodwork with sand-paper before applying a finish. You can stain the wood-work with a stain made of oil paint thinned with turpentine, or you can paint it, or you can shellac and varnish it. If the wood is in good condition and of uniform color, you can shellac and varnish it; otherwise, do not attempt this method. If the wood is not good, painting will afford the best opportunity for concealing knots, cracks and other defects, because after the first coat of paint has dried, you can fill in putty, and the second coat of paint will cover it. Putty sticks best after one coat of paint has been

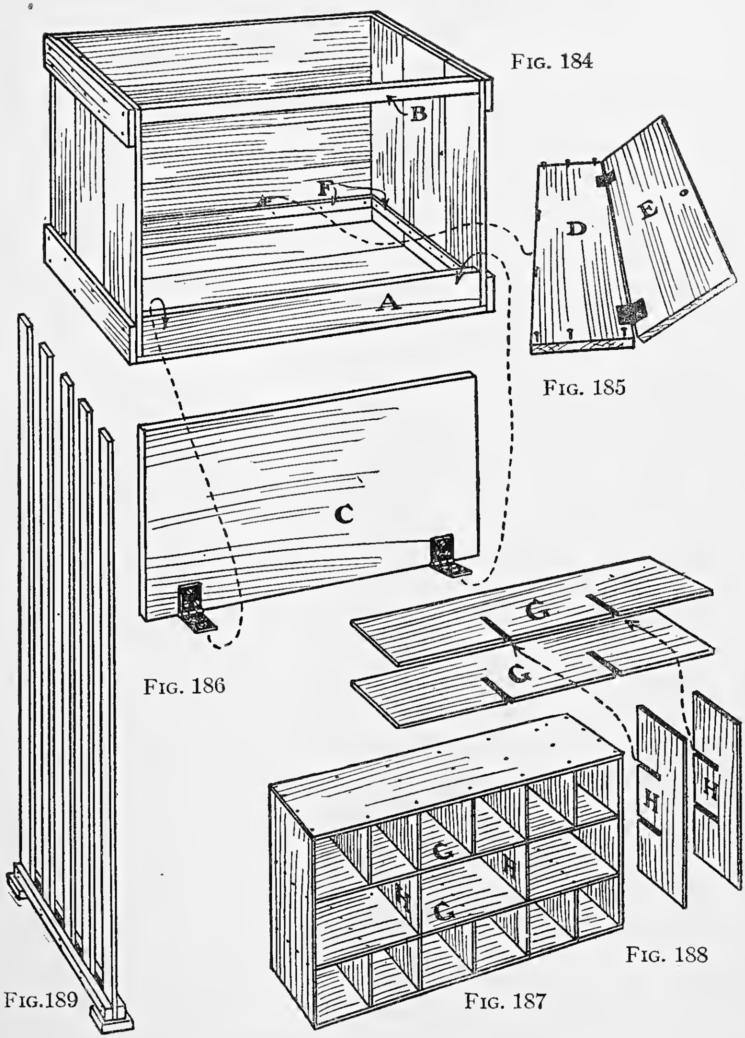


Fig. 184. — First Step in Preparing Packing-Box for Desk
Fig. 185. — Top to Pocket Fig. 186. — Drop-Leaf for Desk Front
Figs. 187-188.—Details of Pigeon-Holes Fig. 189.—End Lattice-Strip Legs

applied. White enamel makes a good finish for a bedroom desk.

After you have completed your desk, you will want to make

A Desk Stool. Of course you can use an ordinary straight-back chair to sit on, but a stool designed along the lines of the desk will be more in keeping. Figure 177 shows a stool designed to go with the desk. You will notice that the designs of the two are similar. The stool legs have been made heavier than the desk legs, which is necessary, of course, because the stool will receive rougher usage, and it must be strong enough to withstand it.

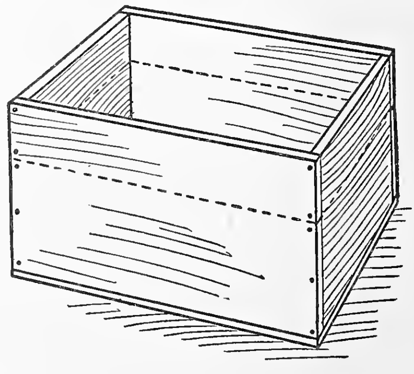


Fig. 190. — Box with Sides Cut Down. Top of Stool Shown in Fig. 177

A grocery-box forms the top of the stool, the legs and their braces are cut out of a ⅞-inch board, and the finishing-strips are pieces of lattice-strips or laths planed smooth, ¼-inch thick and 1¼ inches wide. The box used in the model was 9 inches deep, 11 inches wide, and 15 inches long. The width and length were exactly right, but it was necessary to saw 3 inches from the sides and ends (Fig. 190) to make the box of the right depth of 6 inches. Square a line around the sides and ends, remove any nails that happen to come in the way, and saw off the portion above the line.

The legs are shown in place, in Fig. 191. Their upper ends must be cut as shown in Fig. 192 to fit over the ends of the box, so their outer edge will come flush with the box ends. The length of the legs should be such that the measurements from the floor to the top of the stool will be 18 inches (Fig. 193). Cut the leg strips ⅞ inch thick by 2 inches wide, fasten them in the box corners, as shown, with nails driven through the box bottom into their ends and through the box sides and ends into their faces and edges. Cut the leg braces (*B*, Fig. 191) ⅞ inch square to fit between the legs 3 inches above the lower ends.

Fig. 192

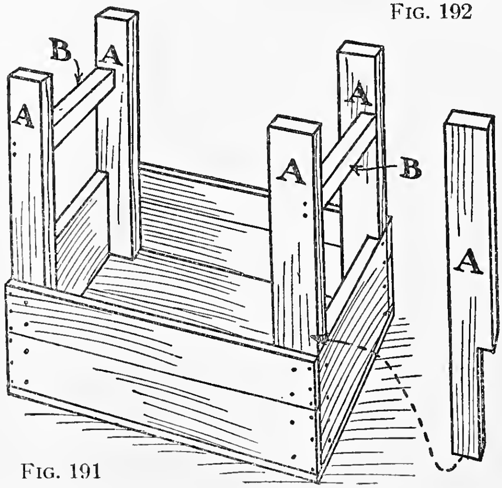


Fig. 191

Figs. 191 and 192.—How the Leg Strips are Cut and Fastened in Box Corners

Strips *C* (Fig. 193) are lattice-strips or laths. Nail them to the box sides with their top edges even with the box bottom (Fig. 195). Fit finish strips *D* to the edges of the legs as shown, butting their upper ends against strips *C*. Cut the pair of end strips *E* to extend from strips *C* to a point ½ inch below braces *B* and fasten them so the spaces between the strips, and from strips to legs will be equal (Fig. 177). Cut strips *F* to fit upon the corners of the box where shown (Fig. 193); their purpose is to balance the design; they correspond to leg strips *D*, except that they project only 1¼ inches below the box. Cut rail *H* of the right length to reach from one leg brace *B* to the other (Fig. 193).

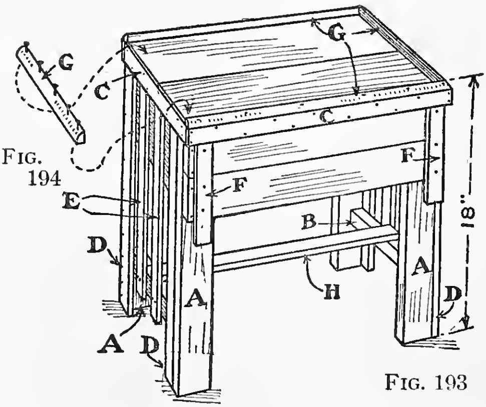


Fig. 194

Fig. 193

Fig. 193. — Detail Showing Stool Ready for Upholstering

Fig. 194. — Strip for Forming Ledge around Upholstering Material

Strips *G* (Figs. 193 and 194) form a ledge around the upholstering filling. If you can get some quarter-round moulding it will save your planing the tops round as shown. When you have nailed the strips in place, trim off the ends to make round corners.

Upholstering. Fill in between the strips *G* with dampened excelsior. Pack this in solid, and let it project ½ inch or so above the top of the strips. Cover the excelsior with a layer of cotton to prevent its showing through the covering material, then cut a piece of cambric or other strong goods, place it over the cotton, and tack it along one edge; draw the cloth tight over the stool top, and tack along the opposite edge (Fig. 197). The low places will now show up, and these must be filled with excelsior and cotton until a nicely formed top is obtained. At the corners especially, it will be necessary to build up by filling in additional excelsior. Give plenty of time to this work. Bear in mind that unless the upholstering is well done, the entire appearance of the stool will be spoiled. When you are satisfied that the top has been filled as well as you can fill it, pull the covering material down over the ends, tack it in place, and trim off the edges.

Finishing. — The woodwork of the stool should be sandpapered next, then painted or stained to match your desk.

Colored cretonne makes a pretty **Covering for the Seat,** but you can use denim or any of the imitation leather material sold for upholstering and wall coverings. Place the material over the stool top, tack along one side, smooth out all wrinkles, and tack the opposite side, then tack the end edges (Fig. 195). Carefully fold over the lapping corners to make as neat a looking piece of work as possible. After the edges have been tacked, finish them off with a piece of *gimp braid*, fastening

Fig. 195

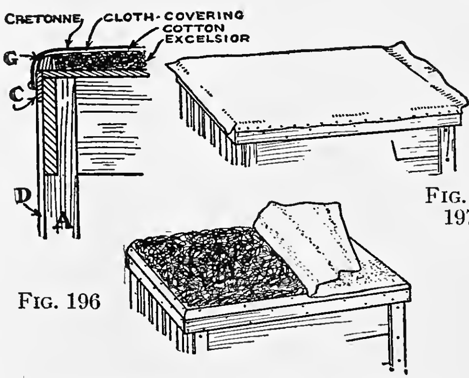


Fig. 197

Fig. 196

Fig. 195.—Section Through Corner of Stool
Figs. 196 and 197.—Details of Upholstering.

the braid with round-head tacks placed at equal distances apart, as shown in Fig. 177. If you have used imitation leather, you can get tacks with heads to match. The edges of this material can be turned under, and tacked with small-head tacks. Then the large-head tacks can be placed so as to cover the heads of the small-head tacks.

FIG. 200

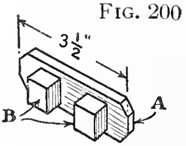


FIG. 199

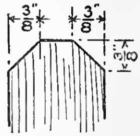


FIG. 198

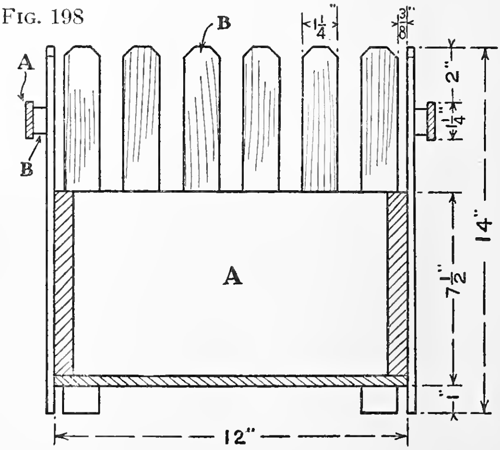


FIG. 198. — Cross-Section of Waste Basket Shown in Fig. 178
FIG. 199. — Detail of Tops of Side Strips
FIG. 200. — Detail of Handle

The Waste-Basket in the photograph of Fig. 178 has a grocery-box foundation (*A* Fig. 198) and sides built up of short lengths of lattice-strips or of laths planed smooth upon both sides or of strips ripped out of box boards. It is suggested that you get a box of about the size used in the model, 7½ inches deep 8 inches wide and 12 inches long. The box the author used was too long for the purpose so had to be cut down. If your box needs alteration you will not find the work much of a trick.

Prepare all side and end strips at one time, the corner strips longer than the intermediate strips, as shown. Trim the upper corners with a small saw or chisel, as shown in Fig. 199. Tack the corner strips in place first. Be careful to get the projections of the lower ends equal, and to get

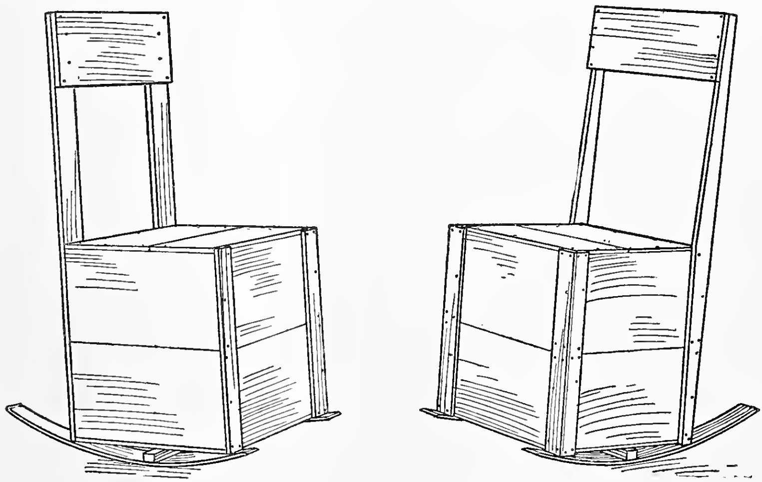


FIG. 202 FIG. 203

FIGS. 202 and 203. — Rockers with Box Seats and Barrel-Stave Rockers Shown in Fig. 201.

them parallel to and 3/8 inch away from the box corners (Fig. 198). Divide the spaces between the corner strips equally. Figure 200 shows how the handles are made of a strip *A* and two blocks *B*. Nail the strip *A* to blocks *B*, then fasten the blocks to the ends of the basket (Fig. 198).

The basket will now be ready for finishing. It is suggested that you finish the wood in one of the ways suggested for the stool.

The Box Rockers in Fig. 201 are made of soap boxes, with barrel-stave rockers, and backs made of strips cut from box boards or any other boards that may be at hand.

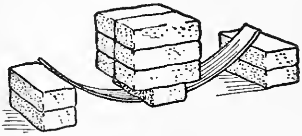


Fig. 205

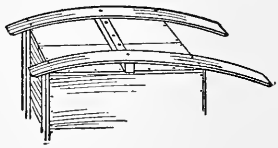
Fig. 206


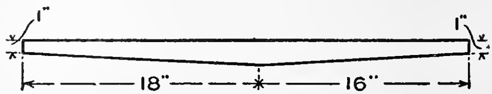
Fig. 204


Fig. 204. — Detail of Chair Back Upright
Fig. 205. — Warping Barrell-Staves for Rocker
Fig. 206. — How the Rockers are Attached

The seat of each chair is made of two soap boxes placed with their open tops together. In the case of one chair, that shown in Fig. 202, the boxes are held together by means of a pair of strips nailed to the front and by means of another pair about 3 feet long (forming the uprights of the chair back) nailed to the back. A board fastened to the uprights at their top completes the chair back.

The rocker shown in Fig. 203 has its boxes held together with strips fastened to the front corners, and a pair of strips long enough to form the chair-back uprights fastened to the box ends at the back. A diagram of the uprights is given in Fig. 204. When you have nailed the uprights of the chair back to the boxes, fasten a board across them at the top.

Warping the Rockers. Barrel-staves are not warped

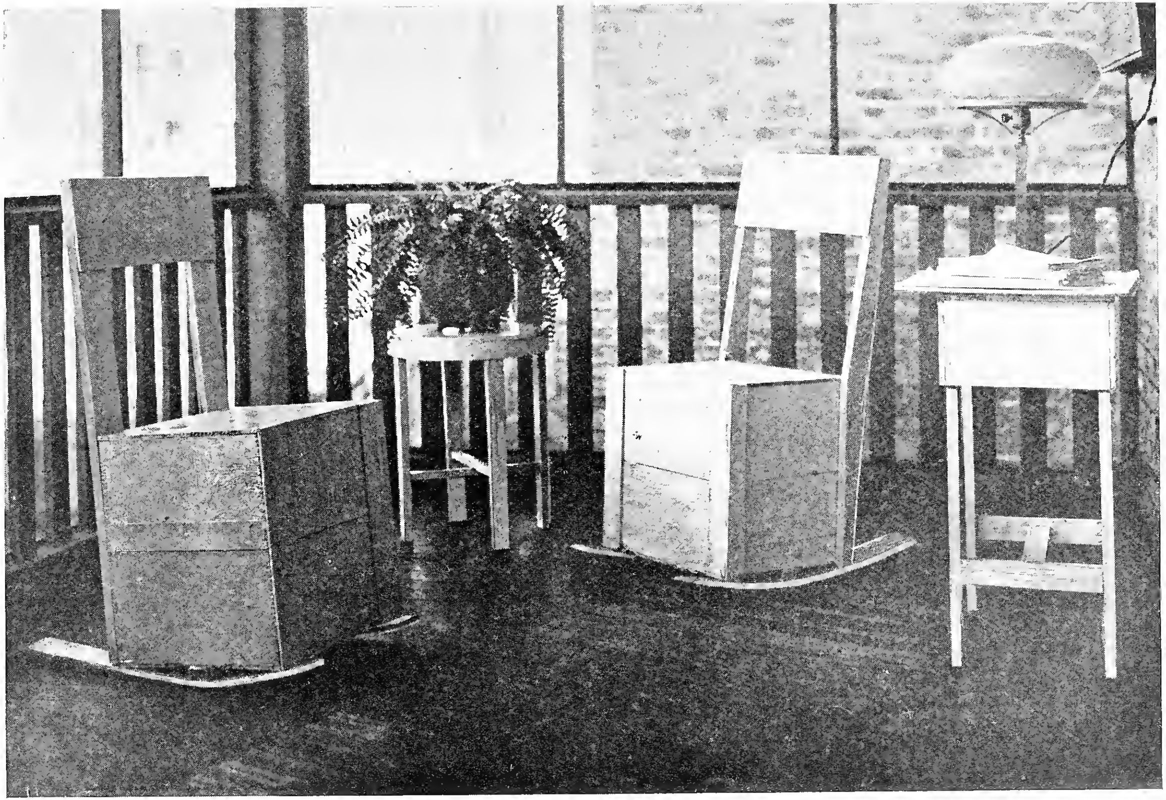


Fig. 201.—Two Box Rockers, a Table and a Tabouret.

enough for rockers. To increase the warp, place the staves in a wash-tub filled with hot-water, and allow them to soak for a half hour or so. Then rest the ends of the staves on boxes or piles of bricks, and weight down the center with a pile of bricks or other weight, as shown in Fig. 205. Make the warp greater than is wanted, because when the weight has been removed the stave will straighten out somewhat.

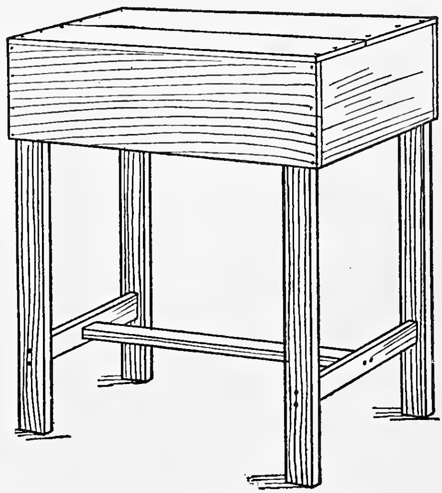
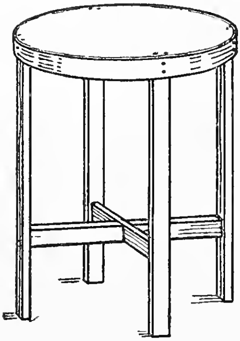


Fig. 207. — Box Table Shown in Fig. 201

Figure 206 shows how the rockers are attached. Nail a strip, measuring 1¼ inches thick, across the chair bottom at the center, then nail the staves to this strip and to the box, allowing several inches of the staves to project beyond the chair front, the remainder of the length at the rear.

One of the simplest ways to make

A Table is shown in Fig. 207. The box used is inverted so that the bottom becomes the table top. The legs are strips 3 inches wide and 28 inches long. Fasten one leg in each corner of the box. Measure the distance between each end pair of legs, cut a pair of strips of a length equal to this distance, and fasten a strip between each end pair of legs 4 or 5 inches from the ends, for braces. Cut another strip of the right length to fit between these leg braces, and fasten it to them for an additional brace.



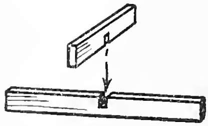


Fig. 210. — Leg Crosspeices

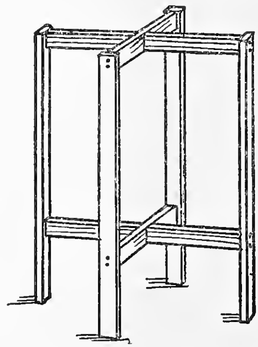
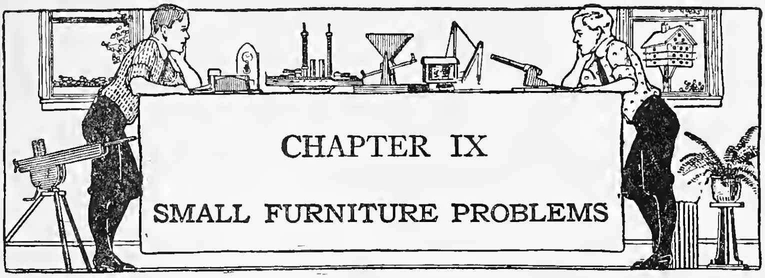


Fig. 208. — Tabouret Shown in Fig. 201

Fig. 209. — Framework of Tabouret

The Tabouret in Fig. 208, also shown in Fig. 201, has a top made of a cheese-box cover. The legs are 1½ inches wide by a length to be determined by the height of tabouret you want. Twenty-one inches is a medium height. The legs are connected by two pairs of crosspieces (Fig. 209), each notched at the center as shown in Fig. 210, so that the strips will *interlock* one another. The diameter of the cheesebox-cover will determine the length of the strips. Nail the legs to the ends of the braces, then nail the cover to their tops.



CHAPTER IX

SMALL FURNITURE PROBLEMS

The description of home-made furniture in this chapter has been confined to the making of the smaller pieces. Some of you boys may be disappointed not to find designs for a library-table, book-case, clock, Morris chair, and pieces of similar proportions, but letters received from readers since the publication of the handicraft book preceding this one, would indicate that small pieces are the more popular. Many boys cannot make large pieces of furniture because of the cost of material.

The Material to use in furniture making will be determined largely by what the local market offers. Perhaps you can get any kind of wood that you want. The quantity required for the furniture shown upon the following pages is small, and the difference in costs between the finer and commoner woods will be so little as to be almost negligible. The wood used in the models shown in this chapter is *oak*. *Red oak* and *white oak* are standard woods for furniture just as are *mahogany* and *walnut*. If you intend to finish the work with stain, nothing is better than oak or *chestnut*. Of the softer woods, *white-pine*, *western-pine*, *cypress* and *whitewood* are easily worked. With tools nicely sharpened, and, of course, no good workman uses tools that are not, hard woods are as easily worked as soft woods.

Finishing. The kind of finish to put on work will be determined by the kind of wood. If you use oak, chestnut, or other hard wood, having a pretty, open grain, do not paint it, because paint will conceal the grain markings. Instead, apply a finish that will accentuate the markings. The best method is to stain the surface, then shellac and varnish it, or simply wax it after staining. If you varnish the wood after staining it, the open grain must be filled with wood-filler before the varnish is applied, so the wood will present a smooth glassy surface. If you stain and wax the surface, filler is not necessary. Filling the grain conceals the markings to a certain extent.

You can buy ready-prepared wood stains in any colors wanted, at most paint stores. If you wish to, however, you can make up a stain that will answer the purpose every bit as well as a boughten stain, by thinning oil paint with turpentine. Pretty effects can be produced by rubbing oil paint of one color into the grain, then wiping the surface clean, and applying a turpentine stain made of oil paint of a contrasting color. The author does not want you to try out any such schemes as this on a completed piece of furniture, however. Use a waste piece of wood to experiment on, and be satisfied that you will like the results before applying stain to your work.

Soft wood has a close grain. If it has a well-defined grain, like cypress, stain will make a pretty finish. Shellacing and then varnishing is a method of finishing commonly applied to soft woods.

When it comes to finishing furniture with paint, white-enamel makes a most desirable finish. Give the surfaces two coats of flat-white paint, then one coat of white-enamel. One difficulty with white-enamel is that unless the best grade is used it soon turns more or less yellow. Never thin white-enamel paint with linseed-oil, because this is bound to make it turn yellow; use turpentine as a thinning *medium.* Painting makes it possible to conceal defects to a certain extent, but do not do careless work with the idea that you can cover up with paint and putty and get away with it. You can't do it. You are not a good enough camouflage artist to hide defects in work that is to be inspected at close range. Putty is to be used as a means of filling nail holes, over the heads of *countersunk* nails, and for filling in around joints. Work it in after the first coat of paint has dried. It holds better then, because the holes and joints are partly filled with paint.

Before you apply any finish to work, be certain that all surfaces have been gone over thoroughly with sandpaper and made smooth.

In the furniture designs shown in Figs. 211 to 214, you will notice that there is a similarity in parts. This duplication of parts will simplify marking out the work, if you make up the several pieces of furniture, because having one part in each shape, you can mark around them in laying out like pieces.

The number of pieces of wood required for

The Waste-Basket shown in Fig. 211, and their dimensions, are indicated in the material bill (Fig. 215), patterns for the pieces are given in Figs. 216 and 218. The frame around the top of the basket (Fig. 217) must be of the exact width and length of base *A*. Cut strips *B* and *C* of the sizes given in Fig. 215, but, in nailing them together

MATERIAL·FOR·WASTE-BASKET		
PIECES	DIMENSIONS	PARTS
1	3/4"x7 3/4"x7 3/4"	A
2	5/8"x1 1/2"x7 3/4"	B
2	5/8"x1 1/2"x6 1/2"	C
8	1/4"x1 1/4"x18"	D
8	1/4"x1 1/4"x17 1/2"	E

FIG. 215

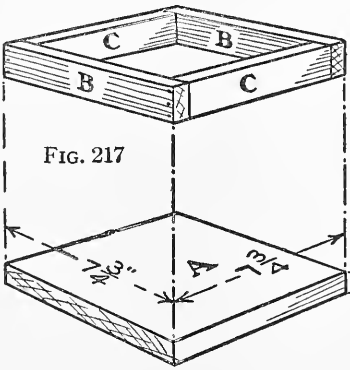


FIG. 217

FIG. 216

FIG. 218

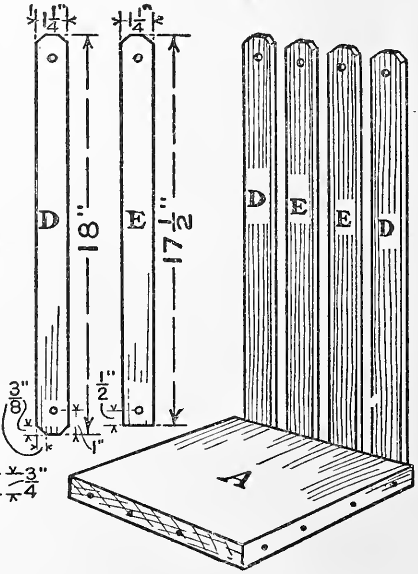


FIG. 219

FIG. 215. — Material Required for Waste-Basket Shown in FIG. 211
FIG. 216. — Detail of Base
FIG. 217. — Detail of Top Frame
FIG. 218. — Detail of Side Strips
FIG. 219. — Assembling

use the base board as a guage, so as not to get the frame larger or smaller.

Side strips *D* (Fig. 218) project ½ inch below the base board of the waste-basket; side strips *E* (Fig. 218) come

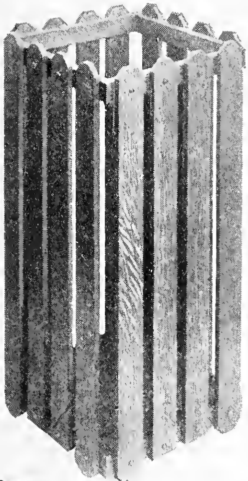


Fig. 211. Waste-Basket.

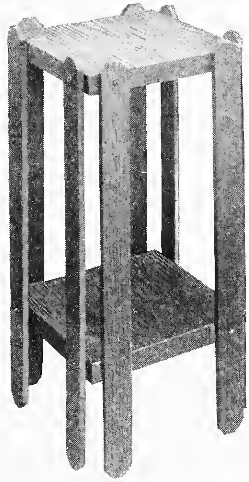


Fig. 212.—Tabouret.

Fig. 213.—Plant-Stand.

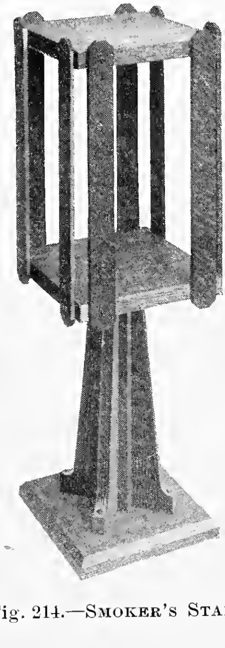


Fig. 214.—Smoker's Stand.

MATERIAL · FOR TABOURET

PIECES	DIMENSIONS	PARTS
2	3/4" × 7 3/4" × 7 3/4	A
8	1/4" × 1 1/4" × 18	B

FIG. 220

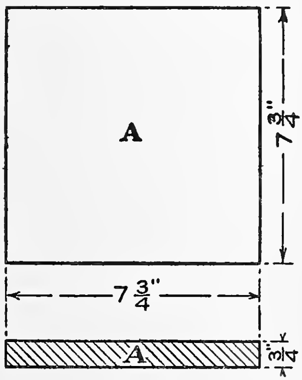


FIG. 221

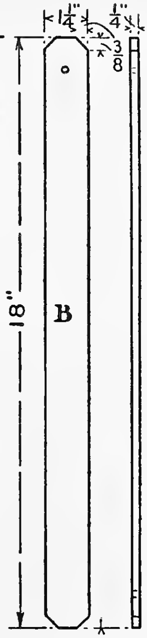


FIG. 222

FIG. 220. — Material Required for Tabouret Shown in Fig. 212
FIG. 221. — Plan and Section of Base Block
FIG. 222. — Face and Edge of Side Strips

flush with the bottom of the base board. The projecting lower end of strips *D* form feet. Cut off the corners of the upper ends, and the corners of the lower ends of strips *D*, as shown.

Fasten the side strips to the edge of the base board, and to the sides of the upper frame, with *round-head blued iron finishing-screws* 3/16-inch in diameter. Use 1-inch screws for the lower ends, and 3/4-inch screws for the upper ends. Drill large enough holes through the side strips so the screw shanks will fit loosely in them, and if you have used hard wood, drill holes a trifle smaller than the screws part way into the edges of the base board and the top frame. When driving screws into hard wood, coat the threads with soap to make driving easier.

The Tabouret shown in Fig. 212 is made of pieces similar to those used in the waste-basket, but it does not require as many kinds of pieces, or as many of each kind. Figure 220 shows a list of material and Figs. 221 and 222 show the dimensions.

The Plant-Stand in Fig. 213 is made of pieces of three shapes (Fig. 223). For the material list, see Fig. 224, for patterns of the pieces, see Figs. 226 to 228. The base board has its upper edge beveled (Fig. 226); the edges of the shelf board are left square.

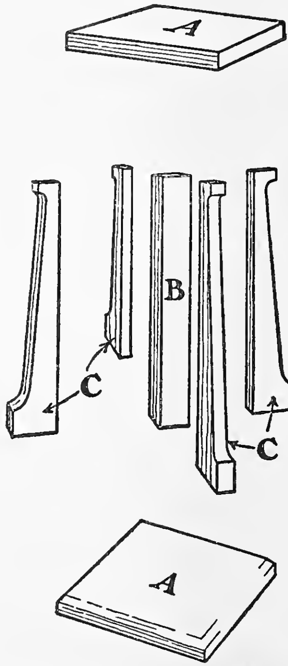


Fig. 223. — Parts Required for Plant-Stand Shown in Fig. 213

Brackets *C* require careful marking out and sawing. Use a bracket-saw or coping-saw (Figs. 18 and 19, Chap. II) for cutting the curves. Be careful to get all four brackets alike. In fastening them to center-post *B*, use glue and round-head screws, unless the wood is soft, in which case the brackets can be fastened with finishing nails. Screw down through the lower bracket end into the base board, and up through the upper bracket end into the shelf. Be careful to center the base board and shelf board on the center post, and also one exactly over the other. If you don't center them you will have a poor looking piece of work.

FIG. 224

MATERIAL · FOR · PLANT-STAND		
PIECES	DIMENSIONS	PARTS
2	3/4" x 7 3/4" x 7 3/4"	A
1	1 3/4" x 1 3/4" x 12"	B
4	3/4" x 2 1/4" x 12"	C

FIG. 225

MATERIAL · FOR · SMOKER'S · STAND		
PIECES	DIMENSIONS	PARTS
3	3/4" x 7 3/4" x 7 3/4"	A
1	1 3/4" x 1 3/4" x 12"	B
4	3/4" x 2 1/4" x 12"	C
8	1/4" x 1 1/4" x 14"	D

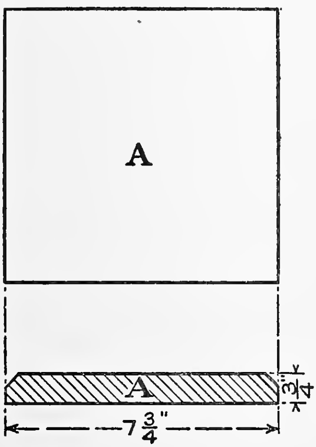


FIG. 226

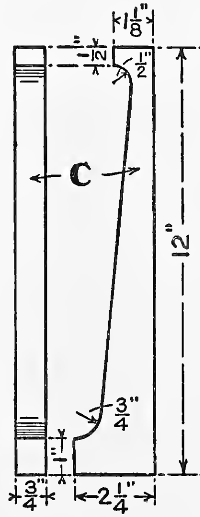


FIG. 228

FIG. 227

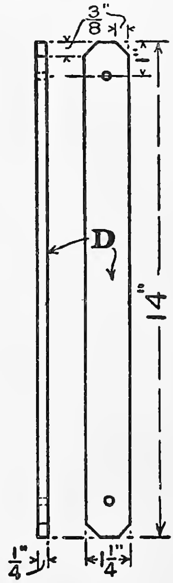


FIG. 229

FIG. 224. — Material Required for Plant-Stand Shown in Fig. 213
FIG. 225. — Material Required for Smoker's Stand Shown in Fig. 214
FIG. 226. — Plan and Section of Base and Shelves *A*
FIG. 227. — Detail of Base Center Post *B*
FIG. 228. — Side and Edge of Base Brackets *C*
FIG. 229. — Side and Edge of Side Strips *D*

The Smoker's Stand in Fig. 214 is a development of the plant-stand design. It is just like it, with the addition of a second shelf supported by side strips screwed to the edges of the two shelves. Figure 225 gives a list of material. Figure 229 shows a pattern of side strips *D*.

The Book-Trough and Magazine-Stand shown in Fig. 230 makes a most convenint piece of furniture for a library or living-room, to hold books and magazines of recent issue.

Figure 232 shows a material list. Only five pieces of boards are required, two end pieces (*A*), two trough strips (*B*), and a shelf (*C*). If you order 1-inch boards planed upon both faces, known as *surfaced-two-sides* (*s*-2-*s*), they will measure between $\frac{3}{4}$ inch and $\frac{13}{16}$ inch thick when you get them, because 1-inch boards are sawed about $\frac{7}{8}$ inch thick, nowadays, and about $\frac{1}{8}$ inch is taken off in *surfacing*. In the case of this piece of furniture, and the pieces preceding it, $\frac{3}{4}$-inch stock will be in better proportion than thicker material.

Figure 233 is a cross-section of the completed trough and stand, with dimensions, Fig. 234 is a side view, Fig. 235 is an end view, and Figs. 237 and 238 are patterns of the shelf and trough boards.

You will find upon the detail drawings every measurement necessary for preparing the parts. The ends should be cut first. Saw these to the right length and width, and cut the side edges to the right taper. Then make a cardboard pattern, or *templet*, of the lower end, with the curve carefully laid out (Fig. 236), and mark out around this upon each piece of board. With a bracket-saw or coping-saw cut the curve, sawing close to the lines, and with a chisel and sandpaper smooth up the edge.

With the end pieces cut, *mortises* to receive the ends of

Fig. 230.—Book-Trough and Magazine-Stand.

Fig. 231.—Telephone Table and Chair.

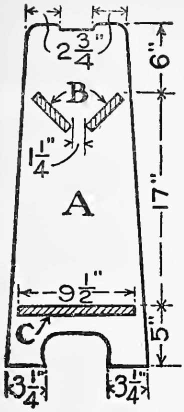


FIG. 233

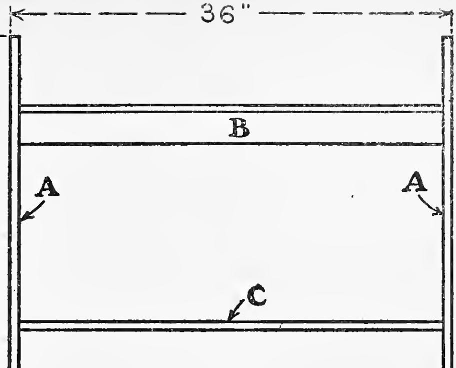


FIG. 234

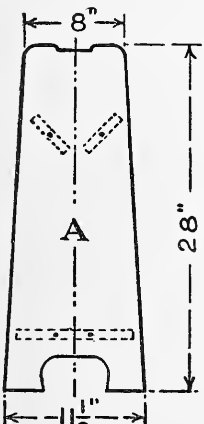


FIG. 235

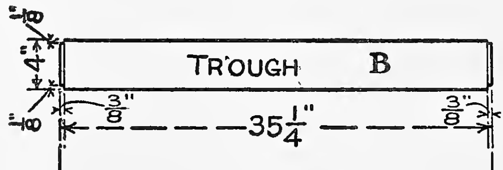


FIG. 238

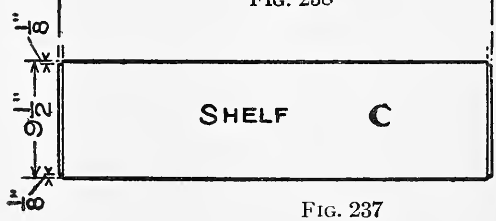


FIG. 237

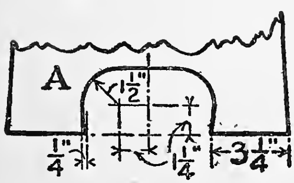


FIG. 236

MATERIAL · LIST		
NO. PIECES	DIMENSIONS	PARTS
2	3/4"×12"×28"-S-2-S	ENDS
2	" ×4"×36" "	TROUGH
1	" ×10"× " "	SHELF

FIG. 232

FIG. 232.—Material Required for Book-Trough and Magazine-Stand (Fig. 230)
FIG. 233.—Cross-Section FIG. 234.—Side View FIG. 235.—End View
FIG. 236.—Bottom of End Pieces FIG. 237.—Shelf FIG. 238.—Trough Board

the trough and shelf boards must be marked out and cut. Upon the accuracy of this work depends the perfect fitting together of parts. The mortises for trough strips *B* must be placed at right angles to each other, and all mortises must be $\frac{1}{8}$ inch less than the board-end measurement, on all sides. Cut them $\frac{1}{2}$ inch deep. *Tenons* must be prepared upon the board ends to fit the mortises, as indicated upon the diagrams (Figs. 237 and 238). The shoulders of these tenons will lap over the edges of the mortises when the parts are assembled, and will conceal them; they will also help to brace the work. The mortises must be cut $\frac{1}{8}$ inch deeper than the tenons, and the tenons must be made to fit loosely enough so that when they are coated with glue, previous to assembling the parts, they will drive in easily, yet be tight enough to make a snug fit. Use a chisel with which to cut the mortises. Cut down along the sides, first, then chip out the wood between, and smooth off the bottoms. Cut the shoulders with a fine-tooth saw.

With the mortises and tenons carefully prepared, the book-trough and magazine-stand can be glued up. Glue alone will hold the work, but screws must be driven in to reinforce the joining. Four screws driven through each end, one into each of the book-trough strips, and two into the shelf board, as indicated in Fig. 235, will be sufficient. Locate the holes in the positions shown, and with a *gimlet* or *wood-bit* drill holes through the end pieces, and into the ends of boards *B* and *C*, making the holes in the end pieces a trifle larger than the screw shank, the holes in the ends of boards *B* and *C* a trifle smaller than the screw shanks.

Buy round-head blued iron finishing-screws $\frac{3}{16}$-inch in diameter and 2 inches in length, for the work.

A Telephone Table and Chair are two serviceable pieces of furniture which a handy boy can easily make. If there is no telephone in the house, the table and chair will be useful in the front hallway — the table to hold a card-tray, the chair for the stranger who is awaiting mother or father.

The Table, shown in Fig. 231, has a shelf on which to keep the telephone directory. This shelf is placed at the right height so the chair seat will slide underneath it, and the chair back has been made low enough to slide under the edge of the table top, so the chair can be kept entirely under the table when not in use.

Figure 239 shows a bill of material for the table. The table top is 16 inches square, therefore it will have to be made of two pieces. Unless you already have had experience in glueing up work, the author advises you to have this piece glued up at a mill. It will not cost much. However, if you want to do the work yourself, Fig. 245 shows how to go about it. Make the top of two pieces of equal width. The first thing to be certain of, after planing up the pieces, is that the faces are straight and true, and that the joining edges are exactly square, lengthwise and crosswise. With these conditions met, place the pieces back to back in your bench-vise, with the joining edges even with one another, and square lines across the edges at the center and near each end, to mark the positions for dowel-pin holes. At the center of these lines bore $\frac{1}{4}$-inch holes about $1\frac{1}{2}$ inches deep, being careful to bore them exactly at right

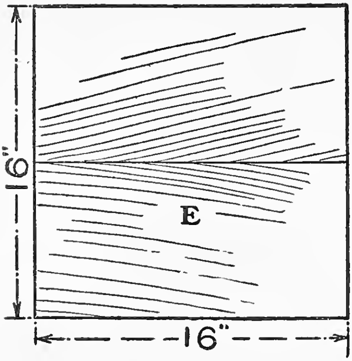


Fig. 242

MATERIAL		
PIECES	DIMENSIONS	PARTS
4	1¼"×1¼"×2'-5¼"	LEGS A
2	¾"× 2"×12¼"	RAILS B
2	" × " ×11½"	" C
2	" × " ×12¼"	" D
2	" × 8"×16"	TOP E
1	" × 9½×13¾"	SHELF F

Fig. 239

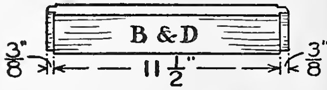


Fig. 243

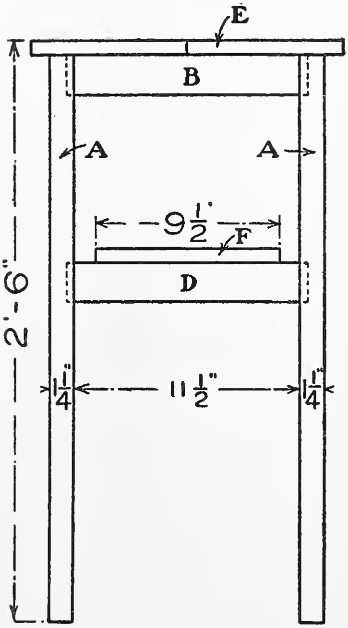


Fig. 240

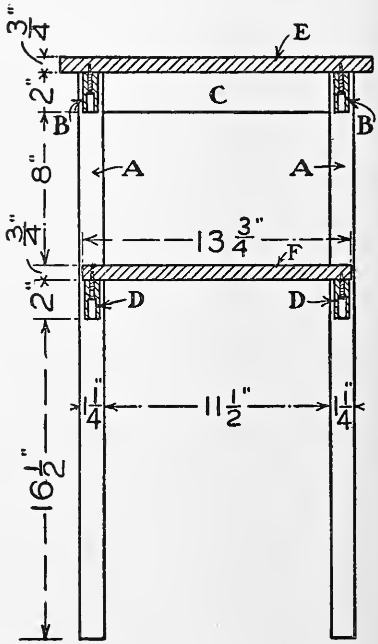


Fig. 241

Fig. 239. — Material Required for Telephone Table Shown in Fig. 231
Fig. 240. — Side View of Table
Fig. 241. — Cross-Section of Table
Fig. 242. — Plan of Table Top *E*
Fig. 243. — Detail of Rails *B* and *D*

angles to the edges. Get a dowel-stick to fit the holes, and cut dowel-pins from it a trifle shorter than the combined depth of a pair of the holes. Coat the pins with glue, also

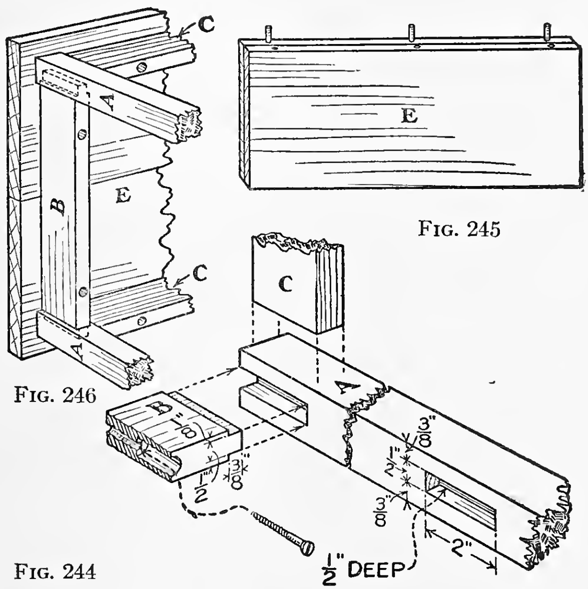


FIG. 245

FIG. 246

FIG. 244

FIG. 244. — Detail Showing Mortise-and-Tenon Joints of Legs and Rails
FIG. 245. — Detail of Table Top
FIG. 246. — Detail Showing Legs, Rails and Top Assembled

both edges of the boards, then drive the pins into the holes. Put the work in clamps, and allow it to remain until the glue has set. Now, if you have done the work correctly, you will have a perfectly joined top.

Figure 240 shows a side view of the table, and Fig. 241 shows a cross-section with the principal dimensions. Rails

B and *D* have *tenons* cut upon their ends (Figs. 243 and 244), and *mortises* for these to fit in are cut in the legs (Fig. 244). Rails *C* are not tenoned; they fit between the legs.

Top *E* and shelf *F* are screwed in place, the screws passing through the rails into them. As it would require very long screws if you ran them entirely through the rails into the table-top and into the shelf, holes are bored halfway through the rails (Fig. 244), and then holes a trifle larger than the screw shank, but smaller than the heads, are drilled through the rest of the way, so screws about 1½ inches long can be used. Provide two screw-holes for each rail, one near each end (Fig. 246).

To assemble the table, after having cut every piece of the correct size, and prepared the leg mortises and rail tenons, first coat the mortises and tenons with glue, and drive the tenons into the mortises. Then upon the under side of top *E* mark out the positions for the legs, and screw rails *B* to the top; coat the ends of rails *C* with glue, slip them between the legs, and screw them to the top. Screw rails *D* to shelf *F* in a similar manner.

In Fig. 247 is specified the material required for

The Chair. The legs are *mortised* to receive the ends of the rails, in the same manner as those of the table are mortised. That is to say, mortises are made for the ends of rails *C*, *D*, *E*, *F*, *G*, and *I*. Mortises for side rails *H* would cut into those for rails *C* and *F*, so rails *H* are not tenoned, but are cut to fit between the legs. You will see by Fig. 249, which is a plan view of the chair, that seat *J* is notched at the corners to fit around legs *B*; also, that

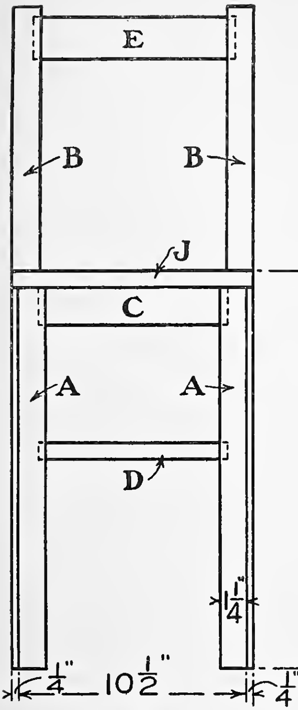


FIG. 248

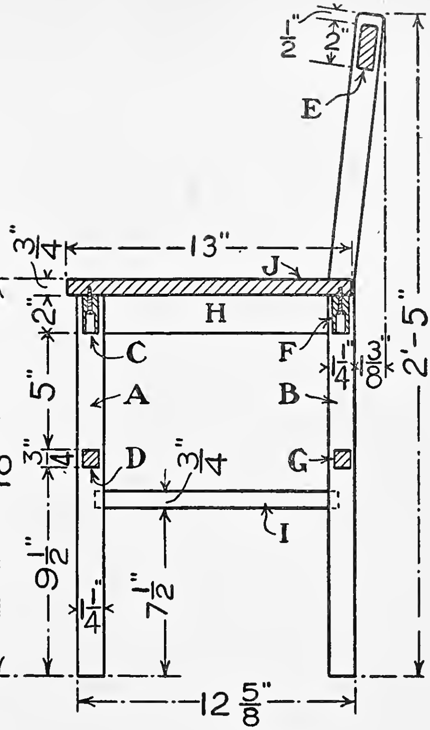


FIG. 250

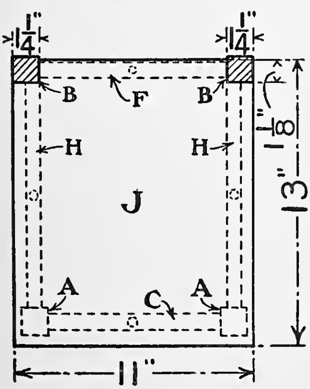


FIG. 249

MATERIAL		
PIECES	DIMENSIONS	PARTS
2	$1\frac{1}{4}$" × $1\frac{1}{4}$" × $17\frac{1}{4}$"	LEGS A
2	" × $2\frac{5}{8}$" × 2'-5"	" B
1	$\frac{3}{4}$" × 2" × $8\frac{3}{4}$"	RAIL C
1	" × $\frac{3}{4}$" × "	" D
1	" × 2" × $9\frac{1}{4}$"	" E
1	" × " × "	" F
1	" × $\frac{3}{4}$" × "	" G
2	" × 2" × $10\frac{1}{8}$"	RAILS H
2	" × $\frac{3}{4}$" × $10\frac{7}{8}$"	" I
1	" × 11" × 13"	SEAT J

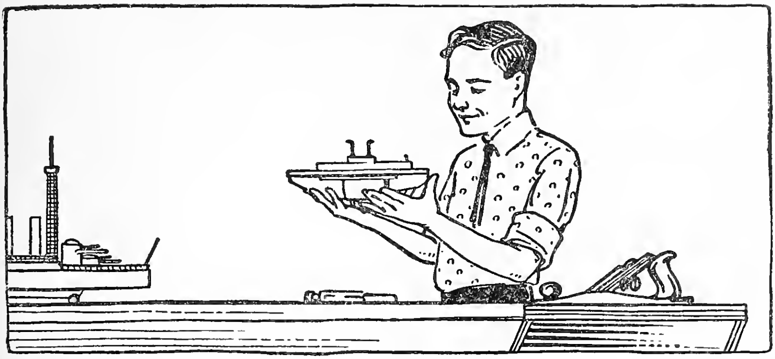
FIG. 247

FIG. 247. — Material Required for Telephone Chair Shown in Fig. 231
FIG. 248. — Front View FIG. 249. — Plan FIG. 250. — Cross-Section

legs *B* are set ½ inch farther apart than legs *A*, which makes it necessary to run rails *H* into the center of the width of legs *A*, and into the inside half of legs *B*. Bore one hole through the center of the edge of rails *C*, *F*, and *H*, in the same manner as holes were bored through the table rails (Fig. 244), to provide for attaching the chair seat. (Fig. 250).

In assembling the chair, drive the tenons on rails *C* and *D* into the mortises cut in legs *A*, then drive the tenons of rails *E*, *F*, and *G* into the mortises cut in legs *B*. Connect legs *A* and *B* by means of rails *I*, and, finally, screw rails *C*, *F*, and *H* to the under side of the seat.

When you have assembled your table and chair, you may find that the legs are a trifle uneven. The way to correct this is to stand the table, then the chair, upon a surface known to be level, and note the short leg. Cut a block of wood of the right thickness to slip under this leg. Then slide this block around each side of the other legs, marking where its top comes on each face of each leg. Trim off the legs at these points.



PART II

War Toys and Mechanical Toys

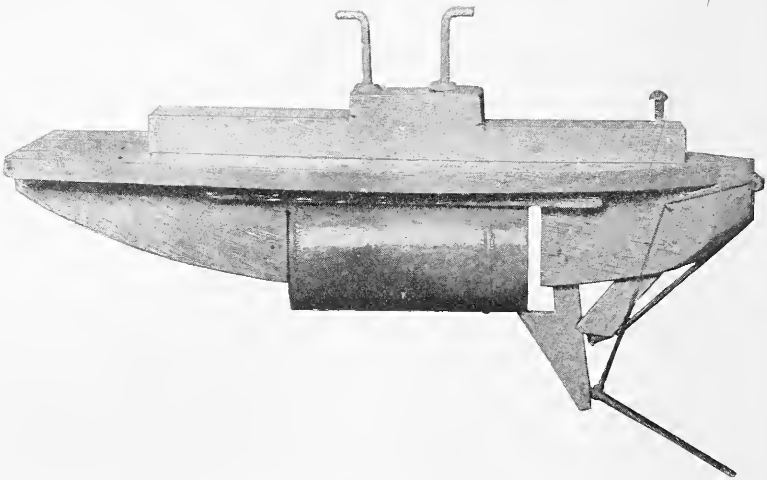


Fig. 268.—A Toy Submarine that Dives then Rises to the Water's Surface (See Chapter 11).

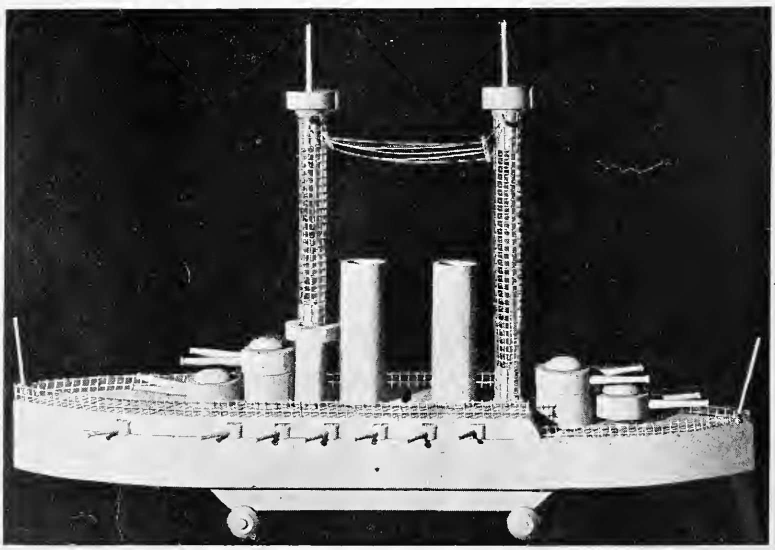
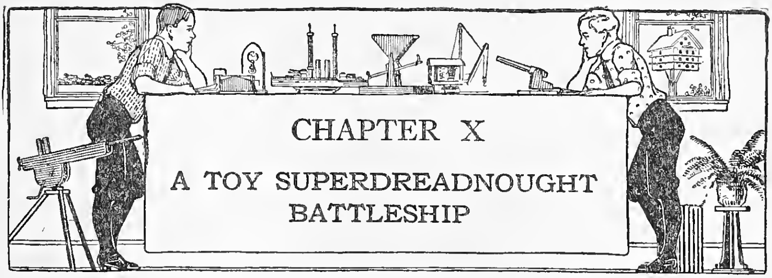


Fig. 251.—A Superdreadnought Toy Battleship (See Chapter 10).



CHAPTER X

A TOY SUPERDREADNOUGHT BATTLESHIP

To make a model that would be an exact reproduction of a modern battleship, you would not only have to possess a set of scale drawings of the ship, but an abundance of patience, and a willingness to devote lots of time to the work. The author would be glad if you could make an exact model, because he knows that you would get a great deal of enjoyment and practical experience out of the work, but he suggests that your first model be simple. You can elaborate upon a second model as much as you please.

The way to make a simplified model of a battleship, building, piece of machinery, or any other structure, is to get a picture of it, or to look upon the object itself, and pick out the half dozen or so parts which determine its contour; then reproduce these parts in as nearly the correct proportion as you can. Take the author's model, shown in the photograph of Fig. 251, for example. The essential parts are not many. They are the *hull*, *deck*, *masts*, *funnels*, *main-battery guns* and *turrets*, and the *secondary-battery guns* below the deck. The *deck-rails*, *fighting-tops*, and *wireless aerial* might be omitted without destroying the lines which give the ship its form. Details other than those shown upon the model illustrated can be added if you wish to spend more time upon the work.

Materials. The best material for model making is white pine, but cypress, spruce, or any other soft wood, will serve the purpose. For the hull of the battleship model shown in Fig. 251 a piece of 2 by 4 is of the right width and thickness. The funnels, turrets, and fighting-tops also can be cut out of a 2 by 4. A board ⅝ inch thick is required for the *superstructure-deck.* The masts require a narrow strip of *wire cloth* with ¼-inch mesh, and four spools. The deck rails are also made of wire cloth. Spools are used for wheels to mount the model on. The guns are cut from dowel-sticks ⅛ inch and ¼ inch in diameter, the small *gun mounts* are cut from a ⅜-inch dowel-stick. The pins connecting the various parts are cut from ¼-inch dowel-sticks. *Button-moulds* 1¼ inches in diameter fit over the ends of the gun turret *pivots.*

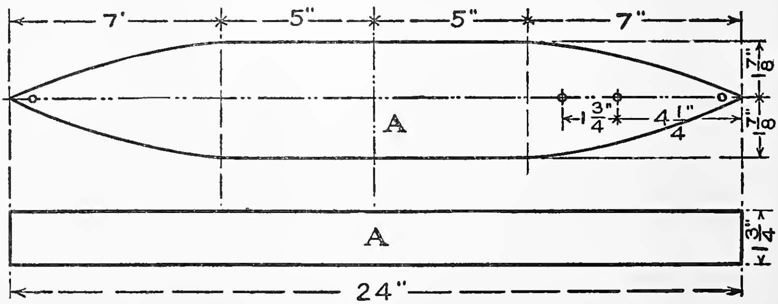


Fig. 252. — Plan and Side Elevation of Hull

Figure 252 shows a plan and side elevation of

The Hull, with all of the dimensions necessary for cutting it out. Figure 253 shows the completed hull. The curves of the ends should be alike, and the best way to get them alike is to draw a *center-line* lengthwise, and another center-line crosswise of the block; then mark out one-half of the outline of one side, drawing the straight line with a ruler, the curved line freehand. Trace this much upon tissue-paper, reverse the paper, and transfer the line each side of the center-lines, to complete the outline. First, cut out the block roughly with a saw, then finish up close to the outline with a plane, and sandpaper the edges smooth.

FIG. 253. — The Completed Hull

The Superstructure-Deck (*B*, Figs. 254 and 255) may be marked out by placing the hull block upon a board ⅝ inch thick, and marking out around its sides. The deck

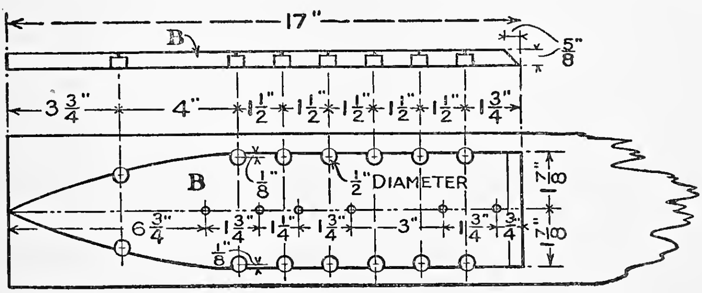


FIG. 254. — Plan and Side Elevation of Superstructure-Deck

piece is a trifle more than two-thirds of the length of the hull. The dimensions are on the diagrams (Fig. 254).

Openings for the guns must be cut in the deck piece along the side edges. The openings are made by boring ½-inch holes ½ inch deep (Figs. 251 and 255). They are located in Fig. 254. The centers are placed ⅛ inch inside of the

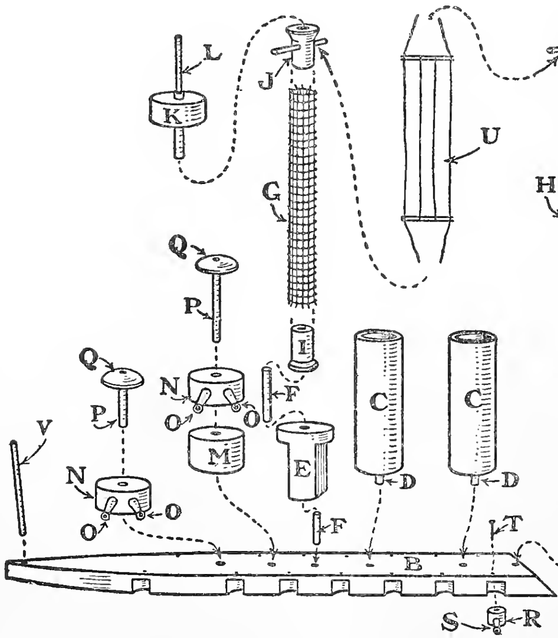


FIG. 255. — Detail Showing How the Superstructure-Deck, Funnels, Masts, Fighting-Tops, Gun-Turrets, and Wireless Aerial are Assembled

edges, so that brads can be driven through the centers for pivots for the guns. Bore the holes before cutting out piece *B*, so there will be no danger of splitting the edges. Be careful to bore all holes of equal depth.

Funnels C, conning-tower E, fighting-tops K, turret bases M, and *turrets N* (Fig. 255) are most easily prepared as shown in Figs. 256 and 257. If you can get round sticks of this diameter — rug-poles or portiere poles, — use them; otherwise, plane up two blocks, one 1½ inches square, the other 1¾ inches square, describe a circle with the given radii upon the ends of the blocks, and whittle or plane the edges until the blocks are round. Finish up the surfaces with sandpaper. With the blocks prepared, it is an easy matter to saw them up to the lengths required.

The tops of

The Funnels will look better if bored out for a depth of ½ inch or so (Fig. 255). Bore the holes before rounding the block the funnels are to be cut out of, to prevent splitting. The funnels are fastened to the deck with dowel-pins *D* (Fig. 255). Bore the pin holes in the deck where located in Fig. 254, and in the center of the funnel ends. Coat

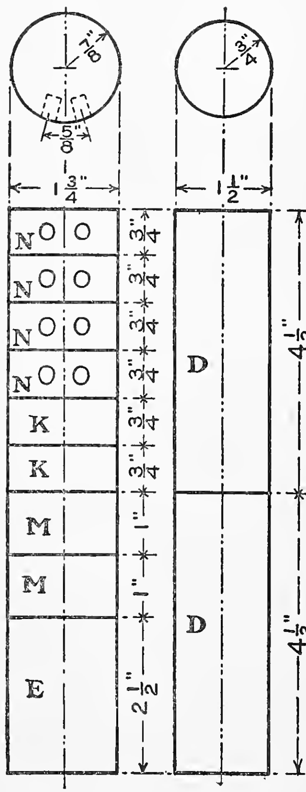


FIG. 257 FIG. 256

FIG. 256. — Detail of Funnels

FIG. 257. — Detail of Conning-Tower, Fighting-Tops, Turret Bases and Turret

the dowel-pins and funnel ends with glue, before driving the dowel-pins into the holes.

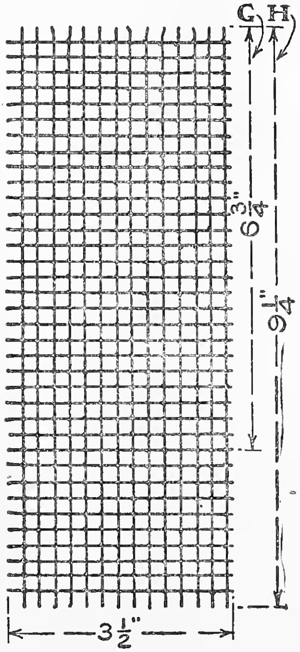


FIG. 258. — Pattern for Cutting Wire Cloth for Masts

Flatten two opposite sides of block *E* (Fig. 257) for

The Conning-Tower, by cutting away a section of each side, as shown in Fig. 255. Peg this block to the deck with a dowel-pin driven into a hole bored at the point located in Fig. 254.

The Masts are built up of strips of wire cloth (*G* and *H*, (Fig. 258) rolled into cylinders with a spool inserted in each end (*I* and *J*, Fig. 255). The strips of wire cloth can be rolled around the spools. Turn in the raw side edges of the wire strips so the wire cylinders will hold their shape. The sticks running through spools *J* (Fig. 255) are *crosstrees* from which the wireless-telegraph *aerial* (*U*) is suspended. Peg spool *I* of the *foremast* to block *E* with dowel-pin *F*, and peg spool *I* of the *aftermost mast* to the deck where the dowel-pin hole is located in Figs. 254 and 255 with another dowel-pin (*F*).

Make the spreaders of

The Wireless Aerial (Fig. 255) out of slender sticks, and use black thread for the wire strands (*U*).

Fighting-Tops *K* are fastened to mast spools *J* by means of dowel-pins *L*, which are driven into the spool holes.

The Turret Bases and Turrets. Holes must be bored through the center of turret blocks *N*, turret base blocks *M*, and into the decks (Figs. 251, 253 and 255), for dowel-pin pivots *P* to run through. These holes are located in Figs. 252 and 254. Make the pivots out of ¼-inch dowel-sticks, or whittle sticks to this diameter. Glue the lower ends of the pivots in the holes bored in the decks, whittle the upper ends to fit the holes in button-moulds measuring 1¼ inches in diameter (*Q*, Fig. 255), and glue the button-moulds to the pivot ends after the turret base blocks and turret blocks have been slipped over the pivots. Holes must be bored in the side of the turret blocks for the guns to run into. To lessen the danger of splitting the blocks while boring, it is best to bore the holes before sawing the blocks from the stick from which they are cut. Figure 257 shows the location of the holes.

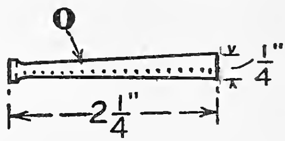


Fig. 259

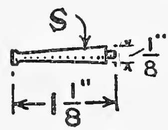


Fig. 260

Fig. 259. — Main-Battery Guns
Fig. 260. — Secondary-Battery Guns

The Main Battery Guns (*O*, Fig. 255), mounted in the turrets, are shown in detail in Fig. 259. Take a ¼-inch dowel-stick, or a stick whittled to this diameter, and cut from it eight pieces of the length shown (Fig. 261), then with a small wood-bit or drill, start a hole for the bore in the *muzzle* end of the guns, and with a jack-knife carefully

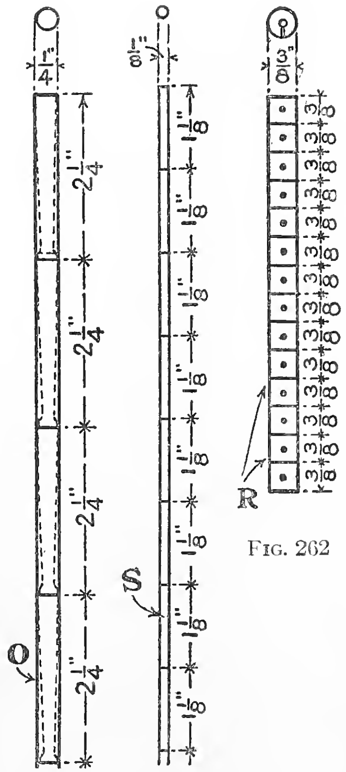


FIG. 261 FIG. 263

FIG. 262

FIG. 261 — Detail Showing How to Cut the Main-Battery Guns from a ¼-inch Dowel-Stick

FIG. 262. — Detail Showing How to Cut Secondary-Battery Gun Mounts from a ⅜-inch Dowel-Stick

FIG. 263. — Detail Showing How to Cut Secondary-Battery Guns from a ⅛-inch Dowel-stick

taper the guns from end to end, as shown in Fig. 259. Smooth up the guns with sandpaper. Glue them in the holes in the turret blocks.

The Secondary-Battery Guns are mounted in the round blocks *R* (Fig. 255). Cut fourteen of the blocks from a ⅜-inch dowel-stick (Fig. 262). With a small bit or drill make a pivot hole through the center of the ends of each block, and another hole in the side of the block to run the gun into. Prepare the guns of the shape shown in Fig. 260. Cut them from a dowel-stick ⅛ inch in diameter (Fig. 263). Start a hole in the muzzle end of each gun for the bore.

The Flagstaffs (*V*, Fig. 255) are 3 inches long. Drill holes for them at the bow and stern of the decks.

The Deck-Rails are made of strips of wire cloth. Cut two strips ½ inch wide, one for the superstructure deck, the other for the lower deck. Drive ¾-inch brads into the decks close to the sides (*W*, Fig. 264), bend the wire strips around the brads, and with wire bind them to the brads.

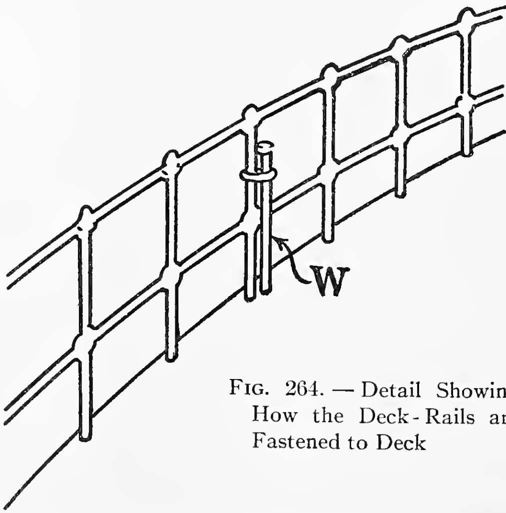


Fig. 264. — Detail Showing How the Deck-Rails are Fastened to Deck

By fastening **Keel Strips** *X* (Figs. 265 and 266) to the bottom of the hull, and mounting wheels upon axels run through screw-eyes screwed into the keel strips (Fig. 266), for **A Running-Gear,** your toy battleship will both float upon water and run upon land. Cut off the ends of a pair of spools for wheels (*Y*, Fig. 267), and fit ¼-inch dowel-sticks into them for axles (*Z*).

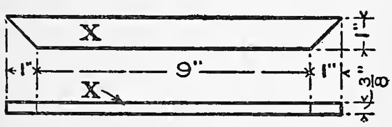


Fig. 265. — Side-Elevation and Plan of Keel Strips

Painting. With all work done as directed, the dreadnought will be ready for its coat of battleship-grey. The author suggests that you paint all parts before assembling. It will be easier, and the parts can be allowed to become thoroughly dry before they are assembled, which will prevent the sticking of such pivoted parts as the gun-turrets and rapid-fire gun mounts. Surfaces marred while

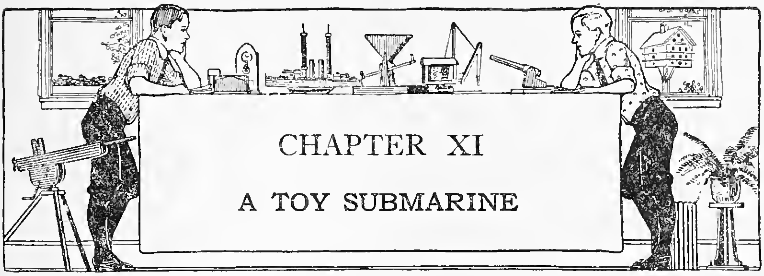
Assembling can be touched up afterwards. There is not much work to putting the model together, when all parts have been properly fitted. In mounting the secondary-

Fig. 266 Fig. 267

Fig. 266. — Details of Keel Strips and Running-Gear

Fig. 267. — Detail of Spool Wheels

battery guns, slip the fourteen gun mounts into the holes bored in the deck piece, then nail the deck piece to the hull, and drive brad pivots down through the deck and gun mounts, into the hull. Figure 255 indicates very plainly where the funnels, masts and other parts go, and fastening them in place is for the most part simply a job of glueing.



CHAPTER XI

A TOY SUBMARINE

THE toy submarine described on the following pages is a model recently devised by the author. A photograph of this toy is shown in Fig. 268, on the page facing page 129, a side elevation is shown in Fig. 269, and an end elevation is shown in Fig. 270.

This toy submarine dives, then returns to the surface.

The Mechanism is best understood by referring to the

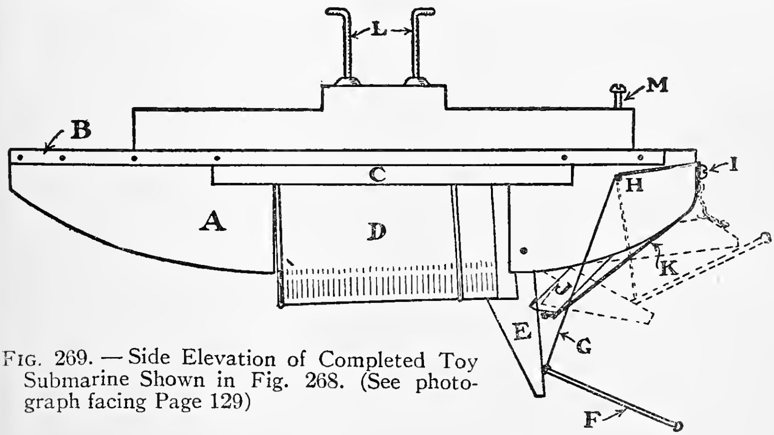


FIG. 269. — Side Elevation of Completed Toy Submarine Shown in Fig. 268. (See photograph facing Page 129)

diagrams of Figs. 269 and 270. The central section *D* is a tin can filled with sand, for ballast. One end is supported upon a brad, the other end upon the *trigger E*. Trigger *E* is held by *catch J*, which slips into a notch cut in the edge of *E*. Can *D* is of sufficient weight when filled with sand, to sink the submarine. When the submarine reaches the bottom of the bath-tub — a tub furnishes a good "zone" for operations — nail *F* in trigger *E* comes in contact with the tub bottom with sufficient force to throw trigger *E* out of position and release catch *J*. Catch *J* is sprung out of the way by rubber-band *K*, trigger *E* is sprung out of the way by rubber-band *G* (see dotted lines in Fig. 269), and can *D* is released. Relieved of its ballast, the submarine rises to the surface. To make the boat dive again, it is but necessary to attach the tin can and reset the trigger.

Instead of having the submarine dive, discharge its weight, and instantly rise to the surface, you can make the trigger mechanism less delicate, so that it will not be sprung by slight contact. Then a gentle submersion to the tub bottom will not bring about the springing of the trigger, and the boat will remain upon the bottom. With a stream of water from a bath-spray forced against the stern, the boat may be propelled forward, and by directing the force of the stream against different portions of the boat you can cause the boat to go through all sorts of maneuvers, even to rising nearly to the surface. Finally, by driving the contact point forcibly against the foot of the bath tub, or against an obstruction placed on the tub bottom, the trigger may be sprung, and the boat, relieved of its weight, will rise to the surface.

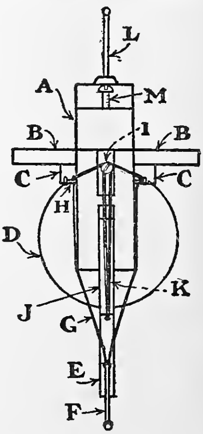


Fig. 270.—End Elevation of Toy Submarine

The simplicity of the work in making this mechanical toy will surprise you. Figure 271 shows a pattern for

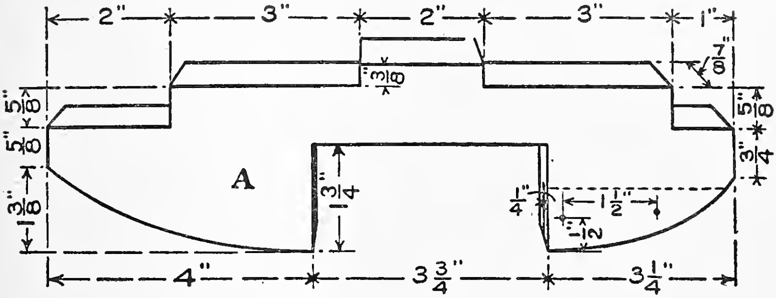


FIG. 271. — Pattern for Hull and Upper Decks

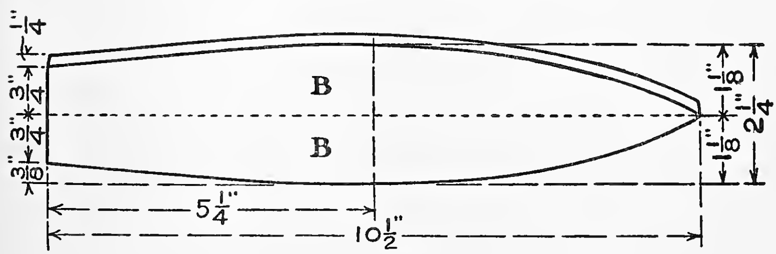


FIG. 272. — Pattern for Deck Pieces

The Hull and Upper Decks (*A*), which are made in one piece. Radii for describing the arcs for the bow and stern of the hull are not given, because after you have located the points for the beginning and end of these curves, as shown, you can easily draw them free-hand. The cutting can be done with a saw and chisel. Cut the ends of the pocket for the tin can weight with a saw, then split out the wood between the saw cuts, or *kerfs*, with a chisel. Taper the sides of the bow as shown in Figs. 268 and 273.

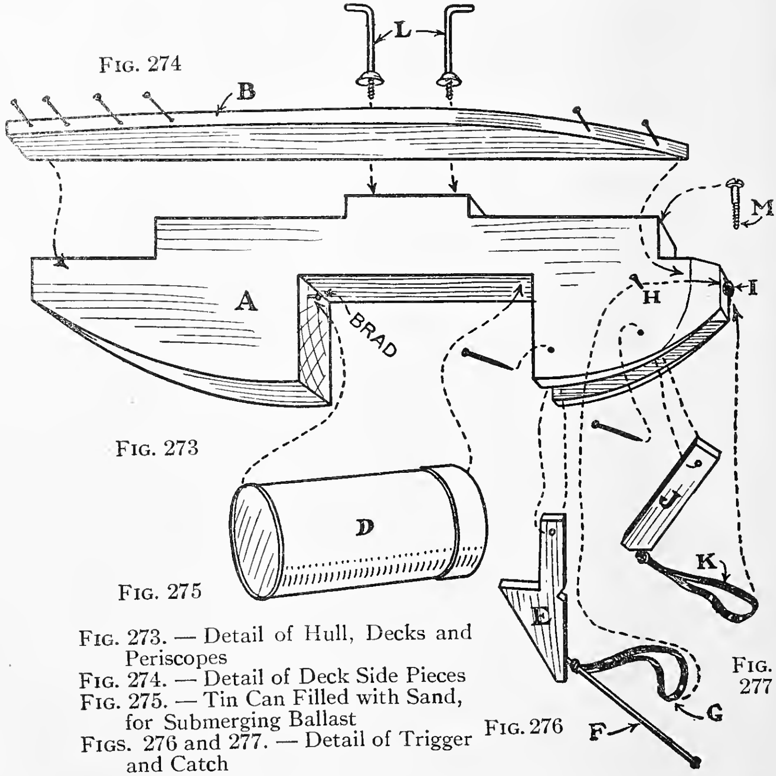


Fig. 273. — Detail of Hull, Decks and Periscopes
Fig. 274. — Detail of Deck Side Pieces
Fig. 275. — Tin Can Filled with Sand, for Submerging Ballast
Figs. 276 and 277. — Detail of Trigger and Catch

Figure 272 shows a pattern for deck pieces *B*. Lay these out in one piece, as indicated, cut out the piece, saw it in half, and nail the halves to the sides of block *A* in the positions shown (Figs. 269, 270, and 274). Strips *C* (Fig. 269) are fastened each side of block *A* (Fig. 270), directly below deck pieces *B*, to complete

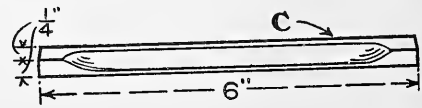


Fig. 278. — Detail of Ballast-Pocket Strips

The Ballast Pocket for can *D*. Figure 278 shows a pattern for these pocket strips. For the can ballast procure a ¼-pound baking-powder can. Pack this full of sand, and if the cover fits loosely, coat the edge with paint to make it stick fast.

Figures 276 and 279 show details of **The Trigger for Releasing the Ballast.** Drive the nail *F*, a 3-inch finishing-nail, into the edge of the trigger at the angle shown. Figures 277 and 280 show how the trigger *catch J* is made. The bow of the hull must be slotted to receive the upper ends of trigger *E* and catch *J*, as indicated in Figs. 271 and 273. The sides of the slot can be sawed down to the depth indicated by a dotted line in Fig. 271, then the wood between the saw kerfs can be split out with a chisel. Use brads for pivoting the trigger and catch blocks between the sides of the slot. Positions for the pivots are located in Fig. 271.

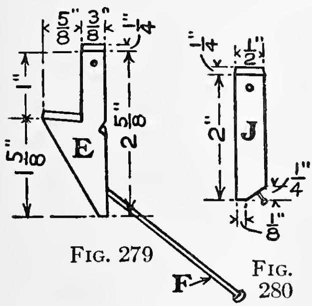


FIG. 279. — Trigger
FIG. 280. — Trigger Catch

Figure 269 and Figs. 273 to 277 explain the assembling and adjustment of the trigger and catch blocks, also of the rubber-bands for springing them. Rubber-band *G* extends from contact nail *F* to a screw *I* in the bow (Figs. 273 and 276). To keep it from interfering with rubber-band *K*, which extends from a brad in the lower end of catch *J* to screw *I* (Figs. 273 and 277), rubber-band *G* is run up and over a pair of brads (*H*) driven into block *A* upon opposite sides, then over to screw *I* (Fig. 273).

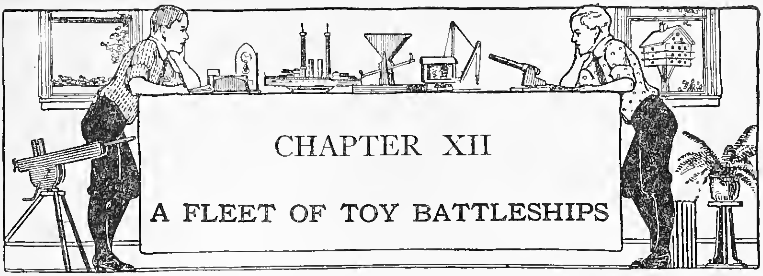
When you have connected the trigger mechanism, you will probably find slight readjustments necessary to bring about a nicety of operation. To support the stern end of the tin can, drive a brad into block *A* in the position indicated in Fig. 273. The projecting rim on the can bottom will rest upon the head of this brad.

This type of submarine has two

Periscopes. Two brass screw-hooks 2 inches in length (*L*, Fig. 269) answer the purpose. Screw a round-head screw (*M*, Figs. 269 and 273) into the bow end of the second deck.

Painting. Use a battleship-grey in painting the toy submarine. Remove the rubber-bands, to keep them from being gobbed with paint, and sandpaper all surfaces smooth.

Submerging the Submarine Upon Lake or Pond can be done successfully, if provision is made for recovering the tin can ballast. Try this scheme. Connect one end of a line to the tin can, and retain the other end of the line in your hand. After the ballast has been released, it will be easy enough to pull it out of the water by means of the line.



CHAPTER XII

A FLEET OF TOY BATTLESHIPS

Make a fleet of toy battleships and submarines, and you will be able to have all sorts of fun. With them mounted on wheels, you can work out your fleet maneuvers on the

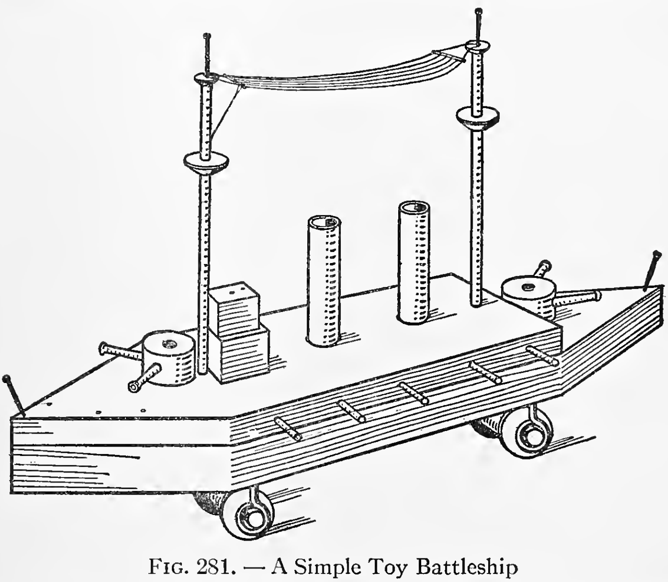


Fig. 281. — A Simple Toy Battleship

floor. In conjunction with the fort and toy cannon described in the following chapter, you can stage wonderful land and naval engagements that will take hours to fight out to a finish. If you have never played at miniature warfare with

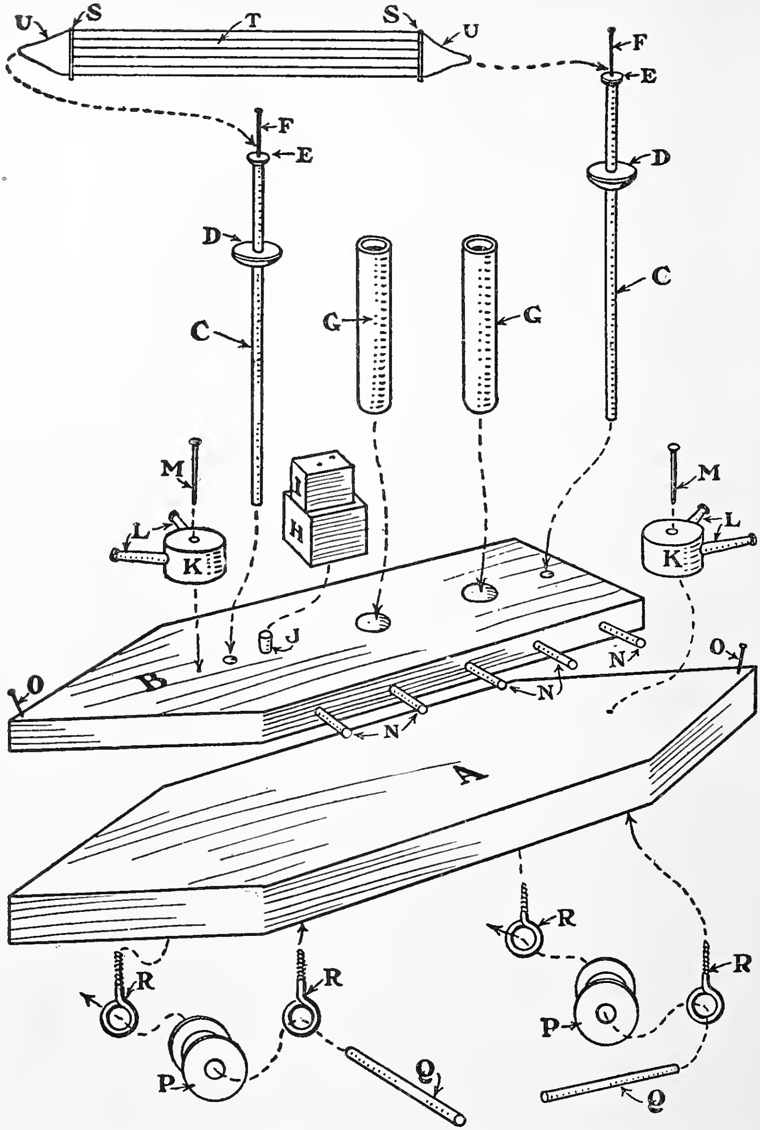


FIG. 282. — Detail Showing How the Hull (*A*), Superstructure-Deck (*B*), Masts (*C*), Fighting-Tops (*D* and *E*), Funnels (*G*), Conning-Tower (*H*, *I*,) Gun Turrets (*K*), Main-Battery Guns (*L*), Secondary Battery Guns (*N*), Running Gear (*P*, *Q*, *R*), and Aerial (*S*, *T*, *U*) are Assembled

ships, forts, cannon, and paper and lead soldiers, you don't know what exciting fun you have missed.

In building the ships for a fleet, you probably will not want to make them all of the form shown in Fig. 251 of Chapter X. Several of that size will do. Make the others simpler, of the *cruiser* types shown in Figs. 281 and 293 of this chapter.

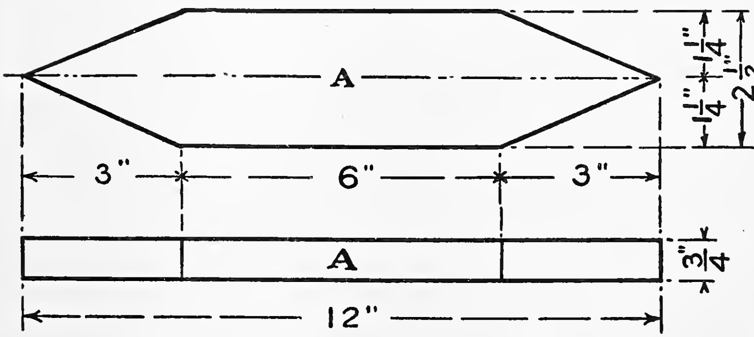


FIG. 283. — Plan and Side Elevation of Hull

Figure 282 shows a detail of every part required for

The Battleship shown in Fig. 281, with an indication as to how each part is assembled. Dimensions for the parts are given in the detail working-drawings of Figs. 283 to 292. If you build several ships alike, you will save time by making all of the parts for one ship, first, and then using these parts as patterns. Mark out and cut the *hulls* (*A*) for all the other boats, then the *decks* (*B*), then the *masts* (*C*), and so on. Use soft pine, cypress, or other soft wood, for the models.

In marking out

The Hull (*A*, Fig. 282), draw a center-line upon the working material, as shown in Fig. 283, and lay off the measurements each side of this, to get the sides alike.

The Superstructure-Deck (*B*, Fig. 282) extends three-quarters of the length of the hull, and it is of the same shape and dimensions as that portion of the hull (Fig. 284); therefore, it can be marked out with the hull as a pattern. The holes shown along the edge (Fig. 284) are made to receive the guns of the *secondary-battery*, the holes in the upper face are made to receive the *masts*, *funnels*, etc.

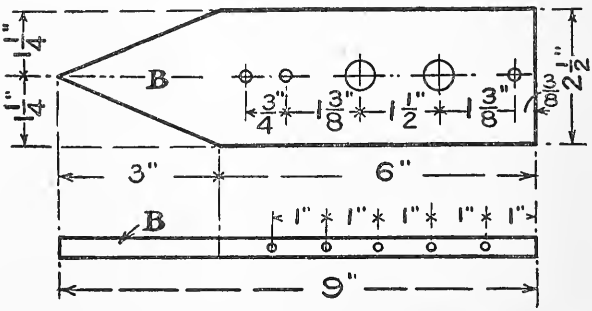


FIG. 284. — Plan and Side Elevation of Superstructure-Deck

The Masts (*C*, Figs. 282 and 285) can be whittled out of sticks, or dowel-sticks can be used.

The Fighting-Tops (*D* and *E*, Fig. 282) are button-moulds of the sizes shown in Figs. 286 and 287. The larger one (*D*) must have its hole enlarged so it will slip over the mast, the smaller one (*E*) rests on the mast-top, and is held in place by the nail *F* driven into the mast (Fig. 282).

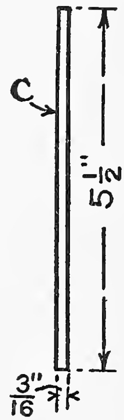
Figure 288 shows a detail of

The Funnels (*G*). Use a dowel-stick if you can get one, otherwise whittle a stick to the given diameter.

The Conning-Tower is made of two square blocks (*H* and *I*, Fig. 282). Figure 289 shows the sizes of the blocks. Nail the blocks together, and peg the lower one (*H*) to the deck with dowel-pin *J* (Fig. 282).

Fig. 286

Fig. 287



Figs. 286 and 287. —Fighting-Tops

Fig. 285.—Mast

The Gun Turrets (*K*, Fig. 282) are small pieces of dowel-stick (Fig. 290).

The Main-Battery Guns (*L*), mounted in holes bored in the sides of the turrets (Fig. 290), are small pieces of dowel-stick cut of the shape shown in Fig. 291. Drill a small hole through the center of the ends of each turret, through which to drive the nail pivot *M* (Fig. 282).

The Secondary-Battery Guns (*N*, Fig. 282) are the ends of burnt matches. Figure 292 shows the length to cut them.

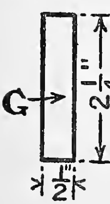


Fig. 288

Fig. 289

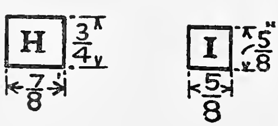


Fig. 288. — Funnel
Fig. 289. — Details of Conning Tower

This toy model is mounted upon wheels so that it can be run upon the floor, as well as floated upon water. Use

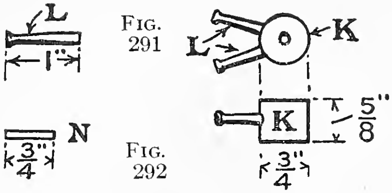


FIG. 291

FIG. 290

FIG. 292

FIG. 290. — Turret and Guns
FIGS. 291 and 292. — Guns

Spool Wheels (*P*, Fig. 282), cut the stick axles *Q* to fit snugly in the spool holes, and support the axle ends with screw-eyes *R*, screwing these into the hull.

The Wireless Aerial is suspended between the mast-tops (Fig. 282). Use toothpicks for spreaders *S* and thread for wire strands *T* and end loops *U*.

The Cruiser shown in Fig. 293 is propelled by a paddle-wheel operated by a twisted rubber-band. The rubber-band untwists rapidly, so that the boat does not travel far before a re-twisting is necessary, but boys who have made this model have been satisfied with the results, so the author believes that you will be satisfied, also.

Figure 294 shows a plan of the completed ship. The method of construction is quite similar to that of the battle-ship just described, so read over the instructions for making that model before beginning work on this one.

The Hull (*A*) is shown in plan in Fig. 295. After marking this out and cutting it, in the same way as described for the other model, prepare the blocks which form

The Superstructure-Deck (*B* and *C*, Figs. 296 and 297). Cut block *B* out of material ⅝-inch thick, by the width and length given. Bore the turret openings along the sides before cutting out the block, to prevent splitting it. Make these openings 1 inch in diameter. You will find the location of their centers shown upon the diagram. Holes *E*

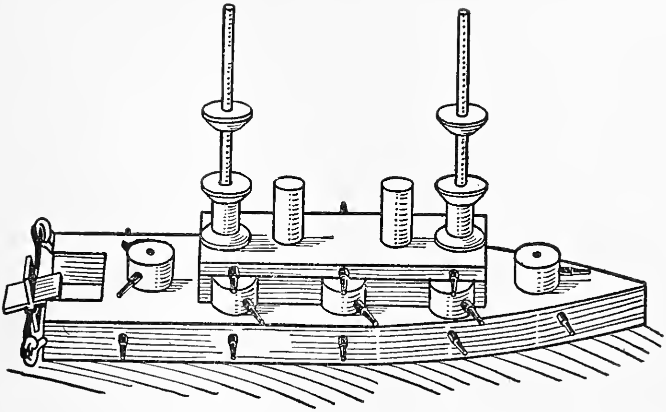


FIG. 293. — Toy Battleship with Propeller

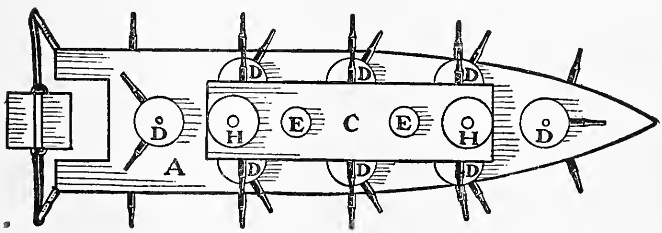


FIG. 294. — Plan of Completed Toy Battleship

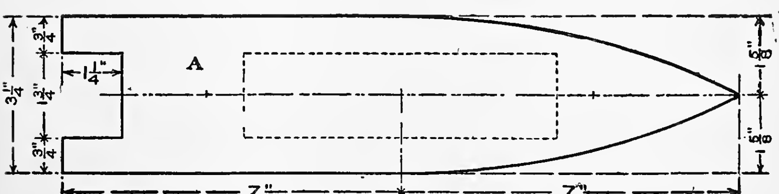


FIG. 295. — Plan of Hull

are for the funnel ends to fit in. Make them ⅝ inch in diameter. Holes *F* are for the mast ends to fit in. Bore them in the positions indicated making them ¼ inch in diameter.

Cut block *C* of the same width and length as block *B*, out of material ¼ inch thick. Bore holes *E* and *F* through it in the same places as those bored through block *B*, so that when the two blocks are placed together, the holes will come over one another (Fig. 298).

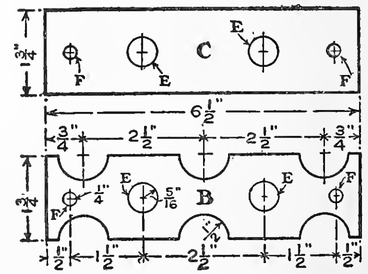


FIG. 297

FIG. 296

FIGS. 296 and 297.—Plans of Superstructure-Deck Blocks

The eight revolving

Gun Turrets (*D*, Fig. 294) can be sawed from a broom handle or portiere-pole. Figure 299 shows the size to cut them. The hole in the side is made to receive a gun. The turrets "fore and aft" have two holes each, for two guns. Another small hole must be drilled through the center of the ends of the turrets, as a provision for pivoting the turrets so that they will revolve.

Figure 298 shows the size to cut

The Main-Battery Guns. If you want to save work, do not taper the sides of the guns as shown. The tapering, however, adds much to their appearance.

The Secondary-Battery Guns. Set five of these in holes bored along each side of the hull, and three in holes in each side edge of deck piece *C*. (Fig. 293). You can cut these like the main battery guns.

The Funnels (*E*, Fig. 298) are shown in detail in Fig. 300. They drive down through the holes bored in blocks *B* and *C* of the deck.

The Masts (*F*) are ¼ inch in diameter and 6 inches long. Slip spools *G* upon them to come at the foot, and halfway between the spools and the mast-tops fasten the spool ends *H* for

Fighting-Tops. You will find it easy to cut off the ends of a spool if you will slip a stick through the spool, to hold the spool by while sawing.

The first step in **Assembling** the model consists in nailing block *B* to hull *A* in the position indicated by dotted lines in Fig. 295. Then mount

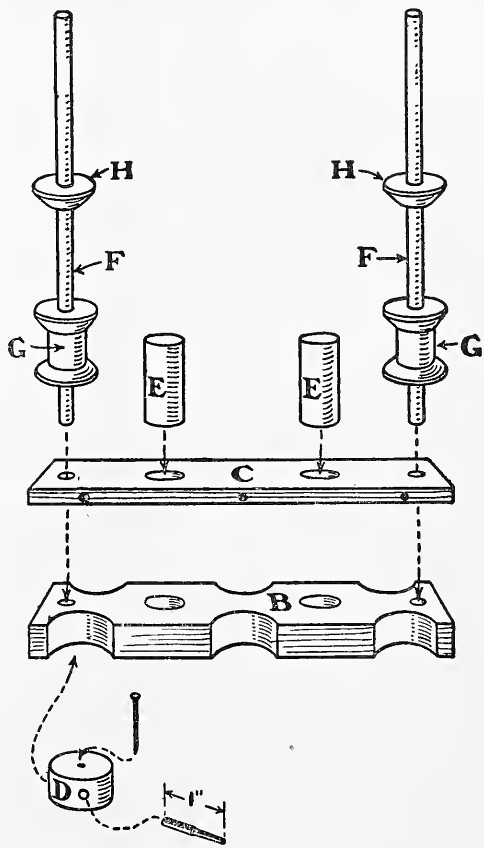


Fig. 298. — Detail Showing How Superstructure-Deck (*B* and *C*), Gun Turrets (*D*), Funnels (*E*), Masts (*F*), and Fighting-Tops (*H*) are Assembled

the gun-turrets, six to turn in the openings in the sides of block *B*, the remaining two "fore and aft" ¼ inch from the ends of block *B*. Having mounted the turrets, nail deck block *C* to block *B*.

The Paddle-Wheel (Fig. 301) is made of two pieces (*I* and *J*, Fig. 302), halved together — that is, each piece has a slot cut across half its depth, so that the two will interlock as shown in Fig. 301. Cut the pieces out of wood ⅛ inch thick. Drive a double-pointed tack into the center of each end of the assembled paddle-wheel, and connect a rubber-band to each tack. Then take a pair of screw-eyes, open each eye enough to form a hook (*K*, Fig. 303), screw the pair into the corners of the stern of the hull, at the angle shown in Figs. 293 and 294, and slip the ends of the rubber-bands over them. By setting the screw-eyes at the angle indi-

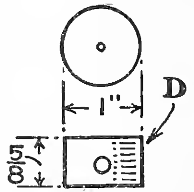


Fig. 299

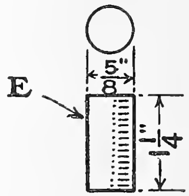


Fig. 300

Fig. 299 — Detail of Gun Turret
Fig. 300. — Detail of Funnel

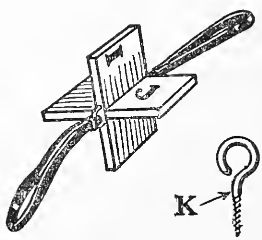


Fig. 301
Fig. 303

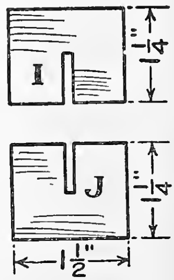
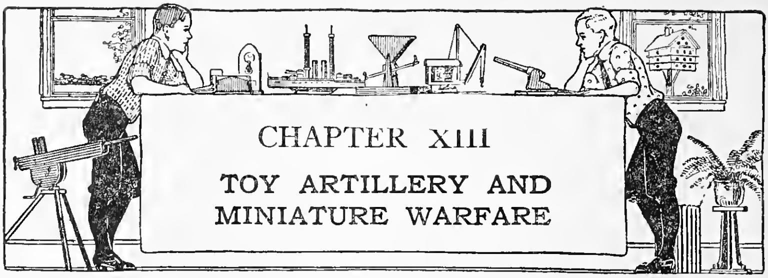


Fig. 302

Figs. 301-303. — Details of Propeller

cated, there is greater length of rubber-band to twist in winding the motor. This is important.

If you make this cruiser model for your indoor battleship fleet, you had better mount it upon wheels in the same manner as the model shown in Fig. 281 is mounted.



CHAPTER XIII

TOY ARTILLERY AND MINIATURE WARFARE

Miniature battles fought with toy soldiers and toy artillery can be made as scientific as those of real war, if one understands military tactics. Without that knowledge, however, you can make up your own rules of warfare, and the author believes that no more interesting game for an evening, or for a whole day, in fact, could be found. That more boys do not play with toy soldiers is probably because they haven't sufficient properties for staging a battle. A handful of soldiers and "dummy" cannon will not answer the purpose. There must be men and equipment enough for two opposing armies, and the guns must be of a type that shoot play shells, else they will afford little excitement.

When visiting several large toy shops recently, the author was impressed with the completeness of equipment for miniature warfare, yet realized how impractical it was to expect that the average boy with limited pocket-money might buy enough of the equipment for a battle-field setting. Then he remembered as a lad how easily he had made guns, forts, etc., for miniature battles, and he decided to show you how you can do the same. Accordingly, when he went home he summoned his own lead soldiers, who had last seen service some twenty-five years ago, and to a man

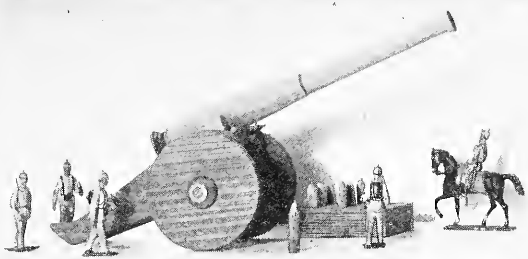


Fig. 305.—Field Artillery Gun.

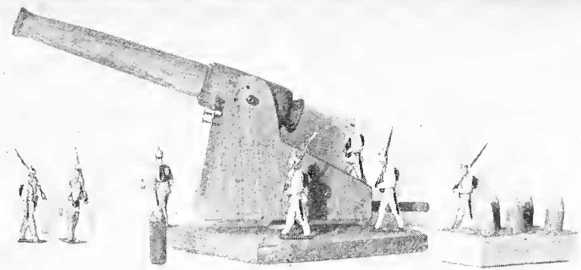


Fig. 306.—Siege Artillery Gun.

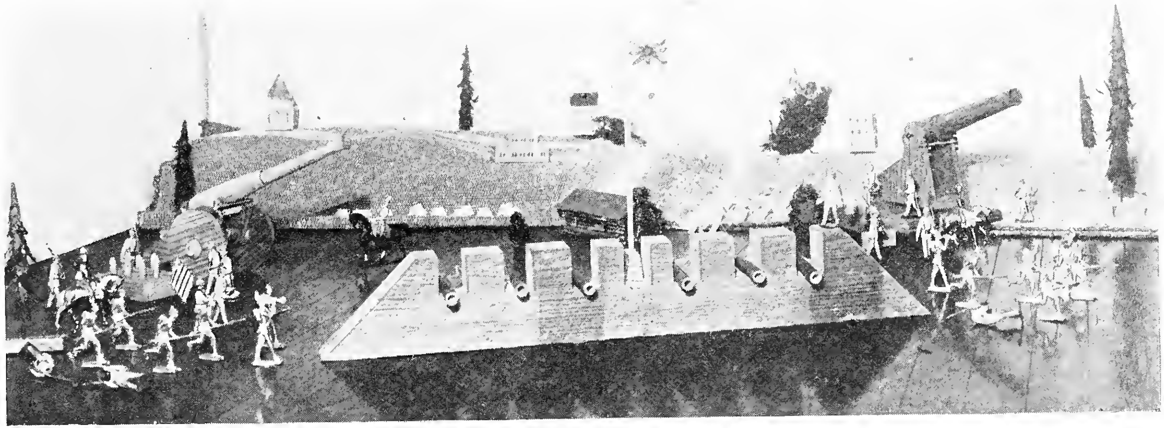


Fig. 304.—Miniature Battles can be Fought Scientifically.

they responded (including three men decapitated by shell fire in one of the engagements of the early nineties). A "munition factory" was then organized, miniature fortifications built, and a battlefield prepared with men and artillery in battle formation, as pictured in the photograph of Fig. 304.

If you do not own any lead soldiers, you will find a good type of soldiers in the stores right now that sell at 50 cents a dozen. Paper soldiers can be purchased for 2 cents a dozen. Lead soldiers look best, of course, but paper soldiers serve excellently. The author never owned more than a small company of lead soldiers, and therefore depended upon paper soldiers for the main fighting strength of his armies.

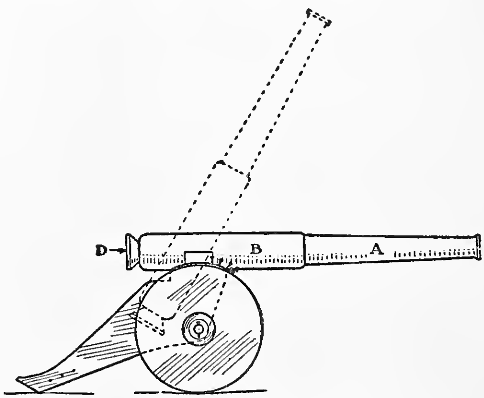


Fig. 307. — Detail of Field Artillery Gun

Next to toy soldiers in importance are guns, and in Figs. 305 and 306 you will find two excellent models that are not hard to make. Shaping the guns is a simple problem in boring and whittling.

A working detail of

The Field Artillery Gun is shown in Fig. 307. The gun tube is made in two pieces, as is shown in the *longitudinal section* of Fig. 308 (*A* and *B*). Use straight-grained soft pine, free from knots and other defects for the tube pieces. First cut a pair of blocks to the dimensions of *A* and *B* (Figs. 309 and 310). Then with a ⅜-inch bit bore a hole

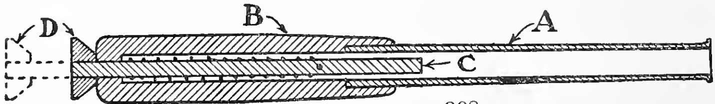
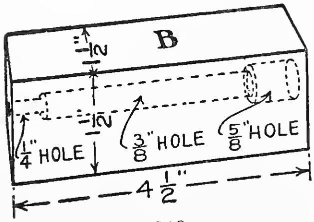


FIG. 308



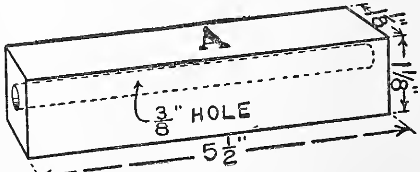


FIG. 309

FIG. 310

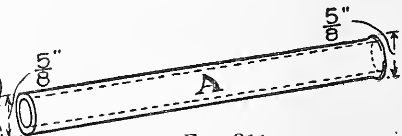


FIG. 311

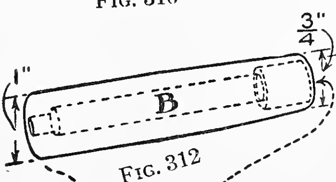
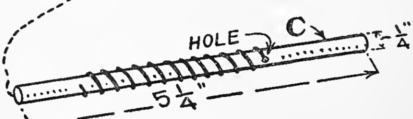


FIG. 312

FIG 314



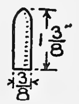


FIG. 315

FIG. 313

FIG. 308. — Longitudinal Section of Gun Shown in Fig. 307
FIGS. 309 and 310. — Wooden Blocks Required for Tube of Gun
FIGS. 311 and 312. — How the Blocks are Bored and Shaped
FIGS. 313 and 314. — Details of Plunger
FIG. 315. — Detail of ⅜-inch Shell

through the entire length of block *A*, at its center. A hole must be bored through block *B* from end to end, also, but three diameters must be used for this hole, as is indicated by dotted lines in Fig. 310. To make this hole, first bore a hole ¾ inch deep with a ⅝-inch bit, then with a ⅜-inch bit and the same center, continue the hole for a distance of 3 inches, and from that point bore the hole through the remaining ¾-inch length of the block with a ¼-inch bit. In order to produce a bore that is straight, it is necessary to bore the holes exactly in a straight line.

With the blocks bored, put a keen edge upon your jack-knife blade, preparatory to

Shaping the Outside of the Gun. Figures 311 and 312 show the diameters to which the blocks should be cut. Shape down the small end of each block first, then work back to the other end. At the *muzzle* end of the block *A*, make the wood around the *bore* as thin as you can cut it without cutting through, and from that point taper the wood up to the other end. Round off the *breech* end of block *B*, and taper off the other end, as shown.

After cutting, sandpaper the surfaces of both pieces of the tube until absolutely smooth, and see that the end of piece *A* fits snugly into the hole in the end of *B*; these sections are to be glued together later.

The Plunger (*C*, Fig. 308) may be either a piece of a dowel-stick, or a stick whittled round, of the size shown in Fig. 313. Drill a small hole through the plunger stick 1½ inches from one end, slip a piece of *spring-brass wire* through the hole, and wind the wire loosely around the stick to about the point shown, to form a spiral spring. Slip the end of the plunger into section *B* of the gun, and out through the hole in the breech. Saw off the end of a spool (*D*, Fig. 314), glue it upon the end of the plunger (Fig. 308), and drive a small brad through the spool end into the plunger end, to reinforce the connection.

Test the Gun to see that the spring rebounds properly after its compression, before you glue sections *A* and *B* together. Figure 315 shows a detail of the

Three-Eighths Inch Shells. These can be sawed up quickly, to the given length, if you will cut them from a ⅜-inch dowel-stick. Taper one end of each shell to a point, as shown, and sandpaper smooth. To make the shells discharge from the gun with a minimum amount of friction, wax them and wax the bore of the gun.

If you find that the spring does not recoil satisfactorily, try a smaller or larger gauge of brass wire. Provided you use spring-brass wire, you should have no trouble with the coil. Space the turns of the coil about as shown in Fig. 313. With the spring properly adjusted, glue together the two sections of the gun tube, and the gun will be ready for mounting on

The Gun-Carriage. Figure 316 shows a *rear elevation* of the mounted gun, and Fig. 317 shows a detail of the *carriage* framework. The pair of carriages *F* may be prepared in one piece, cut out of a piece of wood ⅝ inch thick, then sawed in half. Figure 318 shows a dimensioned pattern for marking out the piece. The ¼-inch hole is for the wheel axle; the ⅛-inch hole is for the *trunnion* screws on which the gun is to be mounted. Separator block *G* (Fig. 317) braces the *trail* of the carriage. Make it of the size shown in Fig. 319. Before fastening carriages *F* to *G*,

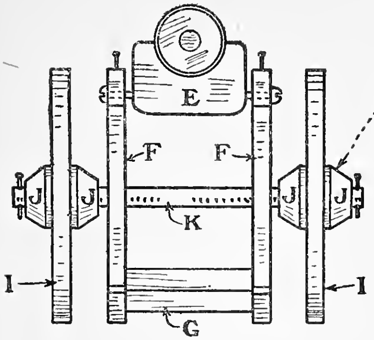
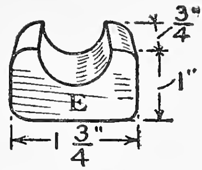


Fig. 321

Fig. 323



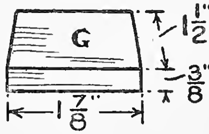
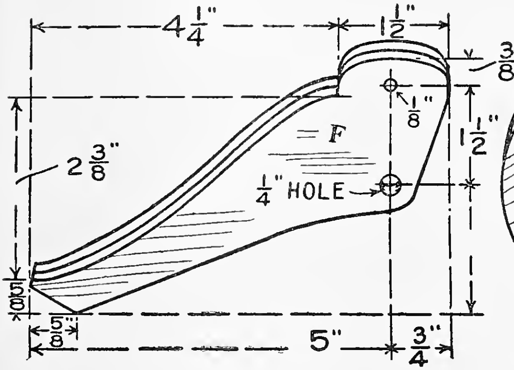


Fig. 316

Fig. 319



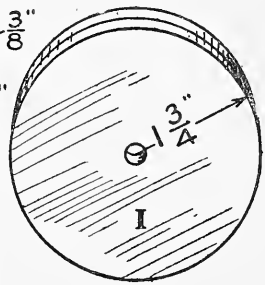


Fig. 318

Fig. 320

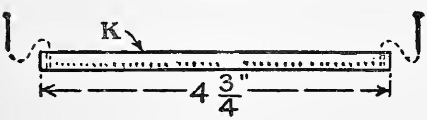


Fig. 322

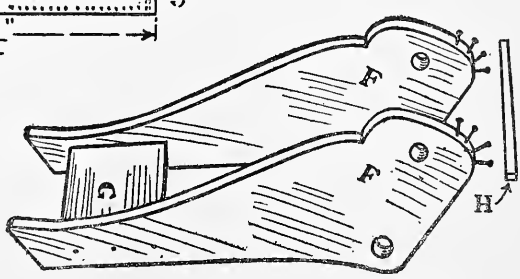


Fig. 317

Fig. 316.—Rear Elevation of Mounted Gun
Fig. 317.—Detail of Gun Carriage
Fig. 318.—Pattern for Carriages
Fig. 319.—Carriage Separator Block
Fig. 320. — Wheels
Fig. 321. — Spool Wheel Hub
Fig. 322. — Wheel Axle
Fig. 323. — Bed Block for Gun

cut wheel axle *K* (Fig. 322), and slip it into the holes bored for it, to keep the holes opposite one another while you nail the pieces together.

The Gun-Carriage Wheels (*I*) may be prepared in one piece, then sawed in half. Figure 320 shows the pattern. The best way to cut a wheel is to saw out the pieces roughly, first, then trim up to the finish line with a sharp chisel, and sandpaper the edge smooth. The wheel hubs are spool ends (*J*, Fig. 321). Fasten them to the wheels with glue. Drive brads through the axle ends for pins to keep the wheels from coming off.

Mounting the Gun. Because of the thinness of the tube of the gun, the screw trunnions cannot be driven into it. The gun must be mounted upon a *bed block* (*E*, Figs. 316 and 323), and the trunnions screwed into the block's sides. The upper side of block *E* must be curved the same as the surface of the gun. To get the right curve, bore a 1-inch hole through a block, then cut this block through at the center of the hole, and trim it up to the dimensions shown in the diagram of Fig. 323. Glue the gun to the bed block, and when the glue has set drive a small screw through each carriage into it.

The Elevating Device of this home-made gun is simple. Drive four brads into the top edge of each carriage (Fig. 317), and cut the cross-bar *H* to slip between the brads. The bar can be adjusted to four positions.

The Siege Gun shown in Fig. 306 is made in much the same way as the field artillery gun just described. In the detail of the completed gun (Fig. 324), the dotted lines indicate two of the positions to which the gun can be elevated. The carriage is pivoted like a turntable to provide for shifting the position laterally.

Figure 325 shows a longitudinal section of the gun. The *tube* is made of two pieces (*A* and *B*), and Figs. 326 and 327 show the dimensions of the blocks out of which to cut them. Bore a ⅝-inch hole through the center of block *A*, from end to end, and a hole of the same size through all but ¼ inch of the length of block *B*; then with a ¼-inch bit bore a hole through the remaining ¼-inch of the length of block *B* (Fig. 327). Care must be taken to bore the holes absolutely straight, else the bore of the gun will not be straight, and the toy shells will lose momentum before leaving the muzzle of the gun.

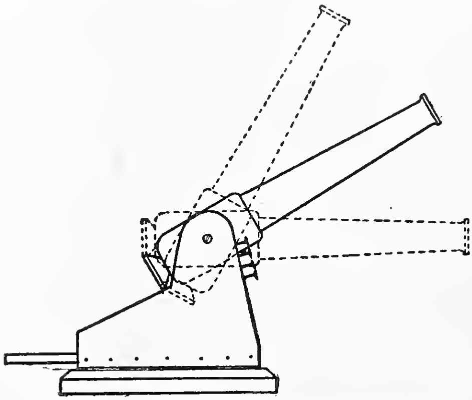


FIG. 324. — Detail of Siege Artillery Gun

The first step in

Shaping the Gun is similar to that of shaping the field artillery gun. Whittle off the edges of blocks *A* and *B* as shown in Figs. 328 and 329. The sides of block *B* must be kept straight; the sides of block *A* must taper to a smaller diameter at the muzzle end. Figures 330 and 331 give the diameters for the finished ends. In trimming up block

A, cut the flange at the muzzle end to the same diameter as the opposite end (1-inch), then taper the wood from the opposite end towards the flange, making the thickness over the bore directly back of the flange, not much more than the thickness of paper. Round block *B* at both ends, as shown in Fig. 331. The pieces will then be ready for sand-papering.

Pieces *A* and *B* are connected by the tube *C*, a spool (Fig. 332) with its flanges cut off, and its sides whittled to fit snugly in the bores of *A* and *B* (Figs. 325 and 332). Before joining the gun-tube sections, however,

The Plunger for projecting the toy shells (*D*, Fig. 325) must be prepared, and be fastened in place in the breech end of the bore. Drill a hole through rod *D* 1½ inches from one end, stick the end of a piece of *spring-brass wire* through the hole (Fig. 333), and wrap several turns of the wire about the rod to form a spiral spring (Fig. 334). With the spring prepared, stick the rod through the breech opening, and fasten a spool-end upon it with glue and a brad (*E*, Figs. 325 and 335).

When you have tried out the gun and found it to fire satisfactorily with

One-half Inch Shells (Fig. 336), cut out of dowel-sticks in the way that the shells for the other gun were made, glue together parts *A*, *B*, and *C*.

The Gun Carriage is shown in detail in Fig. 337. Cut carriages *A* in one piece, out of ⅝-inch stuff (Fig. 338), then saw in half for the pair. Drill a hole where indicated, through which to run the *trunnions* on which the cannon is

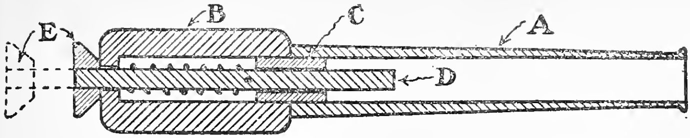


FIG. 325

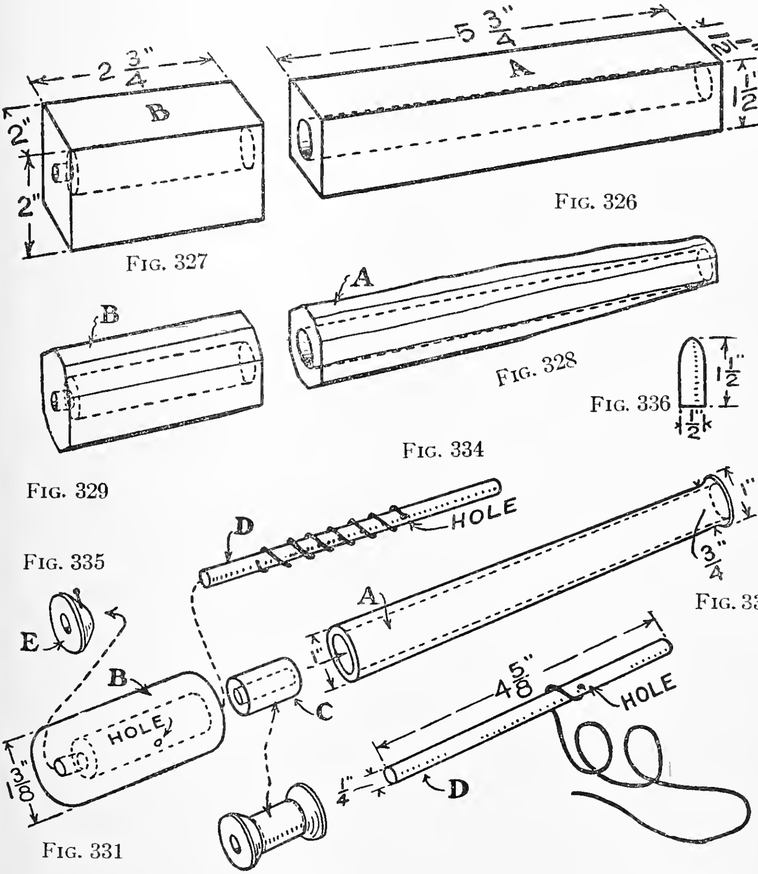


FIG. 326

FIG. 327

FIG. 328

FIG. 336

FIG. 334

FIG. 329

FIG. 335

FIG. 330

FIG. 331

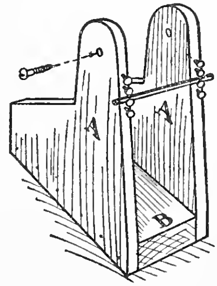
FIG. 332

FIG.333

FIG. 325. — Longitudinal Section of Gun Shown in Fig. 324
FIGS. 326 and 327. — Wooden Blocks Required for Tube of Gun
FIGS. 328 and 329. — How the Blocks are Bored and Shaped
FIGS. 330 and 331. — Tube Blocks Completed
FIG. 332. — Spool Connector
FIGS. 333-335. — Details of Plunger FIG. 336. — Half-inch Shell

to be mounted. Cut base block *B* to the dimensions given in Fig. 339, nail the carriages to its sides, and drive *lever C* into a hole bored in one end. Cut *turntable* base *D* of the size shown in Fig. 340, bore a screw-hole through its center and drive a screw through the hole into base *B* of the gun carriage. The *trunnion screws* on which the gun is mounted, can be screwed through the holes in carriages *A* directly

FIG. 337



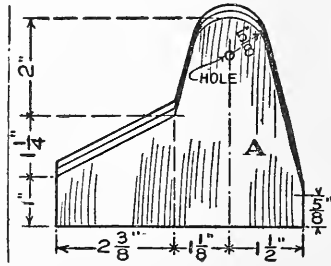
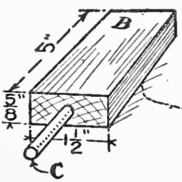


FIG. 338



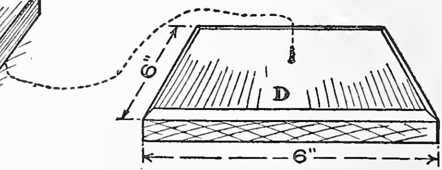


FIG. 339

FIG. 340

FIG. 337. — Detail of Gun-Carriage
FIG. 338. — Pattern for Carriages
FIG. 339. — Carriage Base
FIG. 340. — Turntable Base

into tube *B* of the gun, because the thickness of the wood around the bore is ⅜ inch. Do not drive the screws deeper than one-half of this thickness.

The Elevating Device is the same as that provided for the other gun (Fig. 337).

You can leave your guns without

Painting, but a coat of black or grey paint will much improve their appearance. Do not attempt to paint the inside of the bores; in fact, be careful not to let any paint run into them, for this would gum them up, and possibly spoil the action of the plunger.

Figure 341 shows

A Fortification made out of a piece of 2 by 4. Figure 342 shows how to mark out the *embrasures*, or openings for guns.

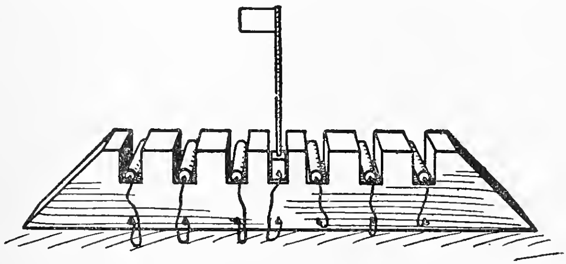


FIG. 341. — Fortification

Cut down the sides of the embrasures with a saw, and split out the wood between the saw *kerfs* with a chisel.

Pieces cut from a ½-inch dowel-stick, 2¾ inches long, with a hole started in one end of each (Fig. 343), will answer admirably for play

Disappearing Guns. Drive a tack into the breech end of each gun, and another into the fortification, beneath each embrasure, then connect the tacks with pieces of string (Fig. 341). The purpose of the strings is merely to keep the guns from becoming separated from the fort, and getting lost.

A Flagstaff is mounted in the center embrasure of the fortification, instead of a gun (Fig. 341). Stick a small flag in a block of wood, set the block in the embrasure, and connect a string to tacks driven into the block and into the fortification. As the flag is to be fired upon, don't use an American flag. That would be an act of disloyalty.

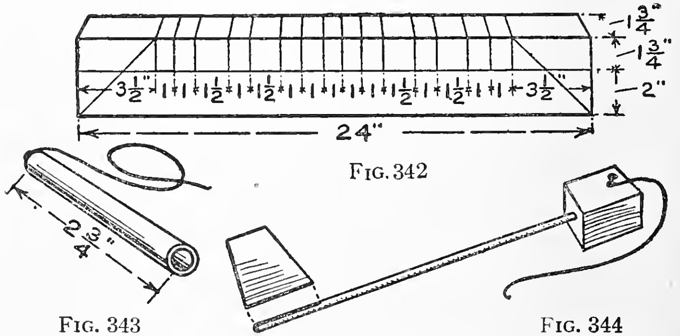


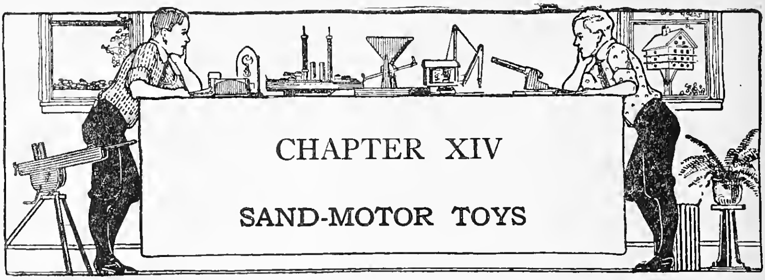
Fig. 342. — Pattern for Fortification
Fig. 343. — Detail of Gun Fig. 344. — Flagstaff

You can make a small flag by fastening a piece of cardboard to the end of a stick, as shown in Fig. 344.

Suggestions for

Laying Out the Battlefield will be obtained from the photograph of Fig. 304. Books piled up along a wall of a room, and covered with a rug, will give elevation and perspective to the background. Notice that the borders of the rug used in the battle scene shown in Fig. 304 make roads. Hang a sheet from tacks driven into the picture-moulding, for a sky background. Build small houses, churches, and other buildings out of cardboard. Use evergreen twigs for trees. Make tents out of small pieces of cardboard folded V-shape. The author wishes that he might show some of the other battle scenes he has modeled, with hills, valleys, streams, bridges, etc., but space does not permit it.

There are many ways of waging miniature wars. You can make and develop your own rules for fighting, and for determining the victors. Mr. H. G. Wells, the English author, literary critic, and war correspondent, wrote an interesting volume several years ago, entitled "Little Wars ," which, if you can procure at your local public library, will give you many valuable suggestions for operating on both a large and a small scale. Mr. Wells has spent several days at a stretch, with friends, in working out miniature war manuevers, and you will find his descriptions of battles won and lost, intensely interesting. The author's miniature battles, participated in by his brother, and his chum Captain David Ross Fraser, U. S. A., will always be remembered by each as among the most thrilling of their boyhood pastimes. Battles were fought out to a finish, until every gun on one side had been silenced, every man slain.



CHAPTER XIV

SAND-MOTOR TOYS

You can do more with a sand-motor than operate the paddle-wheel. It is about as powerful as a small electric-motor, and there are many pieces of toy machinery and other devices which can be rigged up and operated by it.

In the photograph of Fig. 345 you will see

A Practical Sand-Motor rigged up to run a toy trip-hammer and a toy grind-stone. When you have learned the way to connect up these toys, you will have no difficulty in devising other pieces of toy machinery; in fact, you can equip a miniature machine-shop.

Figure 347 shows a longitudinal section of the completed toy. You can make the base any size that you want. That for the model illustrated (*A*), is 6 inches wide and 22 inches long.

The Sand-Hopper (*B*) is an 8-inch *tin funnel*, costing 5 cents. Cut the hopper supports (*C*, Fig. 348), 20 inches long, bevel the top of each as shown in Fig. 349, to fit the sides of the funnel, tack the funnel to the beveled surfaces, and nail the lower ends of the uprights to the base.

Figure 347 shows a cross-section of

The Paddle-Wheel. Figures 350 to 353 show details of the wheel's construction. The wheel *hub* (*D*, Fig. 353)

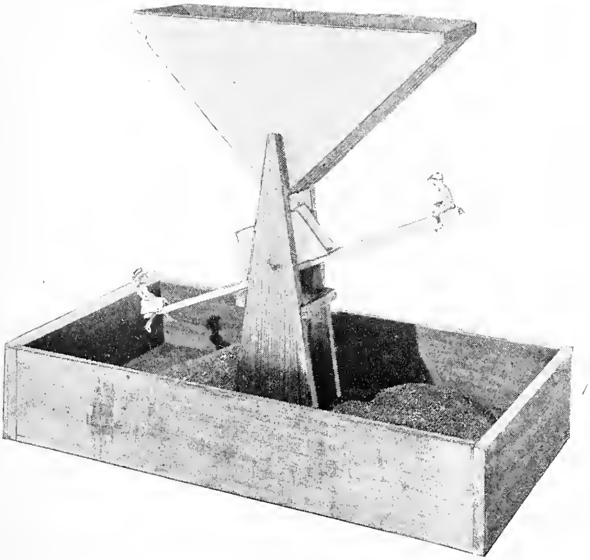


Fig. 346.—Sand-Motor Teeter Toy.

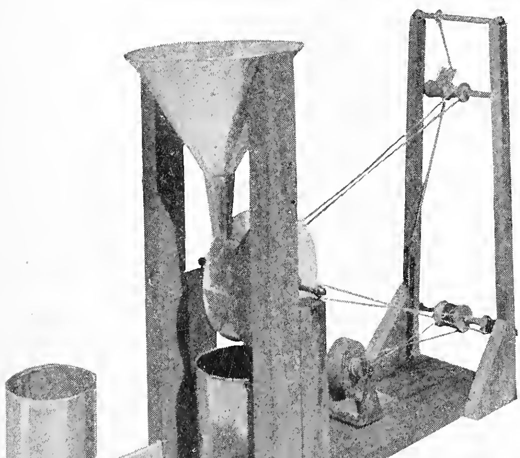


Fig. 345.—Toy Machinery can be Operated by the Sand-Motor.

is a spool, the *wheel ends* (*E*) and the *paddles* (*F*) are of cardboard. Cut the wheel end pieces of the size shown in Fig. 351, the paddles of the size shown in Fig. 352. To assemble the wheel, tack one end piece to the spool hub at its exact center, and fasten the paddles to that end by means

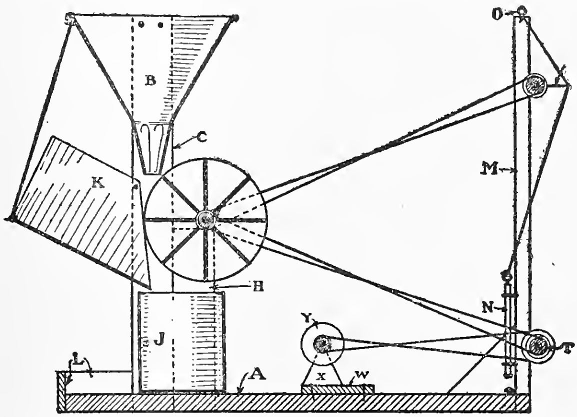


FIG. 347. — Longitudinal Section through Sand-Motor Toy

of pins run through it into the edges of the paddles. Rule lines across the end piece so as to divide it into eight equal parts; then you will have no difficulty in spacing the paddles equidistantly. When the paddles have been fastened to one end piece, tack the other piece to the hub, and fasten it likewise to the paddle edges with pins.

For Shafting, use carpenter dowel-sticks ¼ inch in diameter.

For Pulley-Wheels use spools. Fasten a spool pulley to each side of the paddle-wheel, slip a piece of dowel-stick through the spool holes, for a *shaft*, and support the shaft ends in screw-eyes driven into a pair of uprights (*H*, Fig. 350) fastened next to the sand-hopper supports (Fig. 347). Drive brass upholstering-tacks into the shaft ends to prevent them from pulling through the screw-eyes.

The Position of the Paddle-Wheel must be as shown in Fig. 347, so the falling sand will strike upon the ends of the paddles. A tomato can (*J*, Fig. 347) catches the sand after it passes over the paddles of the wheel. It is best to have a pair of these cans, so that as soon as one fills it may be removed, and the second can quickly be slipped into its place. The filled can may then be emptied back into the sand-hopper.

Fig. 349

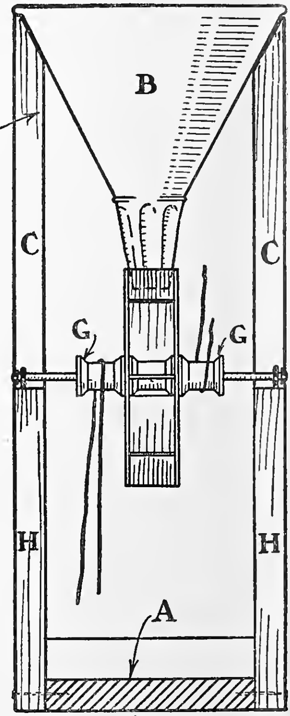


Fig. 348

Fig. 348.—Cross-Section Looking toward Sand-Hopper and Paddle-Wheel
Fig. 349.—Detail of Hopper Support

The paddle-wheel will throw forward part of the sand; therefore, to catch this sand, it is a good plan to make a cardboard chute similar to *K* (Fig. 347), and fasten its turned up edges to the hopper supports, and suspend its outer end by means of string run from it to the edge of the hopper. In the photograph (Fig. 345), the chute was removed so as not to obstruct the view of the paddle-wheel. A small proportion of sand will spill even with the chute in position. To keep this from running off the base onto the floor, it is a good plan to make a ledge by nailing the strips *L* (Fig. 347) to the base edges. An opening at one corner (Fig. 345) will provide an outlet through which to pour out the spilt sand occasionally.

Sand for Motor. If you can get beach sand for the hopper, get it. If you cannot, take coarser sand (builder's

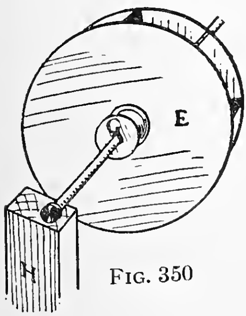


FIG. 350

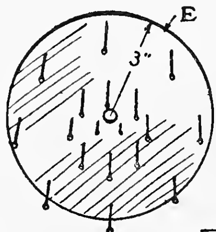


FIG. 351

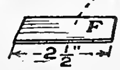


FIG. 352

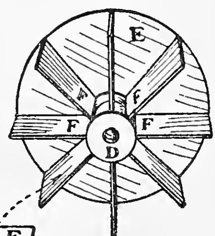


FIG. 353

FIG. 350. — Sand-Motor Wheel FIG. 351. — End Piece of Wheel
FIG. 352. — Paddle FIG. 353. — How End, Paddle and Spool Hub are Assembled

torpedo sand, or any kind you can get) and screen out the finer particles through a piece of screen wire. Sand too coarse to go through screen-wire will clog the hopper outlet. If the sand is damp, it must be dried out to prevent caking.

The Toy Trip-Hammer. Uprights *M* at the end of the base opposite to that on which the sand-motor is mounted

(Figs. 347 and 354), support *shafting* and *pulleys* operated by *belts* from the paddle-wheel. One of the shafts operates

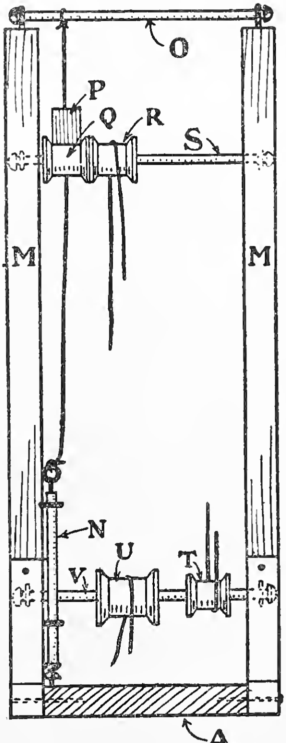


FIG. 354

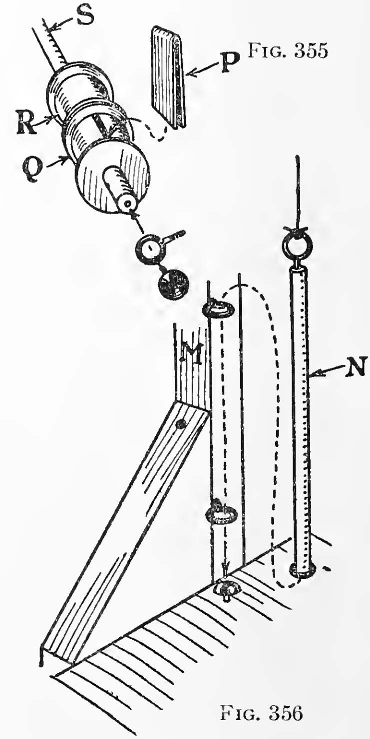


FIG. 355

FIG. 356

FIG. 354. — Cross-Section Looking Toward Framework Supporting Toy Trip-Hammer

FIGS. 355 and 356. — Details of Spool Pulleys, and Trip-Hammer

the *trip-hammer*. The trip-hammer consists of a piece of pencil or dowel-stick (*N*, Figs. 347, 354 and 356), which slides up and down through a pair of screw-eyes screwed into one of the uprights M. A screw-eye in the top of the trip-hammer stick provides a point of attachment for the *hoisting-cable*; a round-headed tack in the lower end forms the *hammer* head, and a second round-headed tack driven into the base serves as an *anvil*.

The *hoisting-cable* attached to the top of rod N must run up to and be tied around a beam (O) fastened across the tops of supports M (Fig. 354). This cable must be tripped by means of a *tripper finger* (P), a piece of tin folded in half and inserted in a slot cut in the side of a spool (Q, Fig. 355). Fasten this spool and another spool (R) upon a shaft (S), and mount this shaft upon screw-eye bearings screwed into

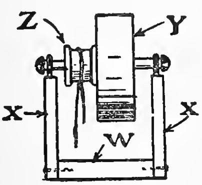


Fig. 357

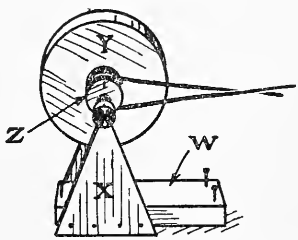


Fig. 358

Figs. 357 and 358. — Details of Toy Grindstone, Belt and Pulley

the outer face of uprights M in the positions shown. Once during every revolution of the shaft, tripper finger P will strike the hoisting-cable and raise the hammer as shown in Fig. 347, releasing it in passing, and letting the hammer drop upon the anvil. Run a string belt from spool pulley R over to one of the spool pulleys G on the paddle-wheel (Fig. 348).

The Toy Grindstone. Spool pulley *T* on the lower shaft *V* (Fig. 354) is belted to the second spool pulley *G* on the paddle-wheel, and spool-pulley *U* on shaft *V* is belted to

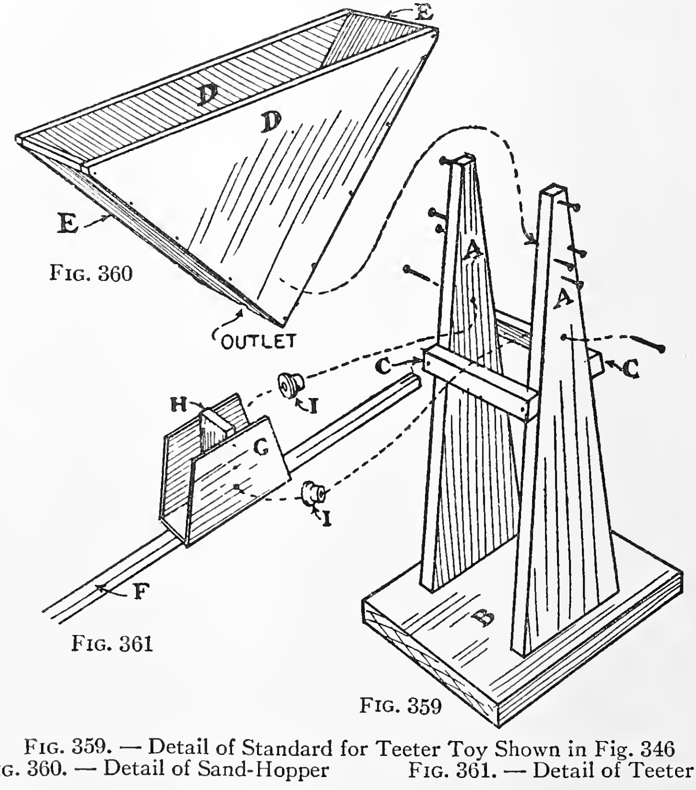


FIG. 360

FIG. 361

FIG. 359

FIG. 359. — Detail of Standard for Teeter Toy Shown in Fig. 346
FIG. 360. — Detail of Sand-Hopper FIG. 361. — Detail of Teeter

a toy grind-stone built as shown in Figs. 357 and 358, with a base block *W*, uprights *X*, stone *Y*, and spool pulley *Z*. Mount the wheels in the same way that the other wheels are mounted.

The Teeter Toy. This sand toy, shown in Fig. 346, is built with a sand-motor of its own.

The Standard supporting the teeter is shown in detail in Fig. 359. Cut uprights *A* of the size shown in Fig. 362, base *B* of the size shown in Fig. 363. Fasten the uprights to the base 3 inches apart.

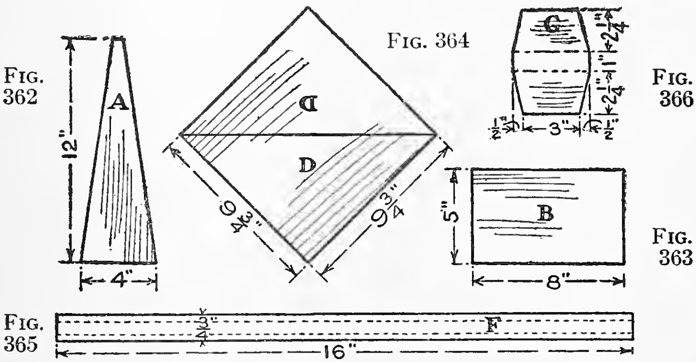


FIG. 362. — Pattern of Standard Upright FIG. 363. — Pattern of Base
FIG. 364. — Pattern of Hopper Sides FIG. 365. — Pattern of Teeter
FIG. 366. — Pattern of Teeter Sand-Pocket

The Hopper is made of four pieces (*D* and *E*, Fig. 360). Cut a square piece of ½-inch board of the size shown in Fig. 364, and saw it in half from corner to corner, for side pieces *D*; cut end pieces *E* 2 inches wide by the length of the short edges of the side pieces. Lap the end pieces, and nail together, then nail sides *D* to their side edges. Bore a hole through the center of the hopper bottom (Fig. 360) for a sand outlet, then fasten the hopper between supports *A*, so the bottom is 3 inches below the top of the supports.

The Teeter must be light in weight, and must be delicately balanced, so it will respond quickly to the overbalancing action of sand dropping into the pockets at the center. In making his first model, the author used a thin stick for the teeter plank, but found that it was too heavy. In the model shown in Fig. 346, a strip of cardboard folded in three was used (*F*, Fig. 361), and the weight of this is just right. Cut the strip of cardboard of the size shown in Fig. 365, score it from end to end, $\frac{3}{16}$ inch from each edge, as indicated by dotted lines in the pattern, and bend over the edges. By bending the strip in this way, it will be stiffened sufficiently to carry the weight of the sand dropping upon it at the center, and the weight of the cardboard dolls on the ends. The

FIG. 367. — Boy for Teeter
FIG. 368. — Pattern of Boy's Body
FIG. 369. — Pattern of Boy's Leg
FIG. 370. — Pattern of Girl's Body
FIG. 371. — Pattern of Girl's Leg

center *sand-pockets* are formed with the piece of cardboard *G* (Fig. 361), cut of the shape and size shown in Fig. 366, and the *separator block H*, which is ¼ inch thick, 1 inch wide, and 2½ inches long. Tack the folded piece of cardboard *G* to the sides of block *H*, and glue the teeter-board strip *F*, at its center, to the under side of the pockets.

The teeter must be fastened between the supports so there will be ½ inch space between the top of block *H* and the outlet in the hopper, and so the outlet will be exactly over the center of the top of block *H*. Use nails for pivots, and drill holes through uprights *A* a trifle larger than the nails, so the nails will turn easily Use halves of spools for *washers* (*I*, Fig. 361), to fill the space between the sides of the sand-pockets and the uprights.

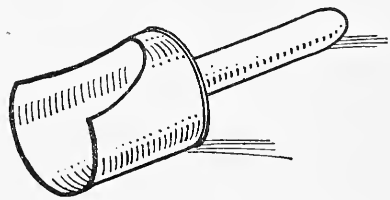


Fig. 372. — Tin Can Sand Scoop

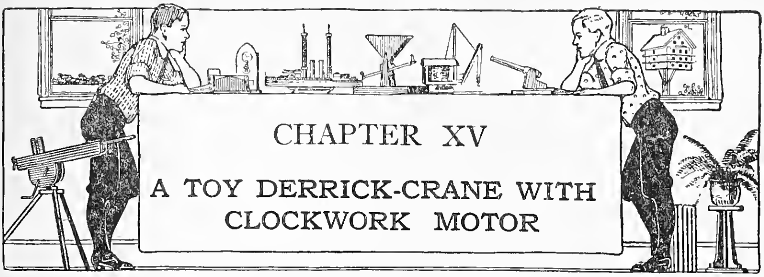
Strips *C* (Fig. 359) are nailed to the side edges of uprights *A* to act as *bumpers*. Their purpose is to prevent the teeter from tilting too far. In the model shown in the photograph, the strips are placed 1¾ inches below the level of the nail pivots. Adjust the strips on your model so as to have the teeter tilt to whatever angle you want it to go.

How the Teeter Toy Works. When the sand-hopper is filled with sand free from pebbles and dirt that would clog the outlet, the teeter is set in motion. The sand pours into whichever sand pocket is tilted uppermost, until the weight is sufficient to cause an overbalance, then the end of the teeter board on that side of the center drops until the bumper *C* is struck. As soon as the teeter tilts in this direction, the sand empties out of the pocket, and the sand from the hopper pours into the other pocket, now uppermost, until the weight again overbalances, and the teeter inclines in the other direction. Once begun, the teetering movement continues as long as sand remains in the hopper.

The teeter toy requires a couple of

Doll Teeterers. In Fig. 367 you will see how to make a boy doll. The pattern of the body in Fig. 368, and pattern of the legs in Fig. 369, are shown full-size. Make a tracing of each pattern, and transfer the tracing upon light-weight cardboard or heavy note-paper. Glue the legs to the sides of the body as shown in Fig. 367. Figure 370 shows a pattern for the body of the girl doll, and Fig. 371 a pattern for the legs. Glue only the tip ends of the legs to the body. Slot each end of the teeter, slip the end of the doll body into the slot, and bend out the legs to straddle the teeter, as shown in Fig. 346.

A Sand Scoop for throwing used sand back into the hopper, can be made by cutting away part of the side of a tin can, and nailing the can bottom to the end of a stick handle, as the scoop shown in Fig. 372 is made.



CHAPTER XV

A TOY DERRICK-CRANE WITH CLOCKWORK MOTOR

All boys are interested in making things that "run," yet, surprisingly, few who have not had the possibilities demonstrated to them through the author's handicraft books and articles, think of utilizing clockwork for motive power. Those of you readers who have built the models described in The Boy Craftsman, Handicraft for Handy Boys, and Home-Made Toys for Girls and Boys, know that clockwork toys are among the best of home-made mechanical toys. You will not need to be told that the derrick-crane illustrated in Figs. 373 and 374 is well worth the time and effort required to make it.

One of the good points about using

Clockwork for Toy Motors is that any boy can obtain a set. The lifetime of the common form of alarm-clock is short enough to make discarded clocks plentiful, and all that a boy has to do, in case there isn't a worn-out clock at home, is to make inquiry of a friend or relative. Almost every one would be glad to have turned to account the clock that has become useless to him.

Figure 375 shows a clockwork converted into a motor for the toy derrick-crane. Besides removing the clock *hands*, it is necessary to remove the *balance-wheel* (*A*, Fig.

376) and the little *lever* (*B*) pivoted next to it. This is done to increase the speed of the clockwork. The wheel and pivot can be flipped out of their positions after the nuts which hold the frame together have been loosed.

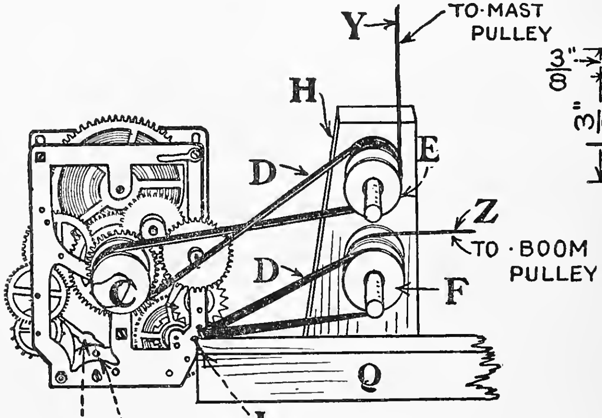


Fig. 375

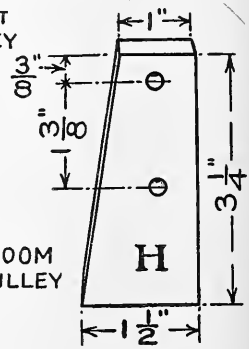


Fig. 377

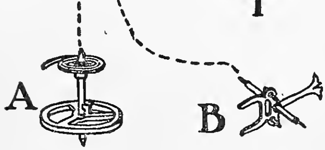


Fig. 376

Fig. 375. — Detail of Clockwork Motor, Rubber-Band Belts, Spool Pulleys and Drums
Fig. 376. — Balance-Wheel and Lever to be Removed from Clockwork
Fig. 377. — Detail of Drum Frame Upright

The Pulley Wheel for belting up the clockwork motor to the toy is a short silk-thread spool (*C*, Fig. 375), fastened to the pivot from which the clock hands were removed. This spool may be fastened either with sealing-wax or solder. Lay the clockwork upon its back, center the spool on the pivot, and pour in the melted wax or solder; but be

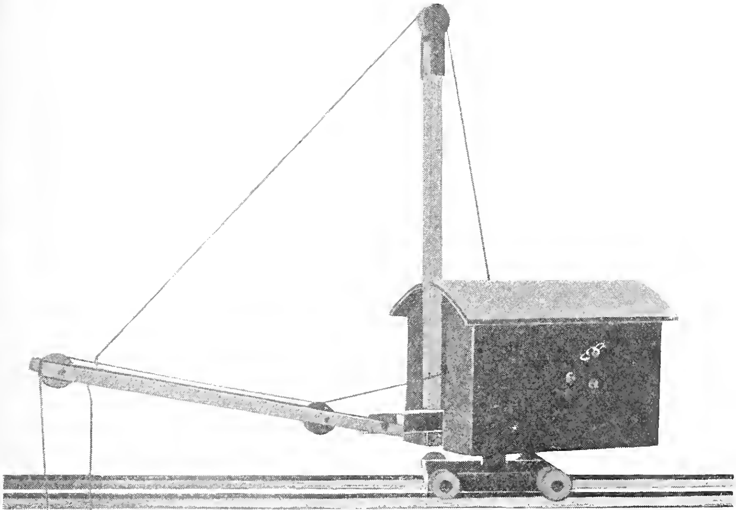


Fig. 374.—Boom and Cable can Be Operated Simultaneously.

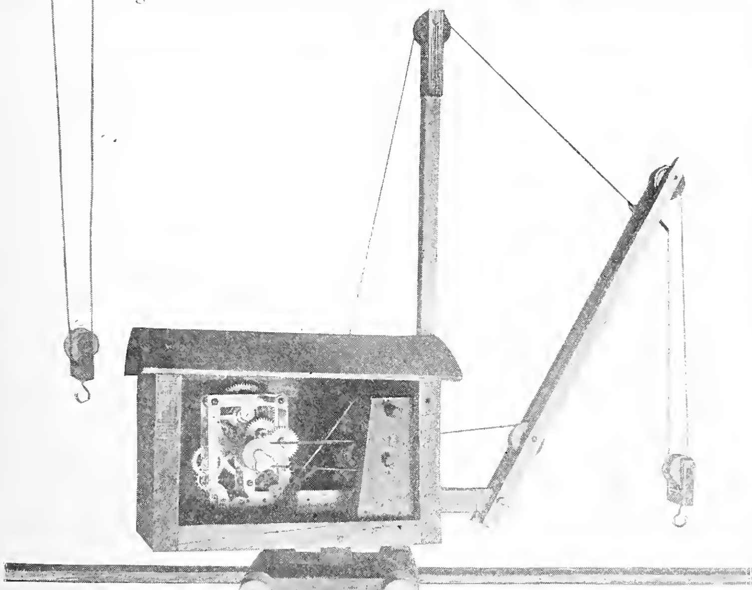


Fig. 373.—The Toy Derrick-Crane with Clockwork Motor.

sure to protect the surrounding wheels by placing a piece of paper over them, especially if you use solder, otherwise you are likely to spill the solder on the wheels and unite them into a solid mass.

For Pulley-Belts, buy a couple of rubber-bands 3/16 inch wide and 2 1/4 inches long (*D*, Fig. 375). The purpose of one of the rubber-band belts is to turn the *drum* on which the *cable* is wound that raises the *derrick boom*; the purpose of the other rubber-band belt is to turn the drum on which the *hoisting-cable* is wound. The belts run from the spool pulleys *F* joined to the spool drums *E*, to the spool pulley *C* on the clock work motor (Figs. 375 and 378). By the two-belt arrangement, one or both winding-drums can be turned at a time, by slipping one or both belts upon pulley *C* on the clockwork motor. When only one belt is connected up, the other is slipped over the nail *I* (Fig. 375) to lock the winding-drum which it turns. By giving the belt a half twist before slipping it over the pulley, as shown in Fig. 375, the drum will turn in the direction opposite to that in which it turns when it runs straight over the pulley; therefore, the winding and unwinding of the drums depend upon whether the belts run straight or are twisted. Five operations can be controlled. The cable can be wound upon one drum while the other drum is locked (Fig. 375), or it can be unwound, both cables can be wound or unwound simultaneously, and one cable can be wound while the other cable is being unwound. Also, both belts can be thrown off the motor pulley, and looped on to the nails *I* (Fig. 378), to lock the drums and allow the motor to run free.

The Winding-Drums are common thread spools (*E*, Figs. 378 and 379), the pulleys on their ends (*F*) are short silk spools. Nail the pulley spools to the drum spools with brads. Cut the *axle* for mounting the drums and pulleys enough smaller in diameter than the spool holes so the spools will turn easily (*G*, Fig. 379). The axles are mounted on *supports* *H* (Fig. 378), a pattern for which is given in Fig. 377. The axle holes are located on the pattern.

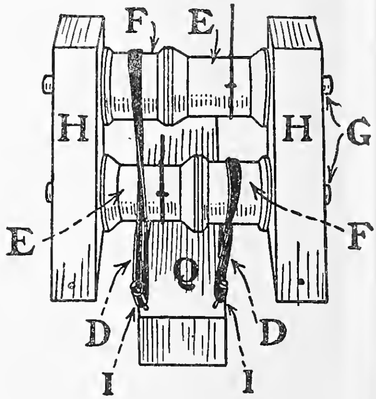


Fig. 378

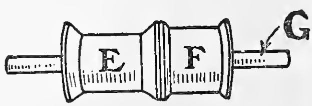


Fig. 379

Fig. 378. — Drum and Pulley Frame
Fig. 379. — Spool Drum, Pulley and Shaft

The Motor Shack is shown in detail in Fig. 380. Patterns for the *floor* (*J*), *end walls* (*K*), and *side wall* (*L*), are given in Fig. 383. Cut floor *J* and ends *K* out of ⅝-inch wood, and use a piece of cigar-box wood for side *L*. The *roof* is shown in pattern *M* (Fig. 383). This is also a piece of cigar-box wood. The roof piece must be soaked in water, to prevent its splitting, before it is bent over the rounded ends *K*. The notch in the front edge of the roof piece is provided to admit the derrick *mast*. The notch in the front wall *K* is provided to admit the *beam* *Q*, (Fig. 384), and the hole bored to one side of the notch is made for the *hoisting-cable* to run through.

Install the Motor before attaching the roof to the shack. Place the clockwork against wall *L*, mark the points where the pivots touch the wood, and bore holes through the wall at these points for the pivots to stick through. One of the

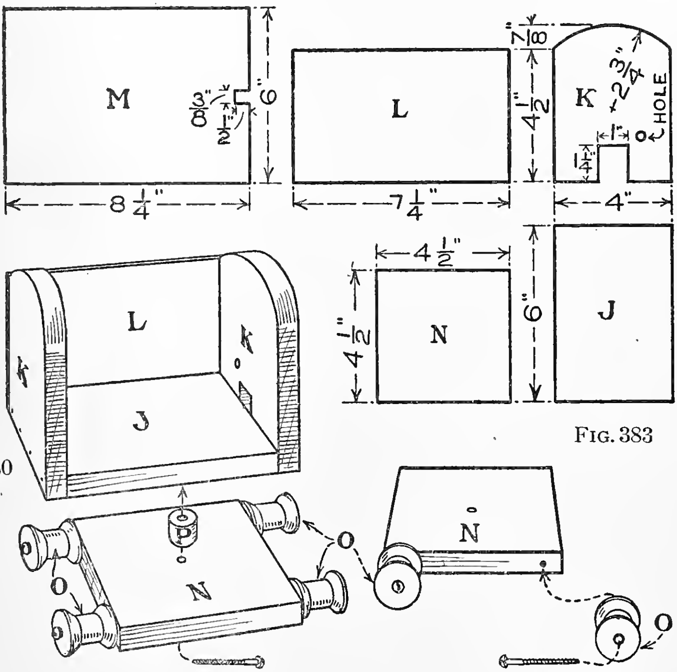
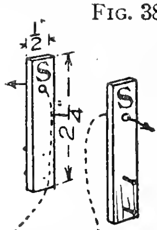


Fig. 380
Fig. 383
Fig. 381
Fig. 382

Fig. 380. — Detail of Motor Shack
Figs. 381 and 382. — Details of Turntable Truck
Fig. 383. — Patterns for Parts of Shack and Truck

projecting pivots is for the *alarm-winding key*, another is for the *time-winding key*. Screw these keys onto their pivots, and they will hold the clockwork to the wall. Nail the winding-drum supports *H* to floor *J* and to front wall *K*.

Fig. 389



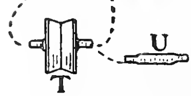


Fig. 386

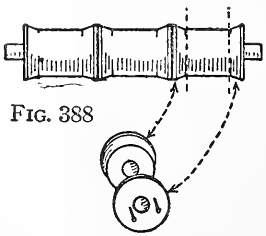


Fig. 388

Fig. 387

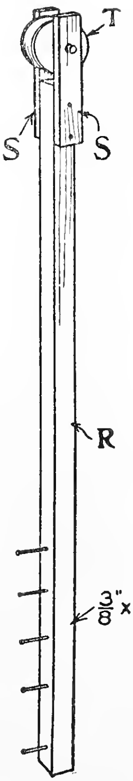


Fig. 385

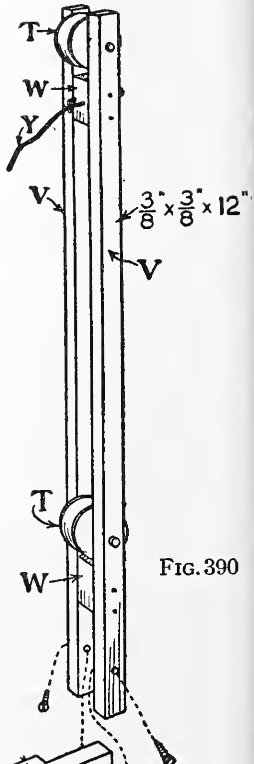


Fig. 390

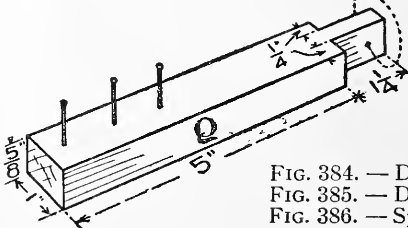


Fig. 384

Fig. 384. — Derrick Beam
Fig. 385. — Derrick Mast
Fig. 386. — Spool Pulley and Axle
Figs. 387 and 388. — How Pulley is Made
Fig. 389. — Pulley Supports
Fig. 390. — Derrick Boom

The motor shack is pivoted upon a base (*N*, Fig. 381),to turn as

A Turntable, so that the derrick-crane may be swung around in any direction, and the base *N* is mounted on spools (*O*, Fig. 382), to form a truck that can be moved along a track (Figs. 373 and 374). Pivot the shack with a screw slipped through a hole bored through the center of board *N* and screwed into the center of floor *J*. Slip the center portion of a spool (*P*) between floor *J* and board *N*.

The Derrick is the next portion to construct. First prepare

The Beam *Q* by the diagram of Fig. 384, with one end notched on each side to fit between the lower ends of the *boom* (Fig. 390). Slip the beam through the notch in the front wall of the shack, and nail it to floor *J*. Then prepare

The Mast *R* of the size shown in Fig. 385. At the upper end of this is fastened

The Mast Pulley *T* (Figs. 385 and 386). The pulley-wheel is

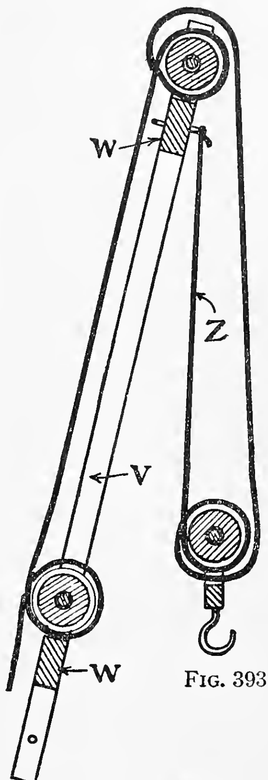


Fig. 393

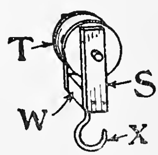


Fig. 391

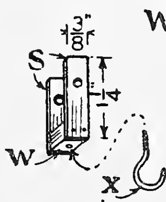


Fig. 392

Figs. 391 and 392.— Details of Hoisting-Block
Fig. 393. — Detail of Hoisting-Cable

made of the ends of a spool (Fig. 387). The easiest way to saw off the ends of a spool is to drive three spools onto a stick whittled to fit tightly in their holes (Fig. 388), and then hold onto two of the spools while you saw off the ends of the third spool. Cut an *axle* to fit the pulley-wheel (*U*, Fig. 386), and prepare a pair of supports with a hole in each to receive the axle ends (*S*, Fig. 389). Nail the supports to the mast end as shown in Fig. 385.

The Boom (Fig. 390) has two side sticks (*V*), two *separators* (*W*), and a pair of pulleys (*T*). Make the pulleys like the mast-top pulley. Assemble the boom parts as shown. The lower ends of sticks *V* are pivoted to the end of beam *Q*, so the boom can be raised and lowered. Bore holes through strips *V* for screw pivots to run through.

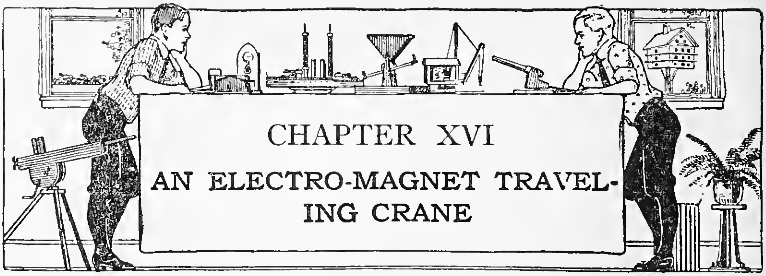
The Hoisting-Block (Fig. 391) consists of a spool-end pulley (*T*), a frame made of two axle supports (*S*, Fig. 392), a separator (*W*), and a *screw-hook* (*X*). Assemble the parts as shown.

Heavy cotton wrapping-twine is best for

The Cables. Attach the cable for raising and lowering the boom to a small *double-pointed tack* driven into the upper separator *W* of the boom (*Y*, Fig. 390), then run it over the pulley on the top of the mast, run it down through a hole in the roof of the shack, and tie it to the upper winding-drum.

Tie the hoisting-cable to a double-pointed tack driven into the under side of the upper separator *W* (*Z*, Fig. 393), pass it completely around the pulley of the hoisting-block, then run it up and once around the upper pulley of the boom, then down to and once around the lower pulley of the boom, and then through the hole in the front wall of the motor shack, and tie to the lower winding-drum. A drop of glue will hold the string cables fast to the winding-drums.

Tracks for the derrick truck to run upon can be made of a pair of long sticks, and these can be nailed to the tops of boxes, or placed across the tops of chair backs.



CHAPTER XVI

AN ELECTRO-MAGNET TRAVELING CRANE

An electro-magnet is one of the most interesting of the simpler, easily constructed pieces of electrical apparatus which a boy can make. In the author's book The Handy Boy, are shown several things to make with electro-magnets. In this chapter an electro-magnet is shown incorporated in a toy traveling crane (Fig. 394) The crane travels back and forth upon a track supported on chair backs, and the electro-magnet, raised by a cord cable that winds upon a spool drum, will lift as many as two hundred and fifty brads at a time. One of the author's readers who built an electro-magnet derrick like the one described in The Handy Boy, writes that by making a trifle longer electro-magnet than that shown in the model, he was enabled to lift a weight of 1 pound 2 ounces. The traveling crane is easy to make.

The Crane Carriage (Fig. 395) is a simple frame built up of two pairs of wooden strips (*A* and *B*), mounted upon a pair of ribbon spool *wheels* (*C*), with a third spool (*D*) mounted between for the *cable winding-drum* Bore three ¼-inch holes through strips *A* (Fig. 396) for the spool *axles*. Cut the axles to fit snugly in the holes of the spool wheels and winding-drum (Figs. 397 and 398), and cut their ends to fit loosely in the holes in strips *A*. *Crank* *F* (Fig. 399) is to be fastened to axle *E*. A similar crank must be fastened to one end of one of the wheel axles (Fig.

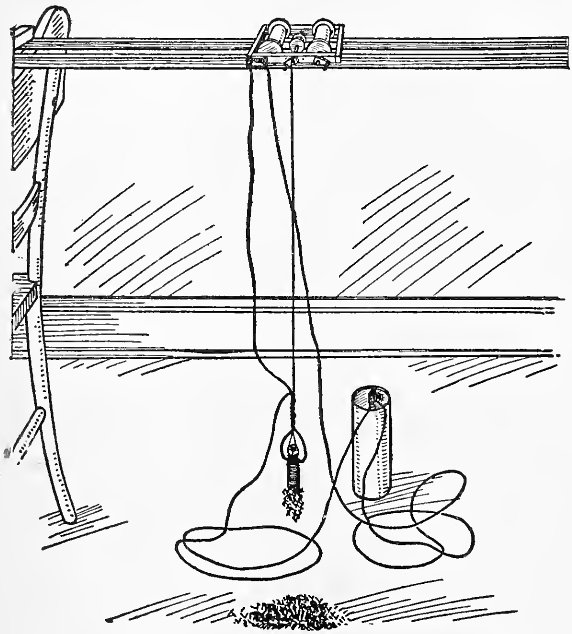


FIG. 394. — The Electro-Magnet Traveling-Crane

395). A long brad forms the *crank-handle*. The handle for the winding-drum crank should fit loosely, and several small holes should be drilled in stick *A* in the correct positions so the crank handle can be pushed into them to lock the winding-drum at any point desired (Fig 395) The crank on the wheel axle moves the crane carriage along its tracks.

Make the Tracks of Sticks heavy enough to support the carriage and loads to be hoisted, without bending. Nail strips across the ends of the track sticks to hold them at the proper distance apart (Fig. 394).

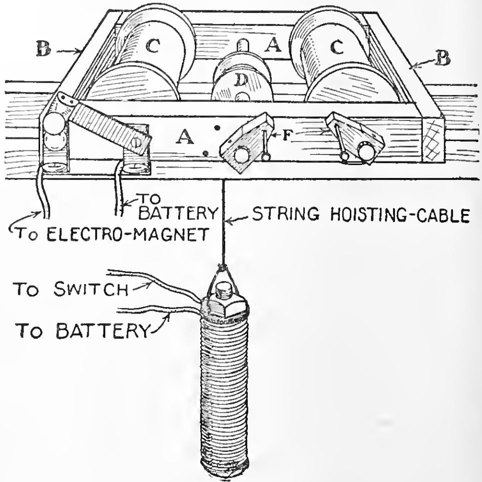


FIG. 395. — Detail of Crane Carriage and Electro-Magnet

The Electro-Magnet has a core of soft iron encased in a coil of wire. When an electric current passes through this coil, the core becomes a magnet, but it retains its magnetism only as long as the current continues to pass through the wire. In using an electro-magnet, therefore, the electric current must be passed through the coil continuously while a load is being lifted, and shut off when the load is to be dropped.

FIG. 398

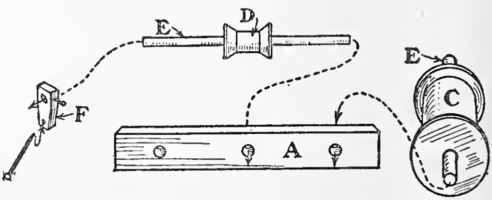


FIG. 399 FIG. 396 FIG 397

FIGS. 396-399. — Details of Crane Carriage

Figure 400 shows the completed electro-magnet. A carriage-bolt about 2 ½ inches long and ¼ inch in diameter is needed for the *magnet* *core*, insulated electric-bell wire for the *coil*, cardboard, paper, and a dry-battery cell.

Cut three cardboard *washers* of the diameter of the bolt-

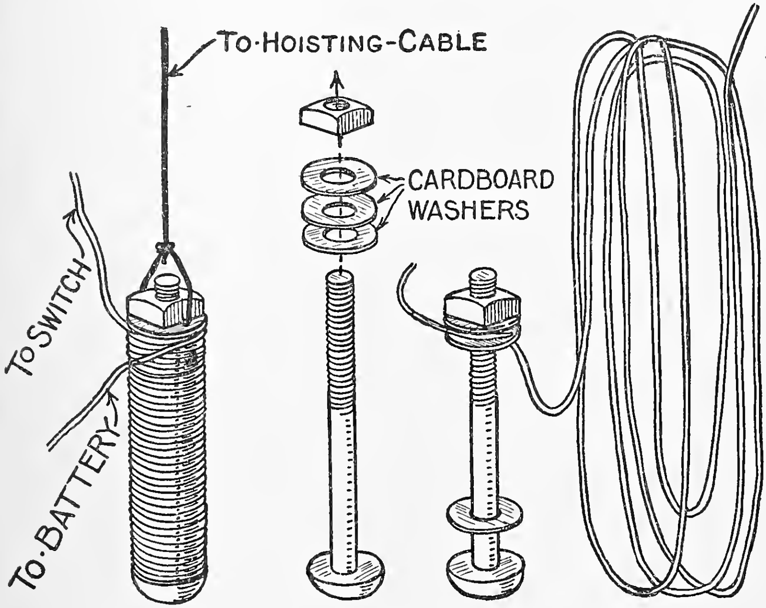


FIG. 400 FIG. 401 FIG. 402

FIG. 400. — The Electro-Magnet
FIG. 401 and 402. — Detail Showing Magnet Winding

head (Fig. 401), slip them over the bolt, and screw on the nut (Fig. 402). Then slip one end of the wire between the upper two washers, and, starting at that end, wind the wire around the bolt, pushing each turn close to the preceding turn. When the head of the bolt is reached, wind back to the starting point; then wind back to the head again, and so on until four or six layers have been wound on. Slip the second end of the wire between the cardboard washers, and screw the nut tight to hold the coil in position.

Figures 394 and 395 show how one wire end of the coil

FIG. 405 FIG. 407

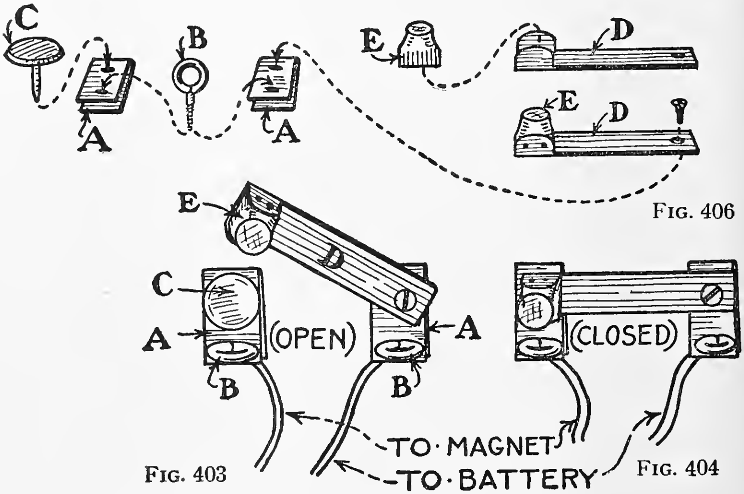


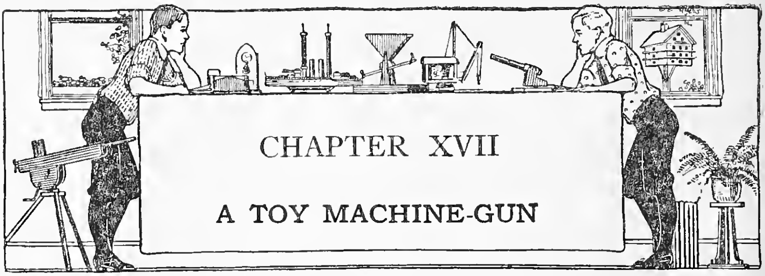
FIG. 406 FIG. 403 FIG. 404

FIGS. 403 and 404. — Switch Open and Closed
FIG. 405. — Details of Binding-Post and Contact Plates
FIGS. 406-407. — Details of Switch

is connected by wire with a dry-battery cell, how the other end is connected with a *switch* on the crane carriage, and how a third wire connects the battery with the switch.

The Switch for opening and closing the electric circuit is shown in Figs. 403 and 404. Make the *contact plates A* out of tin or brass (Fig. 405), and punch holes through them for screw-eye *binding-posts B*, for brass tack *contact point C*, and for the *lever* screw. Make lever *D* (Figs. 406 and 407) of tin or brass, with turned up tips on one end to tack to the wooden *knob E*.

The Hoisting-Cable cord is to be attached to the top of the magnet, then run up and over the winding-drum spool, and glued to it.



CHAPTER XVII

A TOY MACHINE-GUN

If you will carefully follow the instructions and working details given in this chapter, you will have in your possession after a few hours' work, the toy machine-gun shown in Fig. 408. This gun will fire twelve wooden cartridges in as short a time as it takes to turn the firing-crank twelve revolutions. It will wipe out an army of toy soldiers in no time at all. If you want to, you can organize a machine-gun squad and drill out in the open as the boys in the photograph of Fig. 409 are doing. A pamphlet on machine-gun drill can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Figure 410 shows a detail of the completed machine-gun, and the *tripod mount*. Figures 411 and 412 are longitudinal sections through the *stock*, *barrel*, and *cartridge chamber* and *magazine*, showing the *hammer* and *firing mechanism*. Figure 413 shows a longitudinal section of the gun-stock. This is the first part of the gun to prepare. It is made of three parts (*A*, *B*, and *C*). Figure 414 shows dimensions of the blocks required for parts *A* and *B*. After planing up these blocks square and true, and of the given dimensions, draw diagonal lines across both ends of block *A*, and across one end of block *B*, to locate the centers. Then

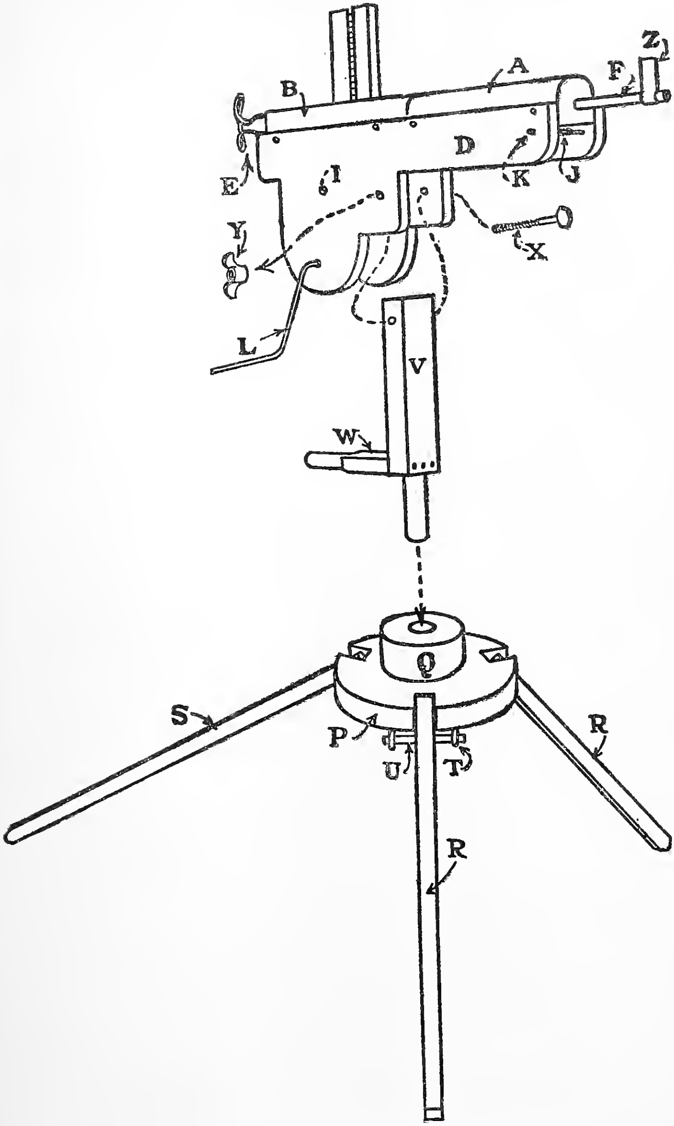


Fig. 410. — Detail of Machine-Gun and Tripod

with a ⅝-inch bit bore a hole through the center of block *A* from end to end, and another hole through the center of *B* for a distance of 7 inches. These holes are for the barrel (*F*, Figs. 411 and 417), a piece of brass-tubing ½ inch in diameter. The reason for boring the hole larger than the

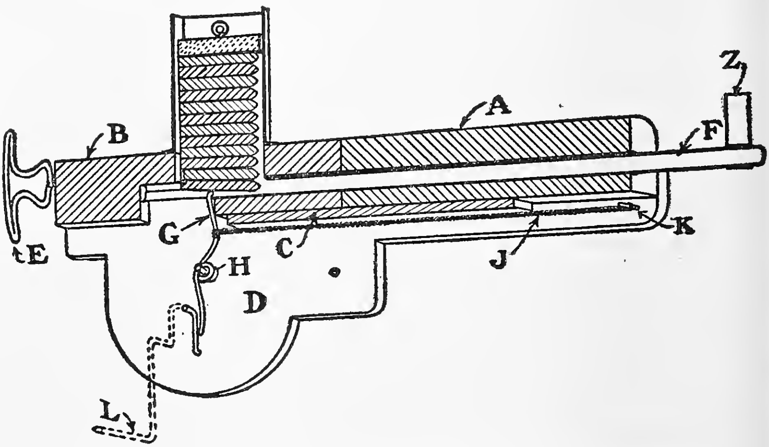


FIG. 411. — Machine-Gun before Hammer has been Drawn Back

barrel is so that the barrel can be mounted straight even though the hole runs a trifle off center. This will allow for only a slight correction, so you must bore the holes accurately. The brass tubing used for the barrel must not be forced into a crooked hole, as it will bend easily, and a bent bore would make a poor gun. It is best to bore from both ends of block *A* halfway through the length. When the holes have been bored, round off the top of block *A* from end to end, as shown in Fig. 415, and shape off the top of block *B* at the end through which the barrel hole has been bored, so when blocks *A* and *B* are joined their ends will match. Two *mortises* must be cut in block *B*, one mortise down through the top as far as the barrel bore, the other up through the bottom as far as the bore. The mortises are located, and

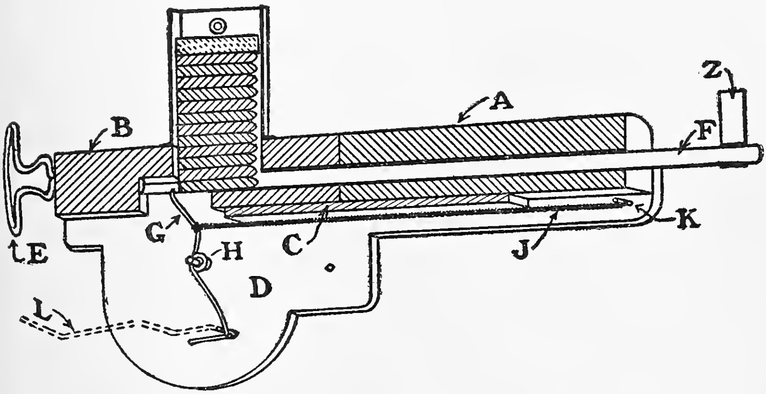
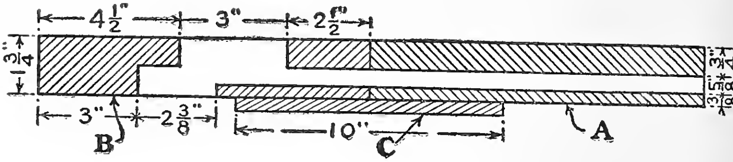


FIG. 412. — Machine-Gun with Hammer in Position for Firing

their sizes are indicated, on Figs. 413 and 415. Mark out the mortises carefully. Bore several ½-inch holes inside of the mortise lines, boring them as deep as the barrel bore, then cut out the wood between the holes with a chisel, and square up the mortises.

When blocks *A* and *B* have been prepared, fasten them together with plate *C* (Fig. 413). Cut this of the same width as the blocks, and 10 inches long, and lap it as shown. Handle *E* on the *breech* end is a wire coat-hook. Mark out side pieces *D* of the stock frame by the pattern shown in

Fig. 413



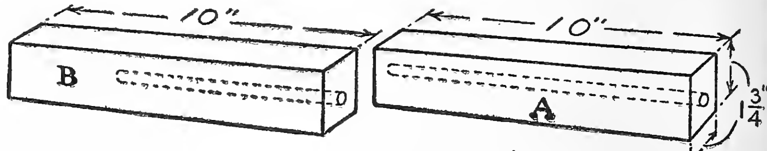


Fig. 414

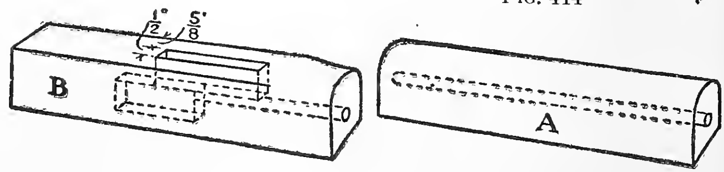


Fig. 415

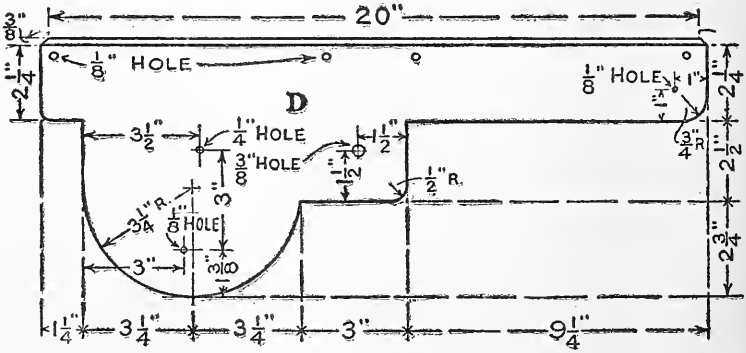


Fig. 416

Fig. 413. — Longitudinal Section of Machine-Gun Stock
Figs. 414 and 415. — Details of Stock
Fig. 416. — Detail of Stock Frame

Fig. 416. The easiest way to prepare these parts so they will be alike is to tack together two ⅜-inch boards, mark out the outline upon one board, and then saw out the two pieces at one time. Plane up and sandpaper the edges, before separating the pieces. Also, bore the holes shown in Fig. 416 — four ⅛-inch holes near the top edge, and four holes of the sizes marked, in the positions located. Use for these holes will be shown later.

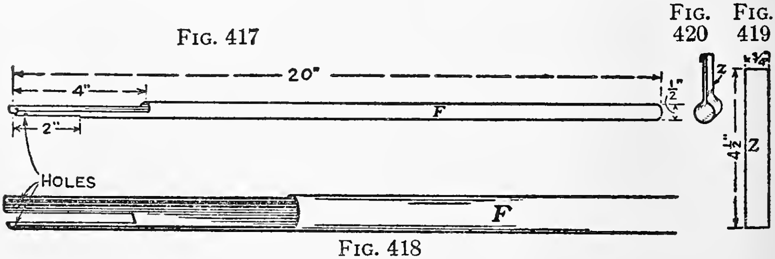
The piece of tubing for

The Barrel must be free from corrosion on the inside, it must be straight, and its ends must be reamed out with a file if burrs remain on the inside edges from the cutting of the pipe. The author used a piece of iron gas-pipe in his first model, but found that brass tubing is better as it presents a smoother inside surface, it is easier to cut, also. You can get brass tubing at almost any machine-shop. If they haven't a piece of the right size at hand, they will likely get a piece for you, or be able to tell you where you can get it. A piece 20 inches long is required. Figures 417 and 418 show how the *chamber* end of the barrel must be slotted for a length of 2 inches, and how the upper half of the tubing must be cut away for a distance of 4 inches. You can cut the slot with a flat file ⅛ inch thick, using it edgewise, and making the slot equal in width to the thickness of the file. The upper part of the tubing can be cut away by using the file flatwise. The pair of small holes shown pierced through the tubing near its end are provided for anchoring the barrel in the gun-stock by driving a finishing-nail through the gun-stock and through the holes.

The Front Sight (*Z*, Fig. 410) is a strip of tin of the size shown in Fig. 419, bent to fit over the muzzle of the barrel, with the tip of one end of the strip hammered over on to the other end (Fig. 420).

The wire for

The Hammer Rod (*G*, Figs. 411 and 412) must be of No. 6 gauge. Figures 421 and 422 show the correct shape and size. To make the turns at the point for pivoting, bend the wire around a bolt or dowel-stick. Spools *H*



Figs. 417 and 418. — Details of Tubing for Machine-Gun Barrel
Figs. 419 and 420. — Details of Front Sight

(Fig. 421) are used to keep the rod centered half way between sides *D* of the gun-stock frame. Cut off as much of the end of each spool as is necessary to make the pair of the right length to fill the space each side of the rod. A ¼-inch bolt 3 inches in length is required for the hammer-rod pivot (*I*, Fig. 421).

The Hammer Spring is a screen-door spring (*J*, Figs. 411 and 421). Pull out several turns of one end as shown in Fig. 421, and slip them over the upper end of the hammer-rod. Pin the other end of the spring between pieces *D* with the nail *K* (Figs. 410 and 411), slipping the nail through the holes in the fore end of pieces *D*. It may be necessary to break off an inch or so of one end of the spring, to make it short enough so it will be held in tension when its ends are fastened.

The Firing Crank (*L*, Figs. 410 and 411) is made of wire of the same thickness as that used for the hammer-rod.

Fig. 422

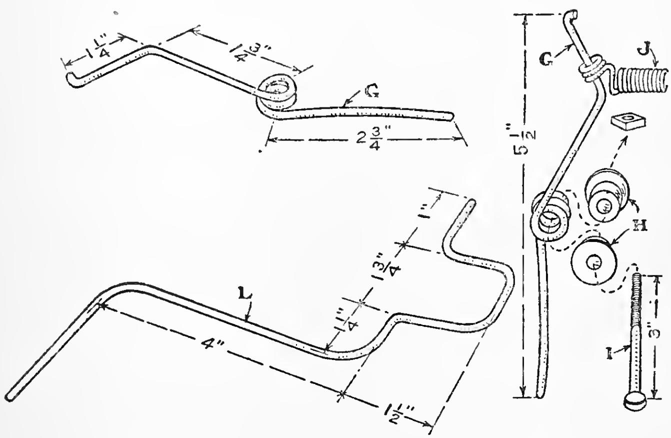


Fig. 423 Fig. 421

Figs. 421 and 422. — Details of Hammer-Rod and Pivot
Fig. 423. — Detail of Firing-Crank

Figure 423 shows dimensions for bending the piece. The loop bent in this piece of wire acts as a tripper on the hammer-rod end, as you will see by looking at Figs. 410 and 411. The hammer-rod, spring, and firing-crank must be mounted in the gun-stock frame between side pieces *D* before the

FIG. 426

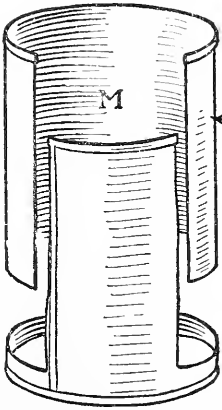
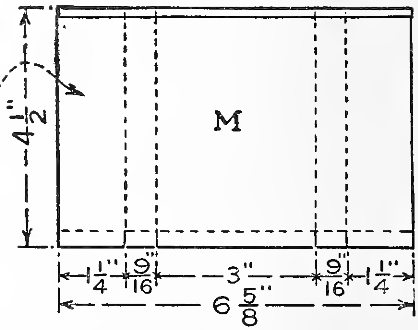


FIG. 427



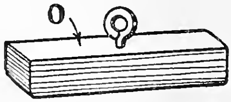


FIG 428.

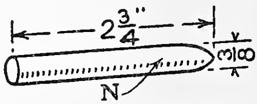


FIG. 424

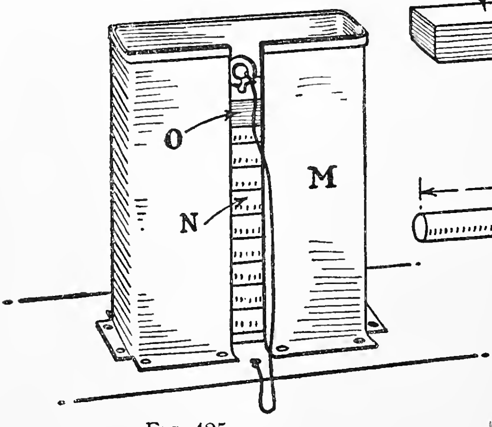


FIG. 425

FIG. 424. — Detail of Cartridge
FIG. 425. — Magazine Filled with Cartridges
FIGS. 426 and 427. — Details of Magazine
FIG. 428. — Weight for Holding Cartridges in Position

latter are fastened to the stock. Figure 411 shows the right position for the hammer tip when the hammer-rod has been released, and Fig. 412 shows the point to which the hammer must be drawn by the firing-crank rod tripper before being released. If you have bent the hammer-rod and firing-crank rod as shown in the drawings, the hammer tip should come at the two points shown. If it does not, bending the wires at slightly different angles will bring about the proper adjustment.

Before proceeding further with the construction, it will be well to test out the machine-gun with

Cartridges. These are pieces of dowel-sticks ⅜ inch in diameter, cut to the length shown in Fig. 424, with one end whittled cartridge-shape. Sandpaper the cartridges smooth, then wax and polish them. To make the bore of the barrel as smooth as possible, pour oil into it, and then, with a piece of soft rag on the end of a slender stick, spread the oil and remove the surplus. Give plenty of time to testing the firing efficiency of the gun, and adjust and readjust the hammer-rod and firing-crank rod until you are satisfied with the results obtained.

The Magazine (Fig. 425) is fastened to the gun-stock directly over the upper mortise, so that the cartridges dropped into it will slip into the chamber beneath. Figure 426 shows how to cut the piece of tin required for the magazine, from the side of a tin can. Leave the turned-over edge on the can side, as shown, to reinforce the upper edge of the magazine. Figure 427 gives the dimensions for cutting and folding the piece of tin. Bend the lower edge to form flanges through which to drive tacks for fastening the magazine to the top of the gun-stock.

The weight shown in Fig. 428 is necessary to hold down the cartridges so the bottom cartridge will always be in

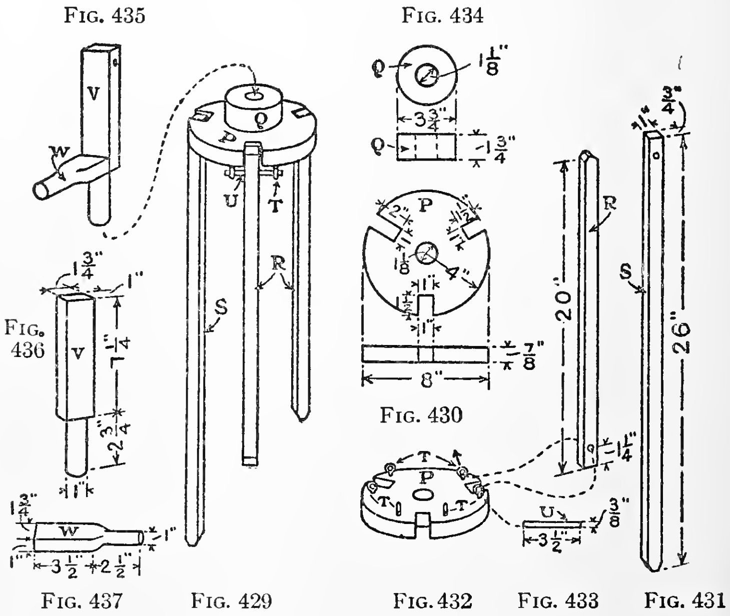


FIG. 429. — Machine-Gun Tripod
FIGS. 430-434. — Details of Tripod
FIGS. 435-437. — Details of Yoke for Mounting Gun on Tripod

the right position in the chamber for the hammer to strike. A piece of solder, or a piece of almost any kind of metal, will do. If you use solder, a screw-eye can be set into one side, to which to attach a piece of string as a means for lifting out the weight after the last of the cartridges has been fired, preparatory to refilling (Fig. 425). The slot in the side of the magazine is made wide enough so the finger can be slipped along it to guide the cartridges dropped into the magazine.

Figure 410 shows

The Tripod mount for the machine-gun, and Figs. 429 to 434 show details of its construction. Prepare the head block *P* of the dimensions given in Fig. 430, and cut three notches in the edge, of the sizes shown, and spaced equidistantly, for the legs. Bore the center hole to receive the *yoke* spindle *V* (Fig. 436). Cut the front pair of legs *R* and the rear leg *S* of the sizes shown in Fig. 431. Bore a 3/8-inch hole through each leg 1 1/4 inches from the upper end, and cut off the corners of the lower end as shown. To mount the legs, screw a screw-eye into the tripod head each side of each notch (*T*, Fig. 432), then cut the dowel-pin pivots *U* (Fig. 433), and drive them through screw-eyes *T* and through the holes in the legs (Fig. 429). Cut socket block *Q* of the size shown in Fig. 434, bore a hole through its center to receive the yoke *V*, and fasten it to the exact center of tripod head *P*.

Prepare yoke *V* and lever *W* (Fig. 435) of the dimensions shown in Figs. 436 and 437. Cut the spindle on the lower end of yoke *V* to fit the hole in socket block *Q*, and bore a hole through the upper end of the yoke through which to drive the axis bolt for pivoting the gun, to provide for changing *elevations*. Use the *thumb-bolt X* and *wing-bolt Y* (Fig. 410) for making this connection.

Paint all parts of the gun black or grey. To make them less conspicuous in the field, it is common practice to paint guns by what is known as the "rainbow smudge" system. But you will not want to dabble in the art of camouflage when finishing your toy machine gun.

To be an up-to-date machine gunner, you must wear

A Helmet like that the boys in Fig. 409 are wearing. A detail of this helmet is shown in Fig. 438. It consists of a

Fig. 441

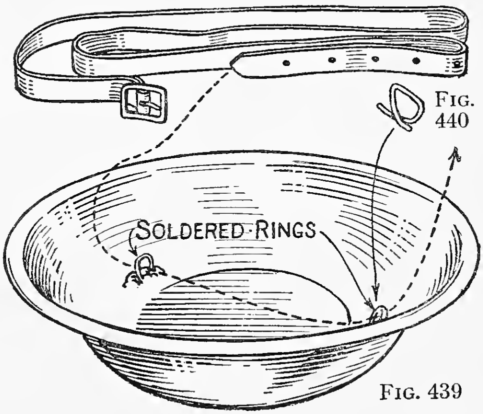


Fig. 440

Fig. 439

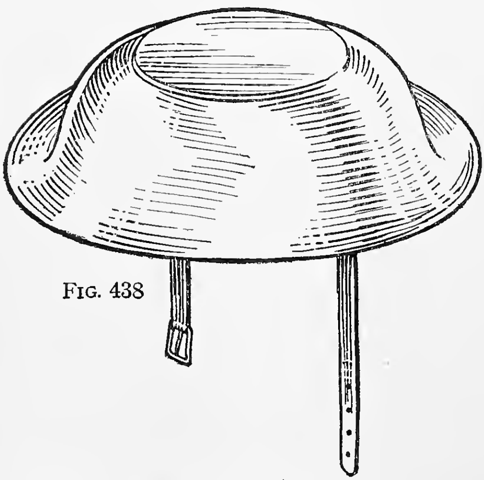
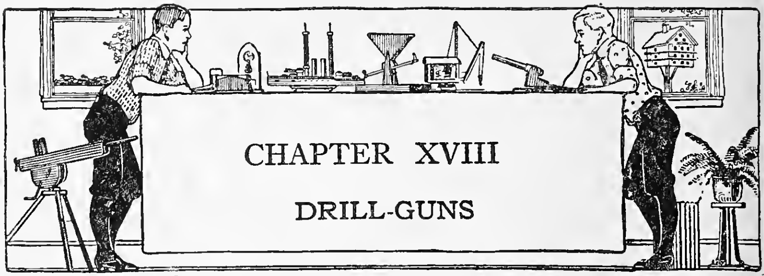


Fig. 438

Fig. 438. — Wash-Basin Helmet
Figs. 439-441.— How to Attach Rings and Straps to Wash-Basin

tin wash-basin 11 inches in diameter (Fig. 439) with a pair of rings bent out of wire (Fig. 440) soldered to the inside, through which to run the chin-strap (Fig. 441). Stitch the strap to the rings, to keep the basin from slipping sidewise.



CHAPTER XVIII

DRILL-GUNS

Every boy wants to belong to a drill-club, and if instruction from a man with military training can be obtained, there is no reason why a boys' club or class should not organize a drill club. The handbook Infantry Drill Regulations, which can be purchased for 50 cents, should be obtained as a reference book, and should be followed closely. Its instructions will be understood more easily after drill movements have been demonstrated by the drill master.

When the author was a lad, the neighborhood boys organized a drill-club, and commissioned him to make guns. These must have fallen far short of standard specifications, because there were no dimensioned drawings in the woodshed "arms plant" to work by; but, as the author recollects, the guns were fearsome looking weapons, with long tinfoil-covered stick bayonets, which, by the way, were "fixed" at all times — which is strictly against regulations, but unknown to the boys at that time. You can make better guns than these were, for this chapter presents all of the working details necessary.

The Simple Model of Drill-Gun shown in Fig. 444 has a stock cut in one piece. A pattern for this, ruled off into

Fig. 442.—Making Drill-Guns.

Fig. 443.—Squad at "Port Arms" (Equipped with Home-Made Drill-Guns and Wash-Basin Helmets).

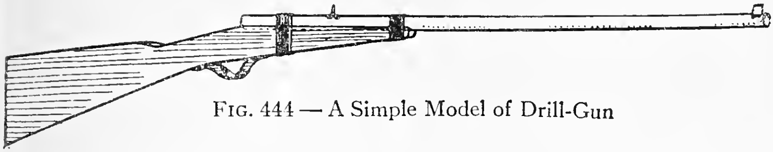


Fig. 444 — A Simple Model of Drill-Gun

squares measuring 1/8 inch each way, each square representing 1 inch, is shown in Fig. 445. To lay out a full-size pattern, draw a similar set of squares, 1 inch square, upon a piece of paper, and reproduce the outline exactly as it is shown upon the small squares. Saw out the piece, round the edges, and sandpaper the wood. This will provide

A Pattern for Marking Out Duplicate Stocks. You will save time by marking out at one time as many of the stocks as you will require.

The Barrel is made of a broom-handle (Fig. 447). Cut a shallow groove along the top edge of the stock for the barrel to fit in, and fasten the barrel with screws and wire bands.

For a Trigger, drive a bent nail (*C*, Fig. 448) into the stock at the point indicated in Fig. 446, and for

A Trigger-Guard fasten a plumber's pipe-strap (*D*, Fig. 448) to the stock, covering the trigger.

For the Front Sight, bend a piece of tin into the shape of *E* (Fig. 449), for

The Rear Sight (*F*, Fig. 450) cut a

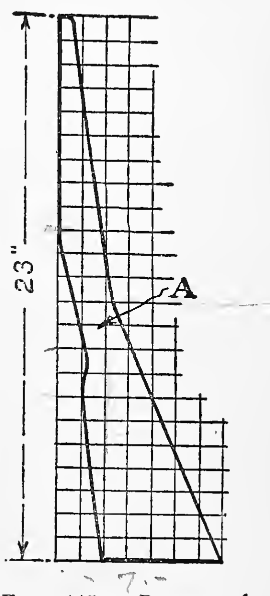


Fig. 445. — Pattern of Stock of Drill-Gun Shown in Fig. 444

piece of tin of the shape shown in Fig. 451, bend it in half, turn up the ends, and bend down the tips of these. Tack the sights to the barrel in the positions shown in Fig. 444.

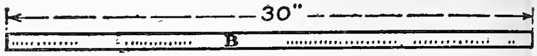
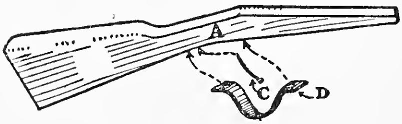


Fig. 447



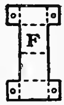


Fig. 446 Fig. 448 Fig. 451 Fig. 450 Fig. 449

Fig. 446. — Stock
Fig. 447. — Barrel
Fig. 448. — Trigger and Trigger-Guard
Fig. 449. — Front Sight
Fig. 450 and 451. — Rear Sight

The gun will now be ready for

Finishing. Give the stock a coat of stain or paint of a walnut color. Stain is preferable to paint. When the stain has dried, apply a coat of shellac, then a coat of flat varnish. Paint the barrel black; also the trigger, trigger-guard, and sights.

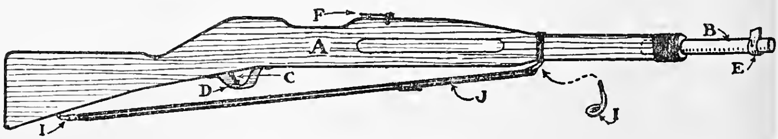


Fig. 452. — Springfield Model of Drill-Gun

The drill-gun shown in Fig. 452 is

A Springfield Rifle Model. Its stock requires considerable more work to cut than the stock of the simpler model, but most boys prefer it for drilling because its lines more nearly approach the lines of the modern army rifle.

Enlarge the pattern for

The Stock and Barrel, shown in Fig. 453, in the manner directed for the other model's stock. Be careful in enlarging this pattern to locate the various points correctly. Before cutting out the piece, it will be well to check up your measurements to be certain that you have made no errors. The barrel end may be either a piece of ½-inch dowel-stick, or ¼-inch gas-pipe, 6 inches long (*B*, Fig. 454). Bore a hole 2 inches in depth in the barrel and drive the piece *B* into it. Fasten with nails if a dowel-stick is used, or with a screw driven through a drilled hole, if iron pipe is used.

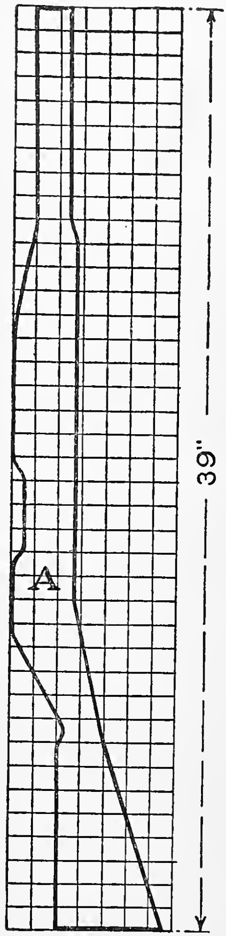
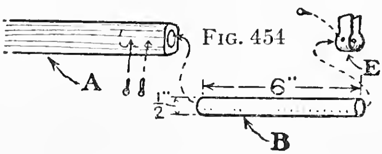


FIG. 453. — Pattern of Stock and Barrel of Drill Gun shown in Fig. 452

The Trigger and Trigger-Guard (*C* and *D*) are the same as those of the other model of gun (Fig. 448).

The Front Sight (*E*) is shown in detail in Fig. 454. Figure 455 shows the shape and size to cut the strip required. A piece of a tin can will do. Trim off the ends of the strip as shown, bend the piece to fit around the barrel, and hammer the ends together.

The Rear Sight is made to fold flat against the top of the barrel (*F*, Figs. 452 and 456). When laid down, the position is known as *battle sight*; when raised, the semicircular notch in the upper edge is known as the *open sight*, the hole beneath it is known as the *peep sight*. Cut a piece of tin of the size shown in Fig. 457, for leaf *F*, and turn the lower end over a piece of wire (*G*, Fig. 458). Bend the ends of the piece of wire into loops, and tack these loops to the sides of the gun-stock (Fig. 456). The leaf will turn up and down with the wire as an axis. Tack *H* (Fig 456, driven close to the hinge of the leaf, will act as a stop when the leaf is raised, and can be used as the rear sight when the leaf is laid flat.



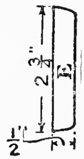
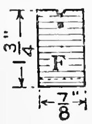
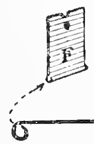


FIG. 454. — Detail of Front Sight FIG. 455
FIG. 455. — Pattern of Front Sight





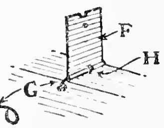
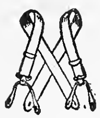


FIG. 457 FIG. 458 FIG. 456
FIGS. 456-458. — Details of Rear Sight Drop-Leaf



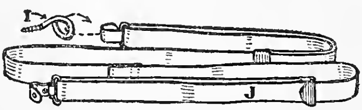


FIG. 460 FIG. 459
FIGS. 459 and 460. — Details of Sling

Finish the Drill-Gun in the manner suggested for the other model. Then it will be ready for

The Sling (*J*, Fig. 452), without which it would not be complete. An excellent sling that will resemble more or less closely a modern rifle sling, can be made of an old pair of suspenders. Figure 459 shows a sling so made. Separate the suspenders where crossed (Fig. 460), cut off the button-hole tips on the rear ends, and sew the two lengths together. The *snaps* on the front ends will then snap over the eyes *I*, screwed into the stock (Fig. 452), and the *slide-buckles* can be used to shorten the straps. For the eyes use bent-over screw-eyes (*I*, Fig. 452). Stain the sling with walnut stain, to make it look as nearly like leather as possible.

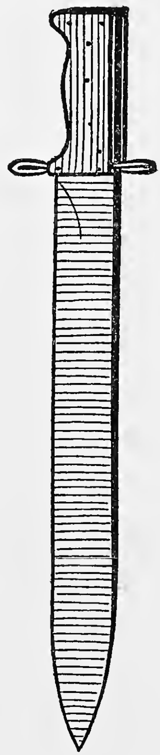


Fig. 461. — Bayonet

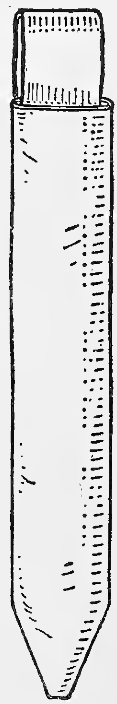
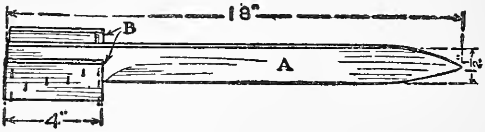


Fig. 462. — Scabbard

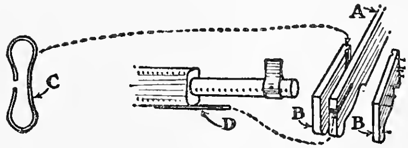
The Weight of a Springfield is 8.69 pounds. Your drill-gun, even if made of heavy wood, will be extremely light by comparison.

To Increase the Weight of Drill-Guns, the author has found it a good scheme to bore several holes in the stock and barrel, and pour these full of melted lead. In doing this, be careful to keep the center-of-balance at about the position of the rear-sight leaf.

A Bayonet is easily made out of wood (Fig. 461). Cut the *blade* of the shape and size of *A* (Fig. 463), and build up the *grip* end with the blocks *B*. Bend a piece of heavy wire into a double loop, like *C* (Fig. 465) for the *guard*, and cut a groove across the inner face of blocks *B* for the wire

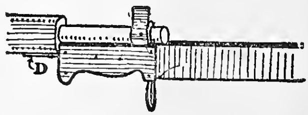


Fɢ. 463. — Detail of Bayonet



Fɪɢ. 465 Fɪɢ. 466 Fɪɢ. 464

Fɪɢs. 464-466.—How Grip of Bayonet Attaches to Gun

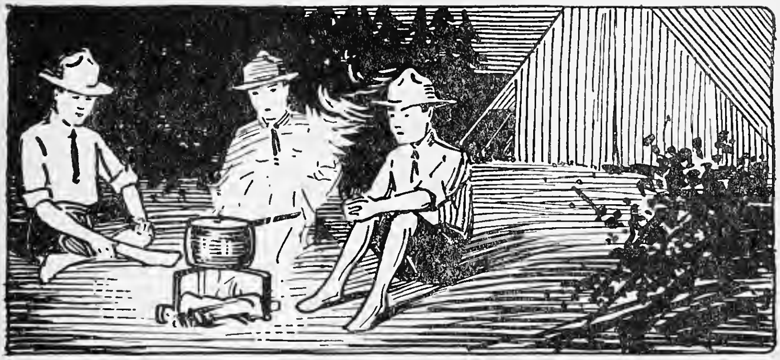


Fɪɢ. 467. — Gun with Fixed Bayonet

to fit into (Figs. 463 and 464). Cut a slot 2 inches long in the end of the blade (Fig. 464). Nail the grip blocks to the end of the blade, and then shape the assembled grip as shown in Fig. 467. If the loops of the guard have been bent properly, they will slip over the muzzle of the barrel. To hold the end of the grip, fasten the metal strip *D* (Fig. 466) to the stock, to fit in the slot cut in the end of the blade (Fig. 464).

Finish the bayonet by first sandpapering the wood very carefully, making the edge sharp and straight. Then paint the blade with aluminum paint, and finish the grip with walnut stain.

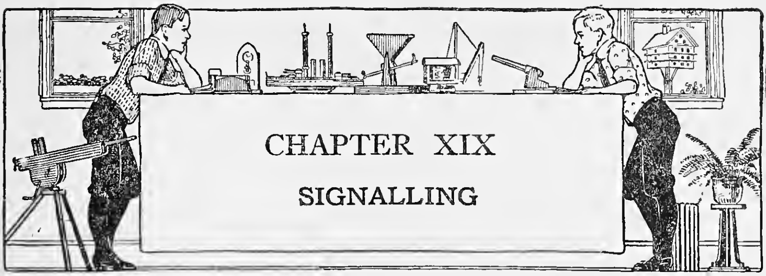
A Scabbard for the bayonet is shown in Fig. 462. Make this out of two pieces of cardboard, glued together along the edges, with a covering of khaki-colored cloth. Make the top loop large enough for your belt to run through.



PART III

Back Yard and Camp Craft

Two-Arm Semaphore Signaling by a Patrol of the Author's Troop of Boy Scouts of America, Elmhurst, Ills.



CHAPTER XIX

SIGNALLING

EVERY boy ought to know how to converse by means of one of the several signal systems in common use. About the simplest system to learn, and one which makes rapid sending possible, is the two-arm semaphore system; therefore, the way to make a pair of hand signal flags, and the signal-code, is shown in this chapter.

It is not necessary to own a pair of flags to learn the code, since the positions of the arms of the boy signalling determine the code letters. The flags serve to amplify the hand positions, and of course this is necessary when sending from a distance. It is easiest to learn the code without the flags, because then you need concern yourself only with the positions of your arms in forming the letters. As soon as you have memorized the positions, and can send at a rate of at least thirty letters a minute, you will be so proud of your achievement that you will want to own a pair of flags at once.

A Hand Flag of Standard Size is shown in Fig. 468, its dimensions are given in Fig. 469, and the size of its staff is shown in Fig. 470. The flag is divided diagonally into two parts, one of which is made of red muslin, the other of white. Cut the cloth enough larger than shown to allow for turning over ¼ inch of each edge for a hem. If you have mother or sister do this stitching on the sewing-machine, it will be the best way of getting a good job done quickly. Cut the staff stick of the size shown, round the edges, and sandpaper all surfaces smooth. Then shellac it, and when the shellac has dried tack the flag to one side.

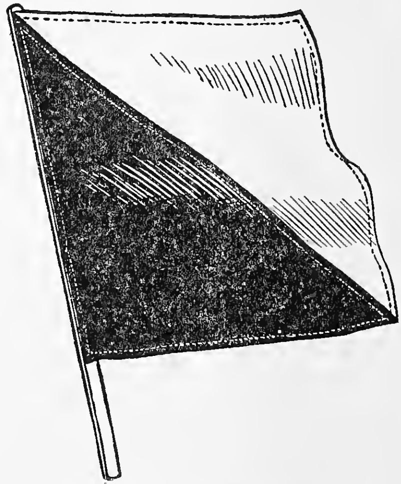


Fig. 468. — Hand Flag

Memorizing the Code is not difficult, but it requires continuous practice to get to the point where one can send rapidly. The following suggestions will help you "get the hang" of it, and probably you will be able to work out schemes of your own that will help you remember the formation of certain letters.

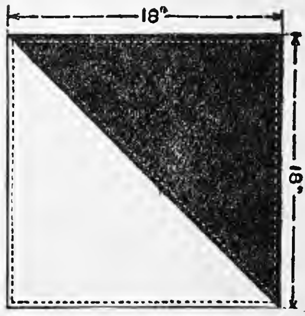


Fig. 469. — Pattern for Hand Flag

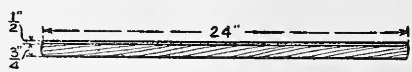


Fig. 470. — Staff for Hand Flag

Observe, first of all,

that the positions of the arms in forming the letters of the alphabet are eight in number, and correspond to the positions of the hour-hand of a clock when at 6 *o'clock*, 7:30, 9 *o'clock*, 10:30, 12 *o'clock*, 1:30, 3 *o'clock*, and 4:30. Observe, also, that the arms advance *clockwise*, in going through the alphabet.

In forming letters *A* to *D*, the left hand is placed in the position of a clock's hour-hand when at 6 *o'clock*, the right-hand is placed successively at 7:30, 9 *o'clock*, 10:30, and 12 *o'clock*. In forming letters *E* to *G*, the right hand is substituted for the left hand, and the left hand is advanced from 1:30 to 4:30. For letters *H* and *I*, the left hand is held at 7:30, the right hand is placed at 9 *o'clock*, then at 10:30. Letters *K* to *N* are formed with the right-hand held at 7:30, the left hand is placed successively at 12 *o'clock*, 1:30, 3 *o'clock*, and 4:30. For letters *P* to *S*, the right hand is held at 9 *o'clock*, the left hand is placed successively at 12 *o'clock*, 1:30, 3 *o'clock*, and 4:30.

For letters *T*, *U*, and *Y*, the right-hand is held at 10:30, the left hand is placed at 12 *o'clock*, 1:30, and 3 *o'clock*. For letters *J* and *V*, the right hand is held at 12 *o'clock*, the left hand is placed at 3 *o'clock* and 4:30. For letters *W* and *X*, the left hand is held at 1:30, the right hand at 3 *o'clock* and 4:30. For letter *Z*, the left hand is held at 3 *o'clock*, the right hand at 4:30.

Remember that the letter *U* is like a *letter U*., that letter *N* is *U* inverted (same as small letter *n* is letter *u* inverted); letter *Y* is like a *letter Y* except that the left-hand is dropped one position; letter *X* is really the left-hand side of a *letter X*. Opposite letters are *A* and *G*, *B* and *F*, *C* and *E*, *H* and *Z*, *I* and *X*, *J* and *P*, *K* and *V*, *O* and *W* (think of *O* and "double-yo"), *M* and *S*, and *Q* and *Y*. Perhaps you will find it helpful to associate these letters in this way.

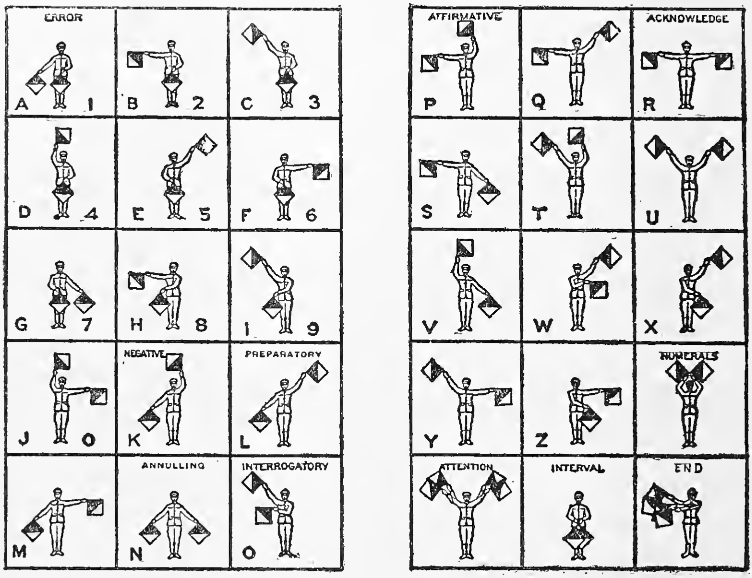
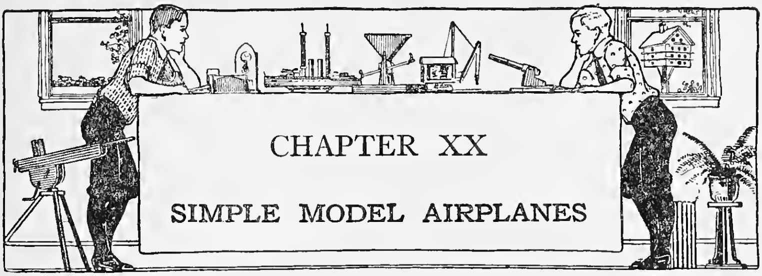


FIG. 471.—Signal Code

To Attract Attention, before starting to signal, shake the flags above your head in the positions indicated for *attention*. Before sending *numerals*, cross the flags over head as shown for *numerals*. Use letters *A* to *J* for *numbers*. Spell out *numerals* when they come in the body of a message. If you make an *error*, signal *A*. To *annul* a message, make *N*. To *acknowledge* that the message has been understood, make *R*. To signify *readiness*, send *L*. Indicate a *negative* reply by *K*, an *affirmative* reply by *P*, a *question* by *O*.

Finish a Message with a chop-chop motion of the flags at the right, as indicated for "end." Abbreviations will not be confused with letters, by the receiver, if the sender follows them with the *interval*.



CHAPTER XX

SIMPLE MODEL AIRPLANES

Before you can build successful model airplanes, you must know the principles which govern their stability, and the best way to learn these is with *gliders* like those shown in this chapter. When you have experimented with these, you will be so interested in the work that you will want to make motor-propelled models, and for models of this type the author refers you to his handicraft book, The Handy Boy, in which are presented instructions for building record-breaking models, for making propellers and rubber-band motors, for a motor-winder and flight-distance measuring apparatus.

For gaining an understanding of

The Matter of Balance, take a business-size envelope. Drop this flat, straight down, and it will land upon the ground without upsetting; but give it a forward movement and it will upset. Its upsetting in the one case but not in the other is due to the action of two forces, the *force of gravity* which pulls it groundward, and the *air pressure* beneath which buoys it up. In order to have it balance, the centers of these two forces must coincide.

The Center of Gravity and Center of Air Pressure. The center of gravity is always the center of weight, the balancing

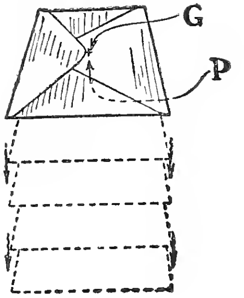


FIG. 472

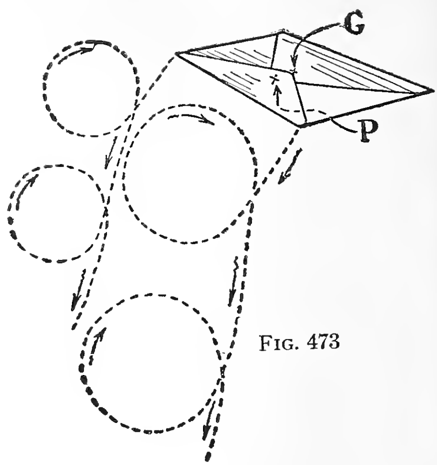


FIG. 473

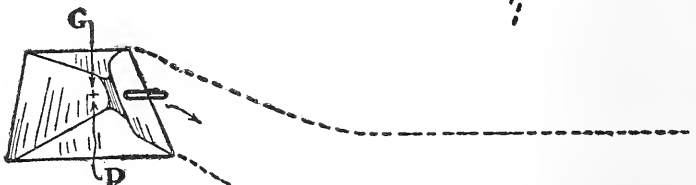


FIG. 475

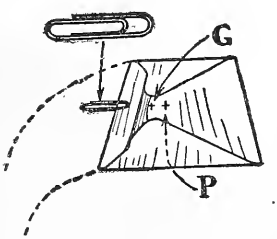


FIG. 474

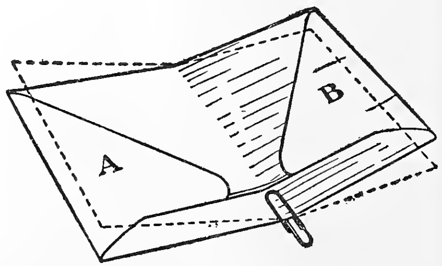
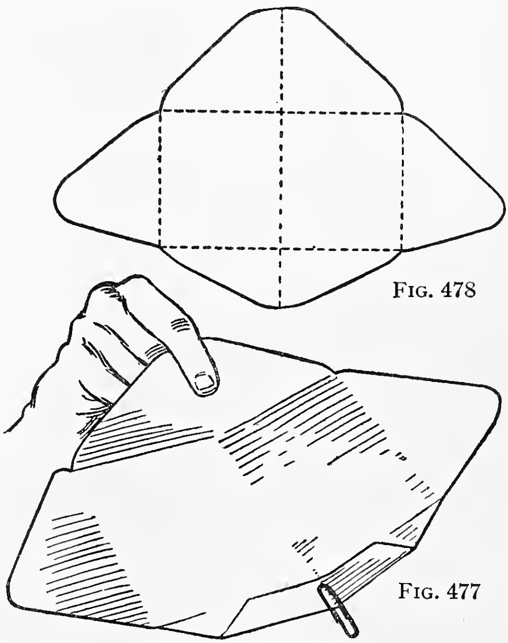


FIG. 476

FIGS. 472-476. — Diagrams in Explanation of the Matter of Balance point. The center of air pressure varies. When the envelope is dropped straight down, flat (Fig. 472), this center of pressure (P) comes at the same point as the center of gravity (G), and there is perfect balance. When the envelope moves forward while dropping, however, the center of air pressure shifts forward, the front edge is forced up, and the envelope upsets (Fig 473).



Figs. 477 and 478. — An Envelope Glider

To Make An Envelope Glide without upsetting it is necessary to shift the center of gravity to a point which will coincide with the center of pressure. This can be done by adding weight to the forward edge. Try a paper-clip, slipping it over the envelope as shown in Fig. 474. If, with the clip in place, the envelope darts head-on to the ground, the clip is too heavy, and has caused the center of gravity to shift beyond the center of pressure (G and P, Fig. 474). Slide the clip back and forth until the weight is so adjusted that the envelope will first dip nosedown for a distance, then straighten up and glide horizontally, as shown in Fig. 475.

If an air current strikes the envelope sidewise, it will cause the center of pressure to shift and the envelope to upset. Bend the envelope along its center so that the

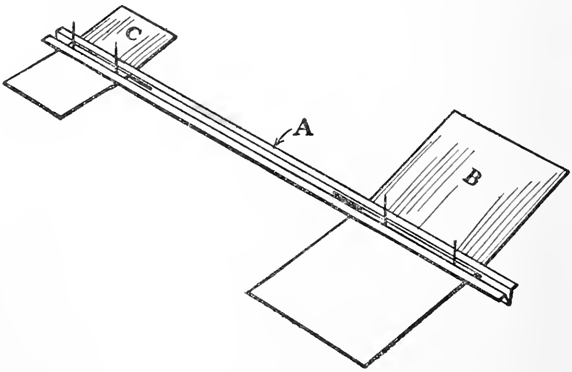


Fig. 479. — A Cardboard Glider

ends will tilt up (Fig. 476), and the danger of upsetting will be lessened. The tilted surface allows the air to slip off of the ends more readily than a flat surface does. Consequently, when a side current strikes end *A* (Fig. 476), lifts it up, and turns end *B* down, as indicated by dotted lines, the envelope glider quickly rights itself because the air slips out from under tilted end *A* and the air pressure forces up flat end *B*.

Figure 477 shows

An Envelope Glider made by opening all pasted flaps of an envelope (Fig. 478), and slipping a paper clip over the folded over gummed flap.

Figure 479 shows

A Cardboard Glider. The framework, or *fuselage* (*A*), connecting the *planes*, is a cardboard strip of the dimensions shown in Fig. 480, folded where indicated by dotted lines, into the shape shown in Fig. 481. *Main plane B* and *elevator plane C* are pieces of cardboard of the size shown in Figs. 482 and 483. Cut a notch at the center of each of the long edges of each plane as shown. The planes must be centered on the fuselage. Cut slots in the fuselage strip, as indicated, to slip the planes through, and when you find by testing out the glider that the ends of the planes balance, fix the planes in position with pins run through from the under side of the fuselage (Fig. 481). In launching the model, turn it so that elevator plane *C* is in front.

Fig. 480

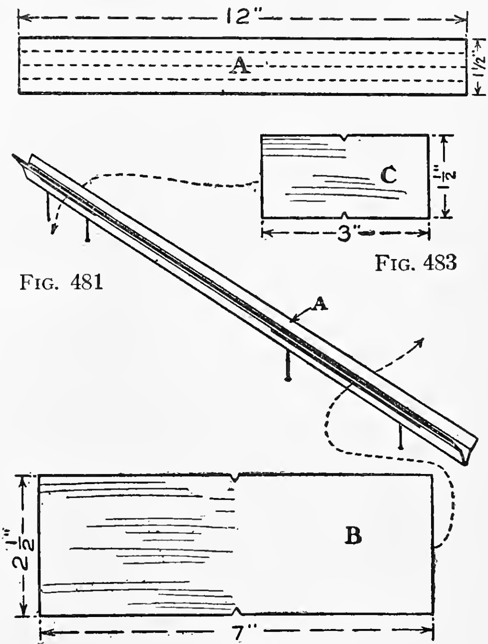


Fig. 483

Fig. 481

Fig. 482

Figs. 480-483.—Detail of Parts of Cardboard Glider

The advantage in making the glider type of model air-plane is that it requires neither motor nor propellers, which are the most difficult parts of model airplanes to make. The glider will not go a great distance, but if you will shoot it into the air by means of a rubber-band *sling shot* you can send it several hundred feet. Figure 484 shows

A Sling-Shot Glider. Cut stick *A* (Fig. 485) of the proportions shown, and with a saw slit one end for a distance of 2 ½ inches to receive keel *B* (Figs. 486 and 488). Cut keel *B* out of heavy cardboard, of the dimensions given in Fig. 489, then fasten it in the slots with brads. The hook upon the bow (*C*, Fig. 486) is provided for the loop of the sling-shot to slip over. Make it out of a heavy hairpin. Bend the pin into a straight piece, then bend one end into a hook (Fig. 487). Make a small hole through stick *A* 1 inch from the bow end, slip the straight end of the wire up through the hole, and bend

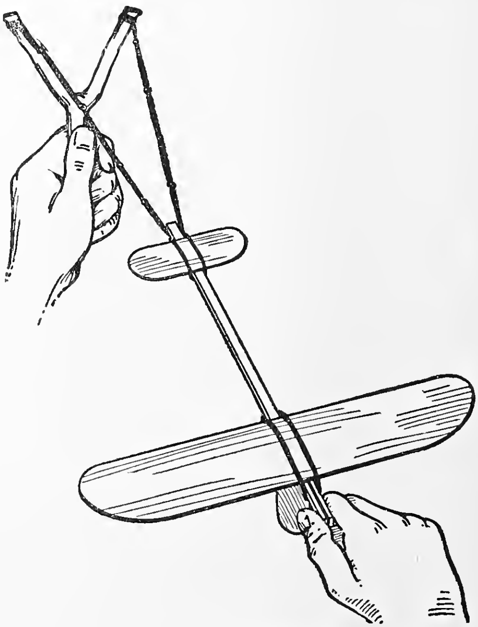
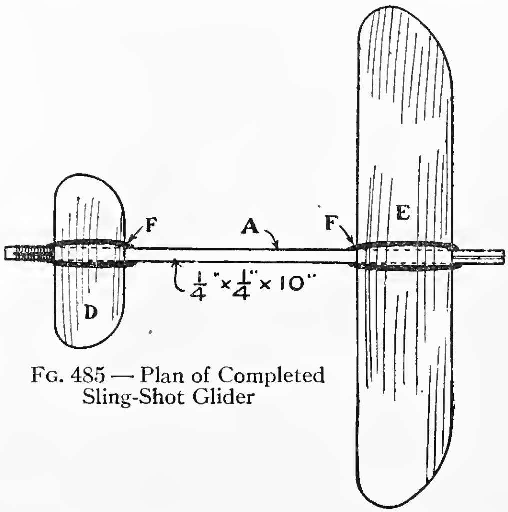


FIG. 484 — A Sling-Shot Glider

it down against the top of the stick as indicated by dotted lines in Fig. 487. Bind the hook to stick *A* by wrapping with thread (Fig. 486).

Elevator plane *D* and main plane *E* (Fig. 485) are made of heavy cardboard. Figures 490 and 491 show diagrams for marking them out. In mounting place them so stick *A* crosses their centers, and bind each to the stick with a strong rubber-band, passed beneath the stick and looped over the plane ends (*F*, Figs. 485 and 486). Rest the forward edge of plane *D* upon hook *C* (Fig. 486) to give it the proper tilt.



Fg. 485 — Plan of Completed Sling-Shot Glider

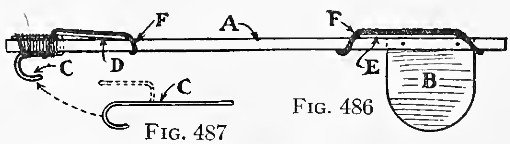


Fig. 486. — Side Elevation of Sling-Shot Glider
Fig. 487. — Detail of End Hook

The Sling-Shot. It is not necessary to tell how to make this of looped together rubber-bands joined to a tree-crotch, because every boy knows how.

To Launch the Sling-Shot Glider, hold the tail end of the glider with the right hand and the sling-shot with the left

Fig. 489

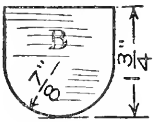


Fig. 488

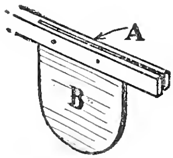
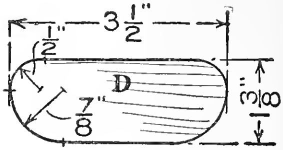


Fig. 490



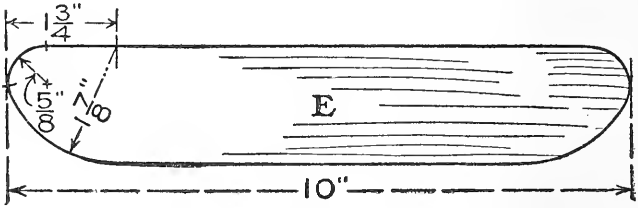


Fig. 491

Figs. 488-491. — Details of Glider Planes and Keel

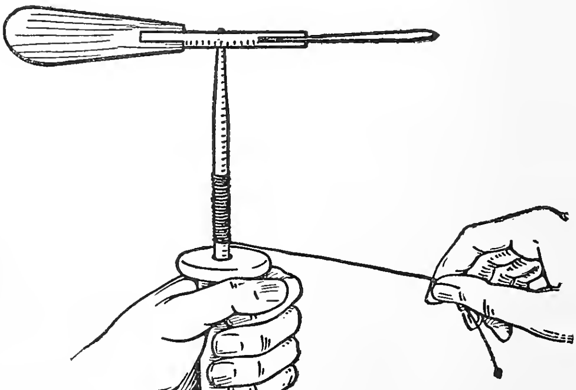


Fig. 492. — An Aerial Top

hand, as shown in Fig. 484, and release the glider in the same way that you shoot an arrow from a bow. Slide the planes backward and forward until you find the positions which give the model perfect balance while in flight.

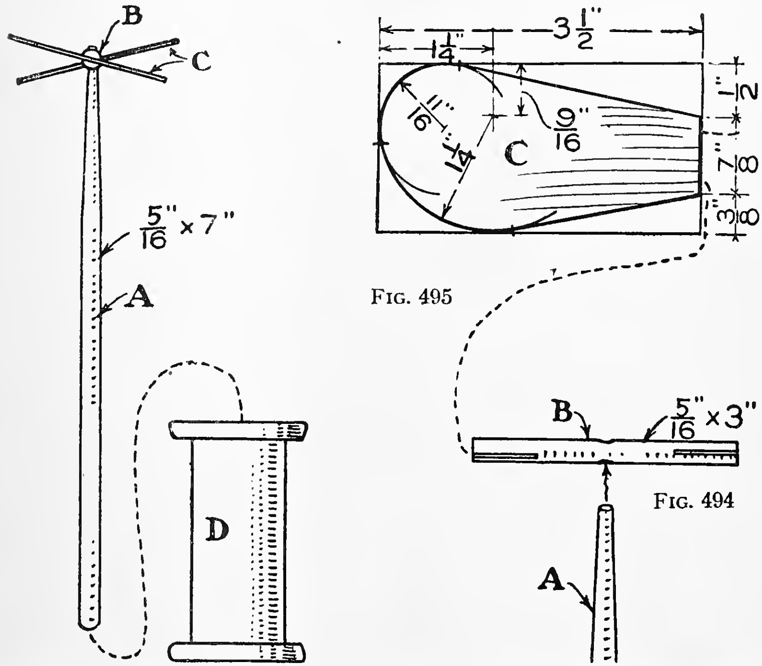


FIG. 493. — Detail of Completed Aerial Top

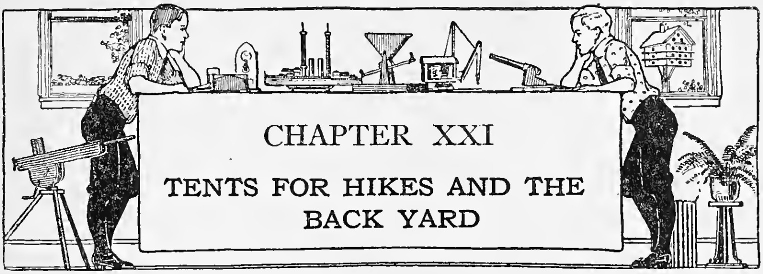
FIG. 494. — Detail showing Hub Stick and Shaft Connections
FIG. 495. — Detail of Propeller Blades

The Aerial Top shown in Fig. 492 is one of the most fascinating of the simpler aerial toys. By means of its spinning cord, it can be made to rise a distance of one hundred feet or more before returning to the ground.

The top requires a stick *shaft* (*A*, Fig. 493), a *hub-stick* (*B*), for which a carpenter's dowel-stick or a flagstaff may be used, two cardboard *propeller-blades* (*C*), and a large *spool* (*D*). With a saw, slot the ends of hub *B* a distance of ¾ inch, to receive the propeller-blade (Fig. 494). Cut the slots at an angle that will give the blades the pitch shown in Fig. 493, and be careful to get the angle of the slots alike. Bore a small hole through the hub-stick, and taper the shaft to fit snugly in this hole (Fig. 494). Whittle the opposite end of the shaft to fit loosely in the spool hole. Plug up the lower end of the spool hole.

Figure 495 shows the dimensions for the propeller-blades. Fasten the blades in the hub ends with brads.

To Spin the Top, wind the cord about its shaft, spinning-top fashion, then hold the spool and string as shown in Fig. 492, and pull the string. When the string has unwound, the top will rise in the air.



CHAPTER XXI

TENTS FOR HIKES AND THE BACK YARD

OLD awnings, draperies, sheets, quilts, potato sacks, in fact, almost any kind of material large or small, torn

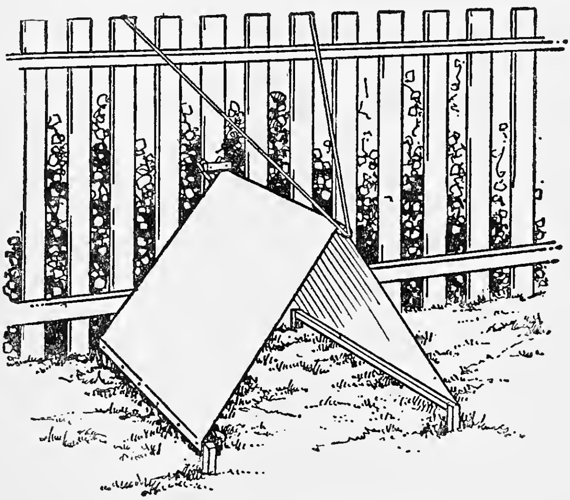


FIG. 496. — "A" Shelter Tent

or worn, can be cut, pieced, or mended, for a back-yard tent; and almost any kind of easily packed material can be made into a good enough shelter for sleeping out when on a hike. Four ways of utilizing such material as the above are shown in the illustrations in this chapter. Other plans

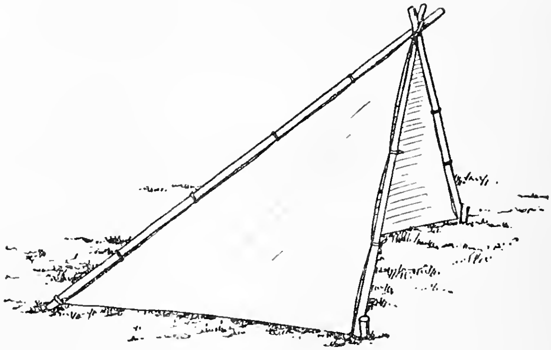


Fig. 496. — Tripod Tent

for tent making — for making an "*A*" and a *wall tent* of standard proportions — are presented in the author's book Handicraft for Handy Boys.

The "A" Shelter Tent shown in Fig. 496 is about as simple a tent as you can make. The *ridge-pole*, for which a rake-handle or pole of about that size, may be used, is supported at one end by blocks of wood nailed to a fence or tree in the form of a bracket. The other end is suspended from the fence top or tree trunk by ropes. The tent material, after being thrown over the ridge-pole, can be tied at the sides to stakes driven into the ground, or the side edges can be tacked to wooden strips fastened to stakes, as shown in Fig. 496. The latter arrangement makes a neater appearing tent.

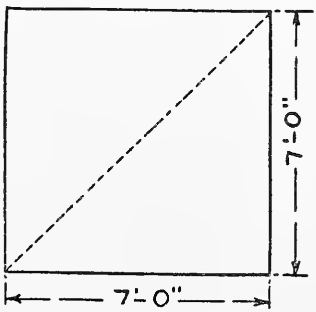


Fig. 497. — Diagram of Cloth for Tripod Tent

For the Tripod Tent shown in

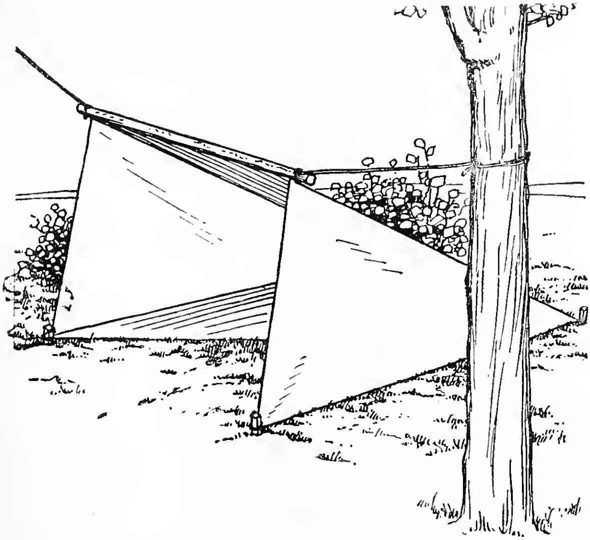


FIG. 498. — Lean-To Tent

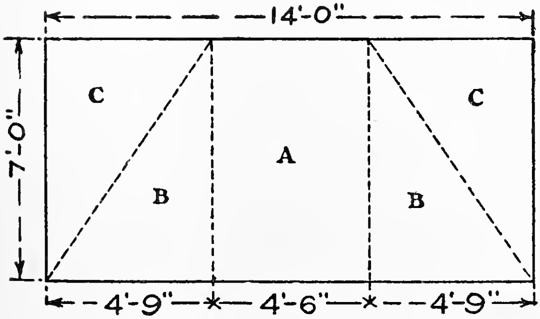


FIG. 499. — Diagram of Cloth for Lean-To Tent

Fig. 496, you will need a piece of covering material 7 feet square, and three poles. The cloth must be folded in half from corner to corner, as indicated by dotted lines in Fig. 497, and the poles must be set up tripod fashion so that the cloth will enclose two sides as shown. Tapes should be sewed to the cloth, or pinned on with safety-pins, for fastening the cloth to the pole supports.

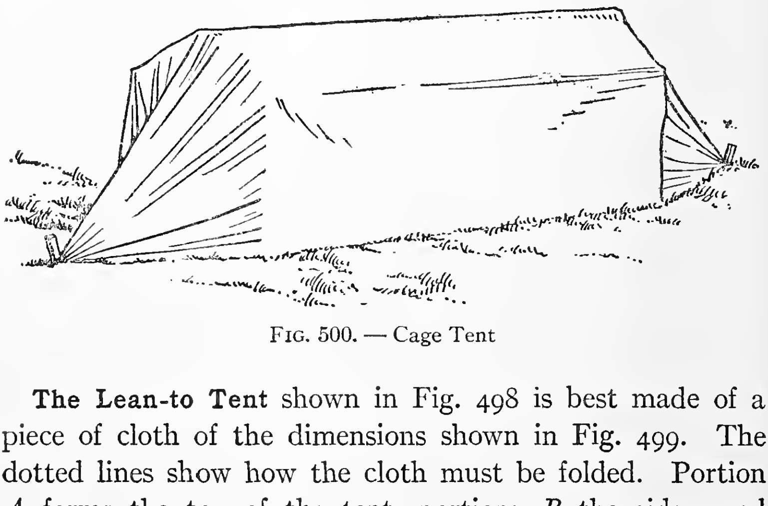
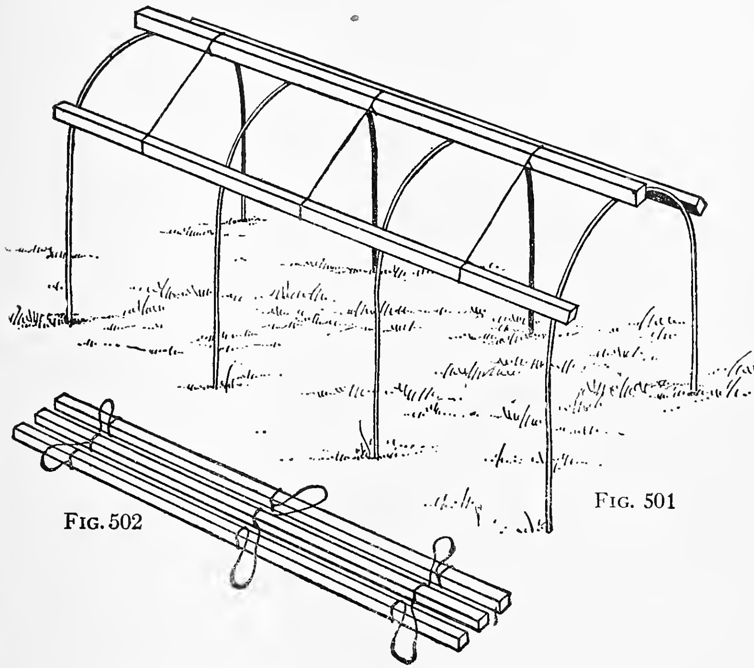


Fig. 500. — Cage Tent

The Lean-to Tent shown in Fig. 498 is best made of a piece of cloth of the dimensions shown in Fig. 499. The dotted lines show how the cloth must be folded. Portion *A* forms the top of the tent, portions *B* the sides, and corners *C* turn under and lie flat on the ground.

The illustration shows the tent supported between trees, with a single pole supporting the front edge of the top. If no trees are at hand, support the ends of the pole on uprights. Tie or sew tapes to the corners of the tent, and drive stakes into the ground at the points for tying.

The Cage Tent in Fig. 500 makes a good close-to-the

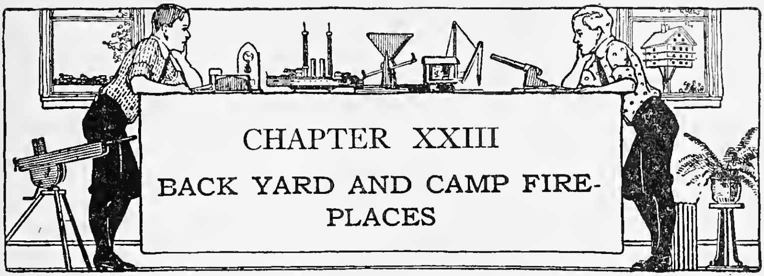


FIGS. 501 and 502. — Details of Framework for Cage Tent

ground shelter tent. Prepare four hoops to support the covering material out of No. 8 or No. 9 wire, cutting this into 5-foot lengths, and bending these pieces into arches 2 feet in diameter (Fig. 501). The tent framework should measure about 5 feet from end to end. Place the arches 20 inches apart, and push the ends several inches into the ground.

The three poles across the top of the arches keep the covering material from sagging between the arches. Cut them long enough to project several inches beyond the end arches. Connect them with cords of the right length to let them hang at the distance apart shown (Fig. 502).

Figure 500 shows how to bring the covering material to a point at each end, and tie it to a stake, to enclose the tent.



CHAPTER XXIII

BACK YARD AND CAMP FIRE-PLACES

THE place to learn how to make a camp fireplace and how to cook, is at home, and as good a spot as any to build the fireplace is the back yard. A small campfire can be built in the yard with safety if a pit is made to hold the fire. On the following pages will be found suggestions for building fireplaces, an oven, and a camp-stove.

The Fireplace with Trenched Fire-Pit, shown in Fig. 503, will keep the fire within a confined area. Remove the sod from a piece of ground several feet in length, 3 inches wide at one end, and 12 inches wide at the other end, running this trench in the direction of the prevailing wind. Each side of the trench, pile the sod removed and spread several inches of earth on top, to make banks as shown in Fig. 503. Properly banked, you can stand a coffee-pot over the narrow end of the trench, larger utensils over the center, and still larger utensils over the wide end. Pots may be hung over the fire by fastening a wire above it in the manner shown, then bending pothooks similar to that shown in Fig. 504, out of wire, by which to suspend the pots.

The customary way of hanging pots over a cooking fire, at camps, is by means of forked sticks suspended from a horizontal pole that is supported in the crotch of a crotched

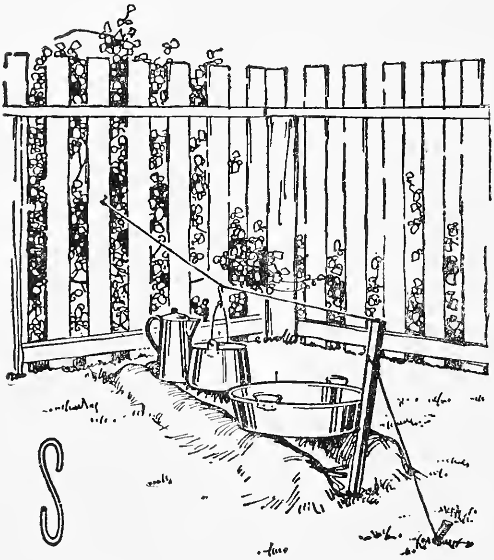


FIG. 504 FIG. 503
FIG. 503. — Fireplace with Trenched Fire-Pit
FIG. 504. — Wire Pothook

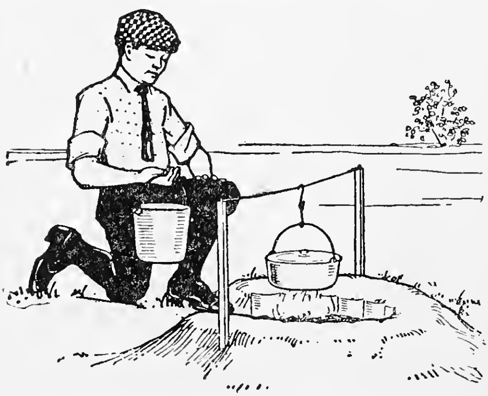


FIG. 505. — Fireplace with Circular Fire-Pit

pole erected at each end of the fire-pit.

The Fireplace with Circular Fire-Pit, shown in Fig. 505, differs from the fireplace just described only in the shape of the fire-pit. A piece of sheet-iron can be placed across the fire-pit to stand utensils on.

The Fireplace with Above-Ground Fire-Pit. shown in Fig. 506 must have its walls built of moist earth or clay, so that the material can be packed together nicely. Tin cans are placed in the walls, three on a side, as shown in

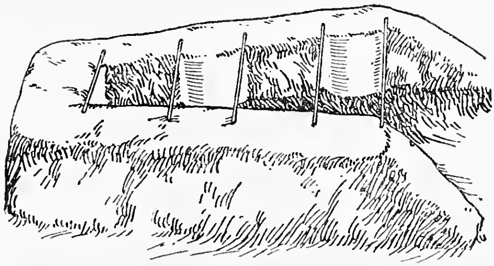


Fig. 506. — Fireplace with Above Ground Fire-Pit

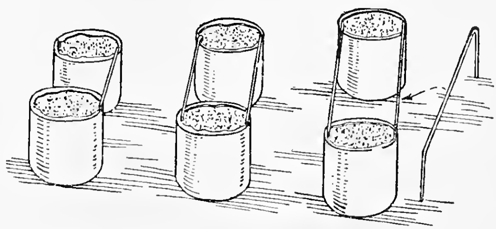


Fig. 507. — Fireplace Utensil Support

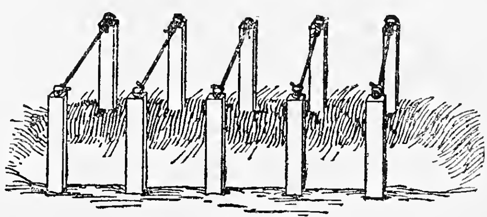


Fig. 508. — Another Scheme for Utensil Support

Fig. 507, to support the cross wires that extend from side to side for utensils to stand upon. Tin cans exposed to a fire will soon crumble to pieces, therefore several inches of earth should be piled up against the cans inside of the fire-pit to protect them. Figure 508 suggests how you can use stakes instead of tin cans for supporting the cross wires.

The Camp Oven shown in Figure 509 is started in the same way as the fireplace in Fig. 506, except that a pit

5 or 6 inches deep is hollowed out in addition to building the above-ground fire-walls. Figure 511 shows how the oven shelf is supported on tin cans; also, how a piece of

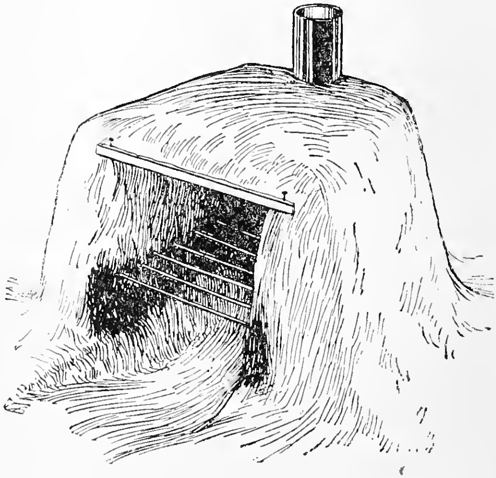


Fig. 510. — Sheet-Iron Front Fig. 509. — Camp Oven

stovepipe is stood erect at the rear end of the fire-pit, for the chimney.

Pile up earth around the base of the stove-pipe, and build up the sides of the oven with earth moistened enough to make it pack together firmly. At a height of 12 or 14 inches above the oven shelf, level off the sides, and across them set a piece of sheet-iron to support the top of the oven. Then cover this top to a depth or 3 or 4 inches with earth. Bank up earth around the base of the oven to make the walls solid, and protect the tin cans that support the shelf-wires, with a covering of earth, so that the fire will not burn them through.

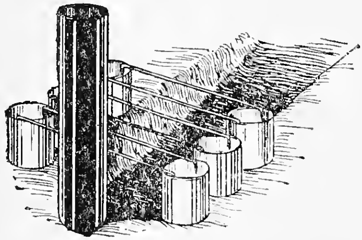


FIG. 511. — Oven Fire-Pit, Smoke-Pipe and Shelf

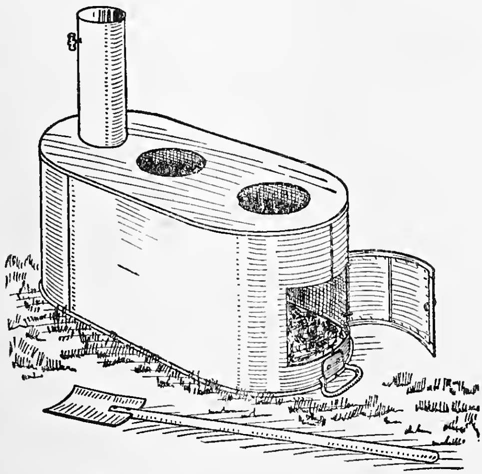


FIG. 512.— Wash-Boiler Camp Stove

The oven front (Fig. 510) is a piece of sheet-iron with wire loops fastened to the upper edge to provide for hanging it from the oven top. Rest a stick across the side walls of the oven, and hang the sheet-iron front from nails driven into it

To cut down the draft, pile up bricks in front of the fire-pit opening, or, lacking bricks, use a piece of sheet-iron. A damper can be set in the smoke-pipe to help check the draft, or a piece of sheet-iron can be laid across the top of the pipe.

A Wash-Boiler Camp Stove. Every time the author sees a discarded wash-boiler in a vacant-lot or scrap heap, he wonders why some boy hasn't seen possibilities in it, and taken it home. You can make a dandy camp-stove like that shown in Fig. 512, out of a boiler, and there are other ways of making good use of one. In addition to the boiler, you will need a section of 4-inch stovepipe, a damper, and some tin cans.

Cut three openings in the wash boiler bottom, 4 inches in diameter, one for the stove-pipe, the other two for cooking utensils to stand over; and in the end of the boiler farthest from the stove-pipe cut an opening for a fuel doorway. The cutting can be done best with tinsnips, but a can-opener will answer the purpose if you haven't a pair of snips.

The piece of tin removed from the fuel doorway must be made into a door (Fig. 513) by fastening strips of tin to its edges (*B* and *C*, Fig 514) to make it wide enough to overlap the edges of the doorway. Attach the strips with carpet tacks. Punch holes in the tin to drive the tacks through, and clinch the tack ends. Hang the door with hinges made of pieces of wire (*D*, Fig. 513), passing the wires through holes punched through the edge of the door and edge of the boiler, and twisting the ends together. A simple catch for the door is made of a screw-hook (*E*, Figs. 513 and 515), and a

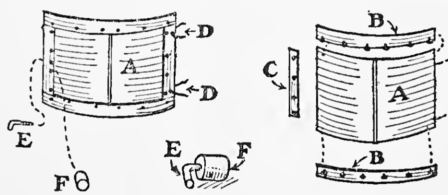


Fig. 513 Fig. 515 Fig. 514

Figs. 513-515. — Details of Door for Camp Stove section of a broom-handle (*F*). Punch a hole through the stove door for the shank of the screw-hook to slip through, close enough to the front edge so when the hook is turned horizontally its tip will catch upon the inside surface of the boiler. Screw the screw-hook into knob *F*.

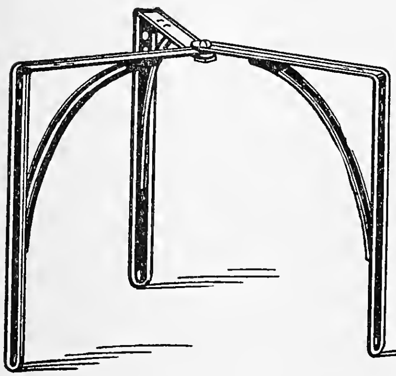


Fig. 516. — Camp-Fire Tripod Spread

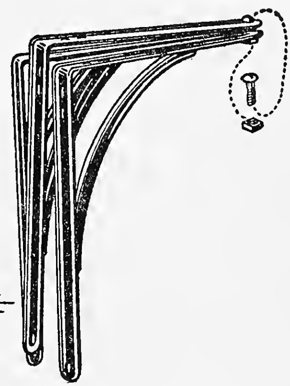


Fig. 517. — Tripod Folded

Make stove covers out of tin cans, and for

A Fire Shovel, fasten a piece of tin in the slotted end of a stick. Just such a shovel as this is shown in front of the stove, in Fig. 512. It makes an excellent shovel for removing ashes.

There are all sorts of patented camp-fire grates and racks, made collapsible to simplify transportation, but

The Camp-Fire Tripod shown in Fig. 516, made of three

10-inch iron shelf-brackets bolted together as shown in Fig. 517, is all that a boy could wish for a one-receptacle fireplace. Figure 516 shows the tripod spread, Fig. 517 shows it folded for transporting, and the photograph of Fig. 518 shows the stove in use. You can use the tripod fireplace in the backyard or at camp.

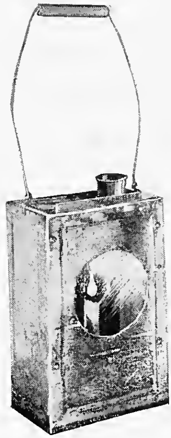
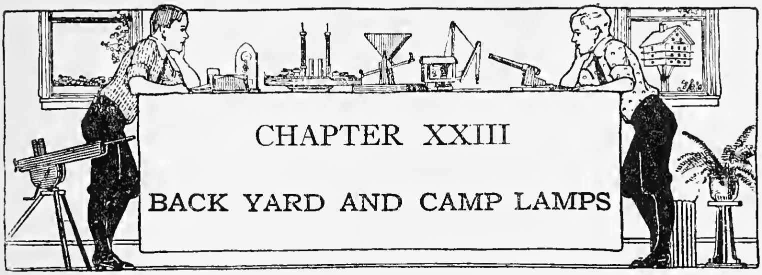


Fig. 519.—A Varnish-Can Lantern (See Chapter 23).

Fig. 518.—Using the Shelf-Bracket Camp-Stove Tripod (See Chapter 22).



CHAPTER XXIII

BACK YARD AND CAMP LAMPS

WHETHER you camp out in the woods or in the back yard, you will find the lamps, lanterns, and other light fixtures shown in this chapter well worth having.

The Varnish-Can Lantern shown in Fig. 519 is a dandy candle lantern. You can procure a varnish-can or oil-can from almost any painter. Perhaps it will be a dirty old can gobbed up inside and out with hardened oil or paint That does not matter in the least. If the can is not too badly dented, accept it. Dried oil or paint can be removed by stuffing the can with paper or excelsior, then taking the can outdoors and lighting the contents. It is best to leave the burning until after the lantern lens opening has been cut, so there will be plenty of draft to keep the paper burning.

Two openings must be cut, a circular opening in the front of the can for the lens, (Fig. 520), and a slot in the top, close to the front, and extending from side to side through which to slide the lens (Fig. 520 and 523). The cutting is most easily done with a can-opener. If mother has the improved kind of can-opener, with a center point that you jab into the can, and a cutter that you adjust to the diameter of opening you want to cut, then swing about the center, you will not have to describe a circle in pencil to locate the circular lens opening. But if mother's can-opener is of the old-fashioned kind, it will require only a little more care to make it follow the circumference of a described circle. Ragged edges left by the cutting can be made smooth with a file. The can-opener will only separate the tin, it will not cut any away; therefore, after cutting the slot in the can top, you must take a pair of pincers and pinch the front raw edge of the tin tight against the can front, because the slot must be wide enough for a piece of glass to slip through.

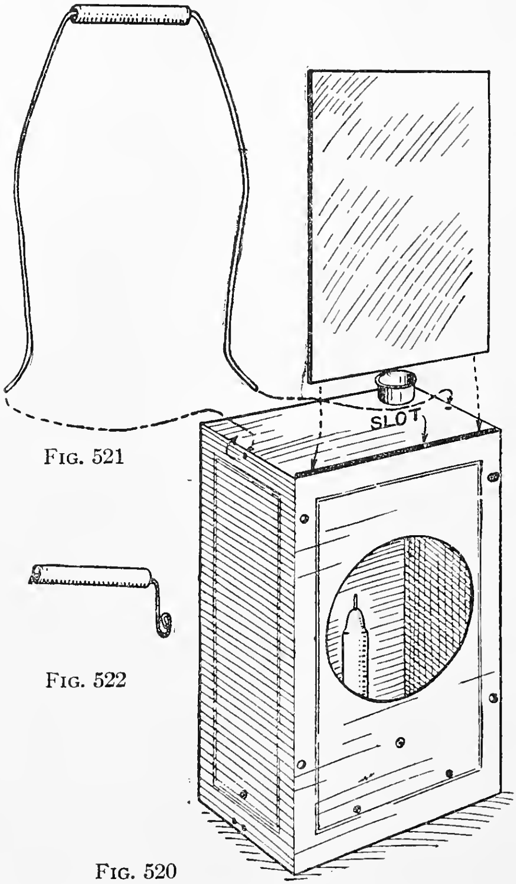


Fig. 521

Fig. 522

Fig. 520

Fig. 520. — Detail of Varnish-Can Lantern Shown in Fig. 519

Figs. 521 and 522. — Detail of Handle

A 5-by-7 camera plate is of the

right size for the lantern lens for a gallon-can. If you cannot get such a plate, you probably can find a piece of glass that can be cut down to these dimensions. With a 10-cent glass cutter cutting is easy. You should own one of these, because it will be of frequent use in your workshop. Guides must be provided for the glass to slide between (*A*, Fig. 523). These are made of strips of tin ¾ inch wide and 7 inches long, cut from a tomato can, and they are bolted in position with stove-bolts ⅜ inch long (*B*, Fig. 523). Punch the holes for the bolts through the lantern front, and through the guide strips, with a nail or brad-awl. Space the holes so they will come towards the ends of theguide strips, and place them at the right

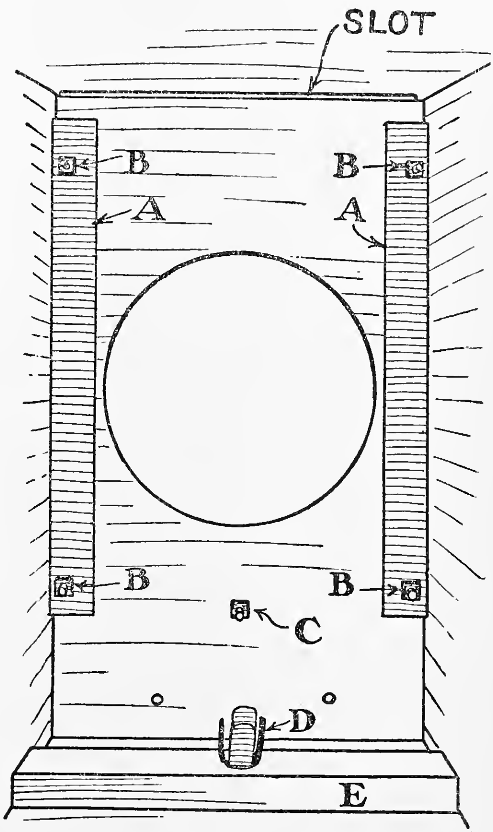


FIG. 523. — Detail Showing Inside of Lantern

distance apart width wise of the can so the glass lens will slide between the stove-bolts. Screw one nut on to each stove-bolt, to come between the lantern-front and guide strip

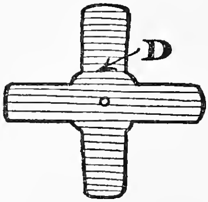


Fig. 524

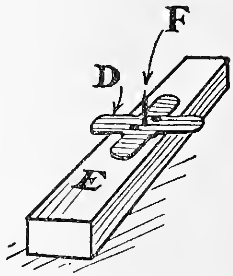


Fig. 525

Figs. 524 and 525. — Details of Candle-Holder

A, then slip the guide strips on to the bolts, and fasten in position with nuts screwed on to the stove-bolts. Stove-

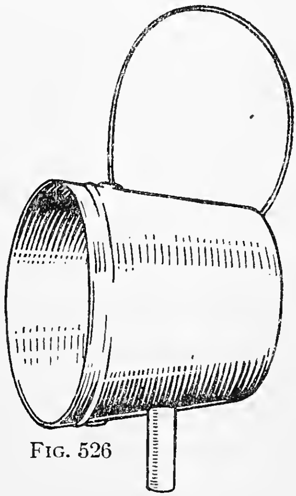


Fig. 526

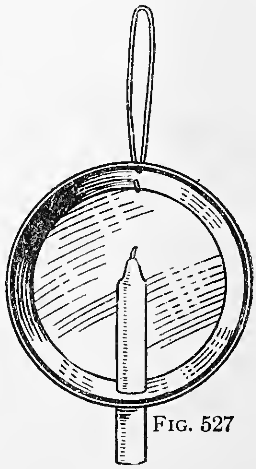


Fig. 527

Figs. 526 and 527.—Lard-Pail Candle Lantern

bolt *C* (Fig. 523) forms a *lug* for the bottom edge of the glass to rest upon. Place it about 6½ inches below the top of the can, so when the glass is in position its top edge will project far enough above the lantern top to be easily gripped by your fingers, when you open the lantern for lighting or extinguishing the candle.

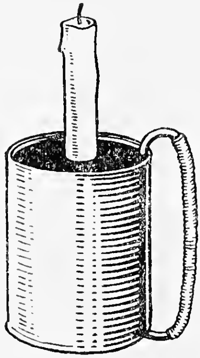
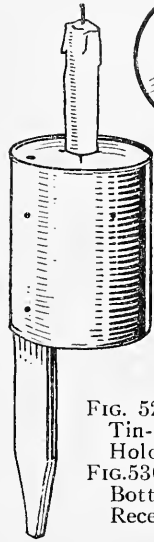


Fig. 528. — Tin-Can Candle-Holder



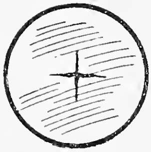


Fig. 530

Fig. 529.—Another Tin-Can Candle-Holder
Fig. 530.—How Can Bottom is Cut to Receive Candle

The candle-holder is made of a piece of tin cut the shape of *D* (Fig. 524), with a hole pierced through its center through which to slip the nail *F* (Fig. 525). Nail *F* must be driven through the center of a stick *E* (Figs. 523 and 525), cut of the right length to fit widthwise across the inside of the can bottom, and its point must be filed sharp like a tack point, because the candle is to be pushed down upon it. The holder is completed by tacking the tin piece *D* to strip *E*, placing a tack each side of nail *F*, then bending up the four ears at the proper points to make a pocket that will hold a candle of standard size. Fasten strip *E* in the lantern bottom by driving nails through the can sides into the stick ends.

The spout of the can forms the lantern chimney, and needs no alteration. For ventilation, punch several holes through the lantern sides, near the bottom, as indicated. A varnish-can has a tin handle, but it would become too hot to hold; and, because it is soldered in place, it would pull off if the solder is heated to the melting point. Therefore, it is best to break off the handle, and substitute a *bale* like that shown in Fig. 521. This is made of a parcel handle (Fig. 522), and a piece of heavy wire 24 inches long. Remove the hooked wire of the parcel handle, and in its place slip the long piece of wire. Bend the wire ends to the shape shown in Fig. 521, slip them through holes punched through the lantern-top and ends (Fig. 520), and bend up and over the standing part of the wire (Fig. 519).

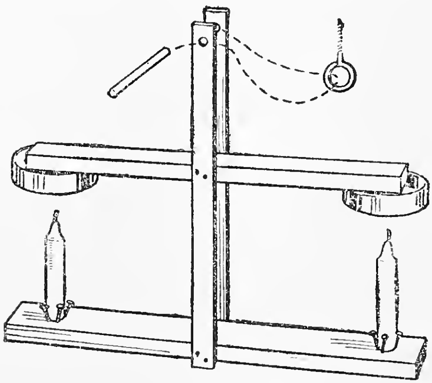


Fig. 531. — Candle Light-Fixture

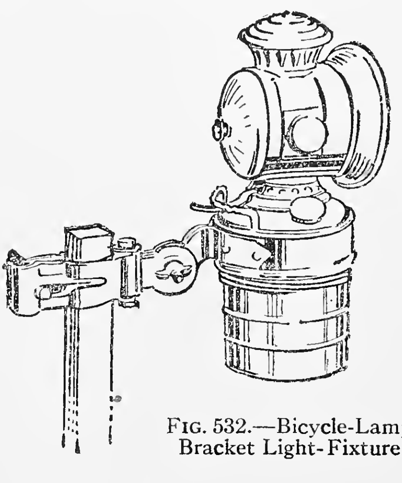


Fig. 532.—Bicycle-Lamp Bracket Light-Fixture

The first step in making

The Lard-Pail Candle Lantern shown in Figs. 526 and 527 consists in

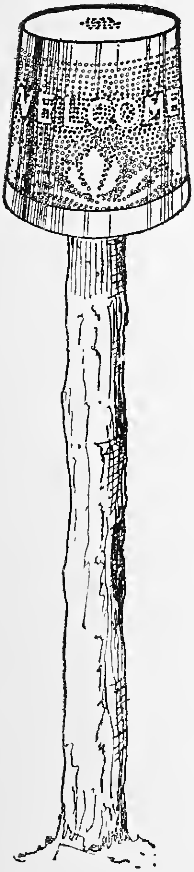


Fig. 533. — Candle Lamp-Post

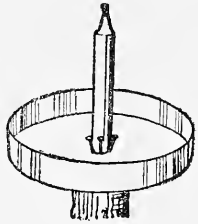


Fig. 534. — Candle-Holder for Lamp-Post

cutting a hole in one side of the pail midway between the top and bottom, of the right diameter so the candle will make a snug fit. Then remove one end of the *bale*, bend it over to the pail bottom, and fasten the wire in the hole. As the candle burns down, push it up through the hole.

The Tin-Can Candle-Holder shown in Fig. 528 may be made out of almost any kind of can at hand. Run a piece of wire down through a hole pierced through the can bottom, twist it into the form of a handle, and wrap it with twine. Fill the can with earth to hold the candle upright.

Another Tin-Can Candle-Holder is shown in Fig. 529. Cut two slits in the can bottom, one crossing the other (Fig. 530), and bend down the four points of tin to make an opening of the right size to stick the candle in. Point a stake on the lower end for a support, and tack the can to its side. Drive the stake into the ground wherever you wish to have light.

The Candle Light-Fixture in Fig. 531 requires four wooden strips. Near each end of a strip 16 inches long, drive four nails to form candle-holders. For reflectors, tack two can covers to a strip 15 inches long, with centers the same distance apart as the candle-holder centers, and connect this strip with the candle-holder strip by means of a pair of narrow strips in the manner shown.

If you want to hang this fixture from a tent ridge-pole, bore a hole through each of the vertical strips near the top, and cut a peg long enough to drive through the holes. Then screw a screw-eye into the ridge-pole, and slip the peg through the holes and screw-eye.

The Bicycle-Lamp Bracket Light-Fixture shown in Fig. 532 is easily set up, by driving a stake into the ground, and fastening the lamp bracket to its top.

A Candle Lamp-Post like that in Fig. 533 is quickly made. A lard-pail or other tin pail of about that size, and a short pole or tree stump, are required. The first thing to do is to perforate the side of the can, using the point of a nail or a nail-set. The holes can be made in a hit-or-miss fashion, or you can work out a design. You might form the word "welcome" with the perforations as indicated. Make a few vent holes in the can bottom.

When the can has been perforated, erect the post. Drive four nails through the can cover into the post top, to form the candle-holder (Fig. 534). The can is easily removed from and adjusted to the cover.

Trench Candles like those that boys have made for soldiers fighting in the European war, are good camp lights (Fig. 535). Take eight or nine strips of newspaper of single-column width (Fig. 536), and roll them tightly upon a pencil or small round stick (Fig. 537). Bind the roll with wire (Fig. 538), then drop it into a pan of melted paraffin, and

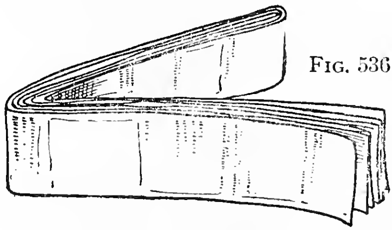


FIG. 536

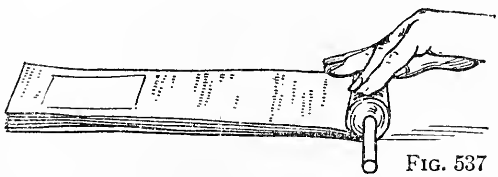
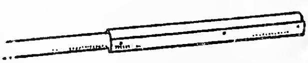


FIG. 537



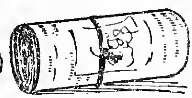
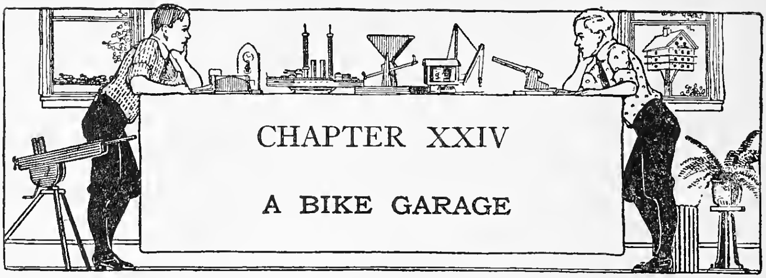


FIG. 539 FIG. 538

FIG. 535

FIG. 535-539—Trench Candle and How to Make It

let it become saturated. A stick with tin fastened around its top to protect the wood (Fig. 539) makes a good trench-candle support.



CHAPTER XXIV

A BIKE GARAGE

No self-respecting boy would leave his bicycle outdoors, exposed to the weather like a neglected piece of farm machinery, because it would not be long before it would look like a "bum old bike," and he would be ashamed to be seen riding it; also, because he knows that it would require a complete overhauling and thorough lubrication to put it back into good running order. The fellow who neglects his wheel must sooner or later learn to care for it properly or he will never become qualified to handle machinery. Sometimes it is an effort for a fellow to put away his wheel upstairs or downstairs, after a long ride, which, it would seem, has exhausted every bit of his energy; and sometimes he will foot a short distance rather than take the trouble to get his wheel out from an out-of-the-way place. To have the wheel handy-by would make it of greater usefulness, and would repay the owner for the time, labor, and expense required to provide an outside shelter.

A garage like the one shown in Fig. 540, built only large enough to hold the wheel, can be set up quickly. From the working-drawings in Figs. 541 to 547 you will get all of the details necessary for building the shed. For the

Working Material you will need a 2-by-4 8 feet long for the corner posts (*A*, Fig. 543), 72 lineal feet of 2-by-2s for the framework pieces *B*, *C*, *D*, *E*, *F* and *G* of the floor,

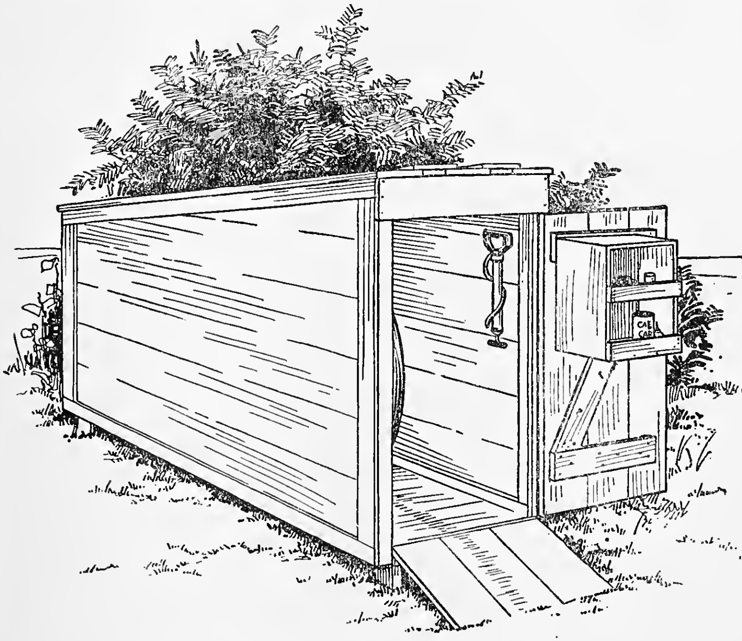


Fig. 540. — The Completed Bike Garage

walls, and roof (Figs. 541, 543, and 545), 175 lineal feet of 10-inch *shiplap* for the walls, door, floor, roof, and runway, and 50 lineal feet of 4-inch boards for trimming around the roof, the wall corners, the doorway, and for door battens. It may be that you can get old lumber of different dimensions from the above pieces, and it may be that you have some pieces on hand which you can run in with new stuff. You can alter the plans in such a way as will best suit your material, bearing in mind of course the dimensions required to accommodate a bicycle. Instead of the *shiplap* specified

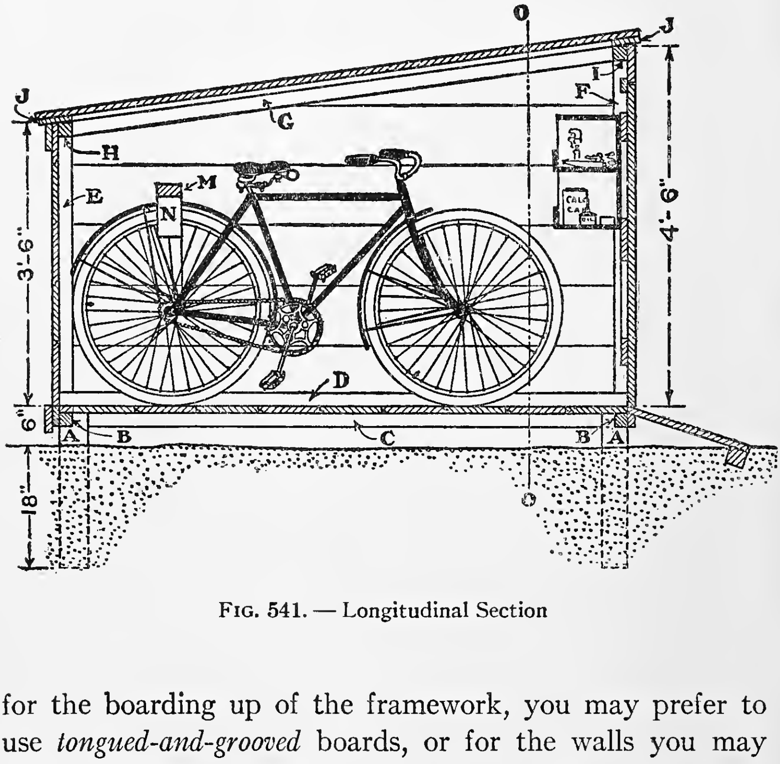


Fig. 541. — Longitudinal Section

for the boarding up of the framework, you may prefer to use *tongued-and-grooved* boards, or for the walls you may prefer *drop-siding*, which makes a neater finish. You may want to sheath up the framework with *plain* or *matched* boards, and then finish with *beveled-siding*, or with *stucco*.

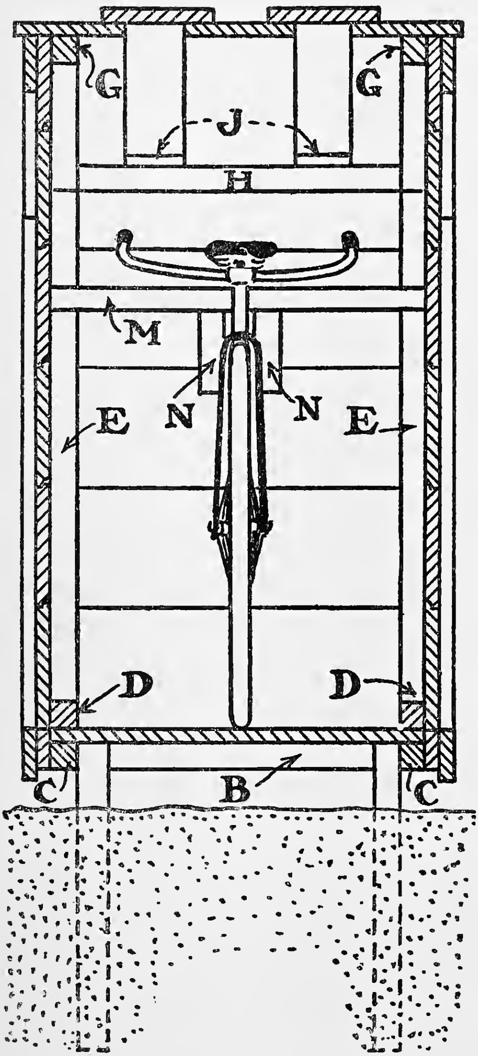


FIG. 542. — Cross-Section

These are matters which you will have to decide yourself. A material man will help you to figure out quantities.

The Floor Framework. The tops of the 2-by-4 corner posts *A* must be notched as shown in Fig. 544 to receive the ends of the floor framework pieces *B*. Having the width and length dimensions given you in Fig. 543, you can locate the proper positions for the corner posts *A*. Dig the post holes 18 inches deep. Be certain that the posts line up correctly before you fill in around them. They may look right, yet be enough out of the way to throw the entire framework out of square. The proper way to do is to fasten pieces *B* in the notches in the tops of the posts, after the posts have been dropped

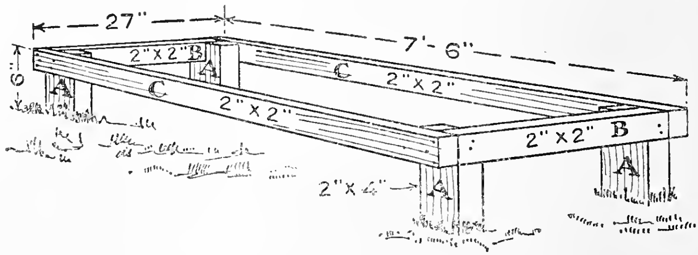


Fig. 543. — Foundation

into the holes, then fasten pieces *C* to their ends, with one nail driven part way in. Test the corners one at a time with a square, and, when you have corrected any error that you may find, nail a temporary diagonal brace across the tops to hold the pieces rigid. When all corners are correct, spike all members in place.

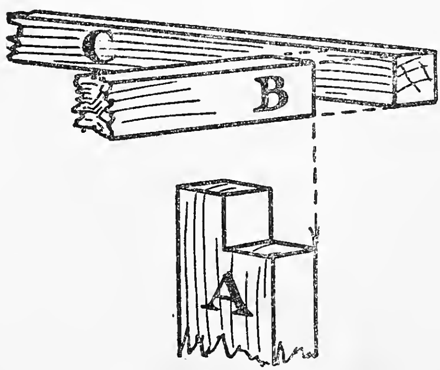


Fig. 544. — Corner of Foundation

Lay the Floor short-ways of the framework. With it in place, build the walls. Make

The Side Walls in sections like that shown in Fig. 545. Cut the plate *D* and corner uprights *E* and *F*, of the dimensions indicated, and place them flat upon the ground; block up the ends and center, if necessary, to make them level. Spike together the ends of these pieces, then nail about four of the side boards to them. Trim off the tops of uprights *E* and *F* so top plate *G* will rest squarely upon them, and spike the top plate in place. Then finish nailing on the remaining wall

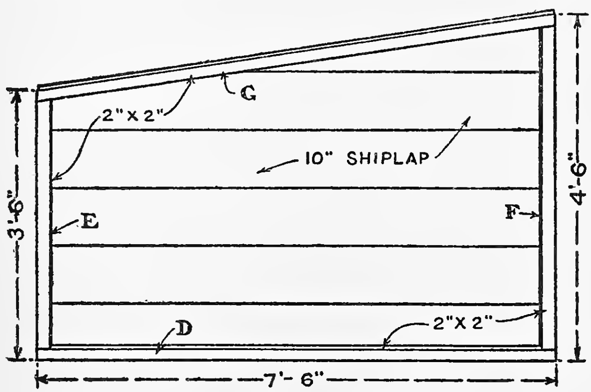


FIG. 545. — Side Wall

boards. Having completed one wall, turn it over so the framework members will be uppermost, place the framework members of the opposite wall upon them, nail on the siding, and you will have the second wall a duplicate of the first, only reversed.

Erecting The Walls. When the two side walls have been completed, stand them erect upon the shed floor, in their right positions, hold them in position with temporary braces, and spike the floor plates to the floor. Cut end plates *H* and *I* of the right length to fit between side wall plates *G*, and spike them in place. Then nail on the rear-wall siding.

Figure 542, a cross-section taken through the shed at the point o-o (Fig. 541), shows how

The Roof is put on in two layers, the upper layer overlapping the edges of the lower layer. Fill in the pieces *J* between the ends of the lower boards (Fig. 541 and 542).

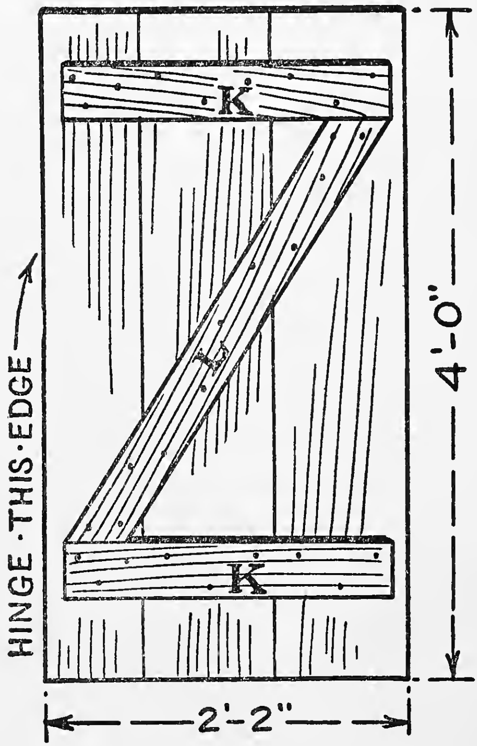


Fig. 546. — Door

Figure 546 gives dimensions for

The Door, and shows how to batten together and brace the boards. Trim up the doorway with a board across the head, and a strip down each jamb. Cut the trimming boards of the right widths to leave a ¾-inch clearance around the door edges. Hinge the door on the edge indicated in Fig. 546, and fit it with a strong lock. A box can be fastened to the inside of the door for

A Cupboard in which to keep miscellaneous tools and supplies, as shown in Fig. 541, provided you use heavy enough hinges in hanging the door to prevent sagging.

Make a Wheel-Rack to support the bicycle when it is in the garage (Fig. 541) Make this as shown in Fig. 547. Cut the piece of 2-by-4 *M* of the right length to fit between the side walls of the shed, and nail the blocks *N* to it at the center 2 inches apart. Fasten the rack in the shed at the right height to catch the top of the rear wheel of the bicycle.

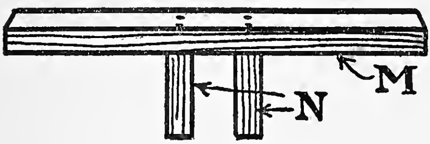
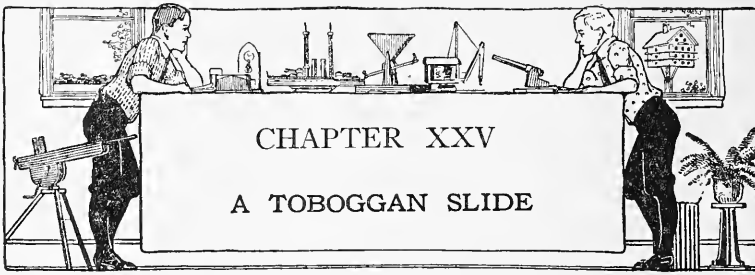


Fig. 547. — Rack for Rear Wheel

A Runway from the ground to the floor level, built as shown in Figs. 540 and 541, will complete the carpenter work on the garage.

Paint the Bike Garage two coats of oil paint to protect it from the weather. It will look best if you paint the trimming pieces a different color from the body color.

To Make the Garage Tighter, you can cover the inside of the walls and roof with building paper well-lapped and tacked.



CHAPTER XXV

A TOBOGGAN SLIDE

A FRAME toboggan-slide is a simple structure for boys to build, but the matter of expense frequently prevents them from undertaking the work, or the idea does not occur to them until after the first snow-storm has arrived, — and any boy who has tried outdoor carpentry in cold weather, with gloves and heavy clothing to hamper the movements of hands and limbs, knows that it cannot be done satisfactorily. Such conditions often cause the abandonment of the idea of building a slide or a postponment until the following autumn.

The plans in this chapter will enable you boys to build a small toboggan-slide with little or no expense, and you can put it up in cold weather because there is little carpentry connected with the work, and part of that may be done indoors. Besides, as there are no heavy pieces of lumber to handle, you can tackle the job without assistance.

Building Material. Figure 548 shows the completed toboggan-slide, and Figs. 549 and 550 show how it is constructed out of a packing-box, a few wooden strips, and snow. Of course, such a slide as this may be built entirely of snow, but, unless it is placed in the corner of the yard where there will be a high fence on each side of the platform

Fig. 548. — The Completed Toboggan-Slide

to protect the coasters, there should be a railing to prevent any one from slipping off the top of the slide and possibly injuring himself.

A packing-box is used for

The Platform Base. Get a large packing-box, or, if you cannot find one, take a number of small boxes and

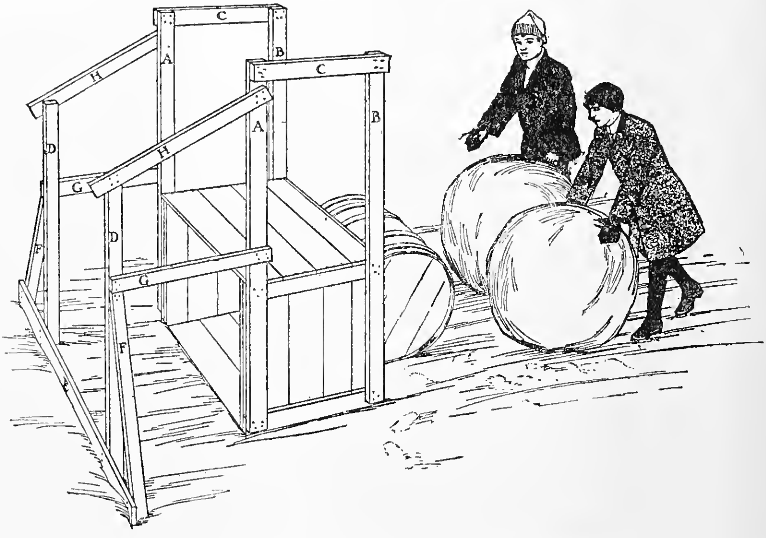


FIG. 549. — The Completed Platform and Railings

bind them together with strips. The length of the box, or the length of the combined boxes, should be at least 3 feet, as there should be this much space between the platform railings.

The Platform Railings are fastened to the ends of the box (Fig. 550). Nail the pair of uprights *A* and *B* to each end of the box, then fasten the crosspieces *C* to their tops. The railing should come at least 30 inches above the finished toboggan-slide platform; and, as the top of the platform may be built up of snow 12 inches or more higher than the top of the box, to make a higher slide, this height must be settled before cutting the railing uprights, in order to get them of the right length.

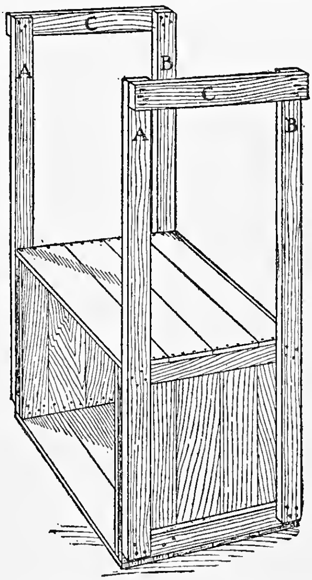


FIG. 550. — How the Platform Railings are Put On

Figure 549 shows how

The Step-Railings are fastened in place, and Fig. 551 shows how the uprights *D* are connected and braced. First cut uprights *D* about 18 inches shorter than uprights *A* (Fig. 549), then cut the board *E* (Figs 549 and 551) about 3 feet longer than the packing-box, and nail it to the edges of uprights *D* at their lower ends, placing the uprights the same distance apart as uprights *A*. Cut the braces *F* 3 or 4 feet long, and nail their ends securely to board *E* and uprights *D*.

After making this piece of framework, set it about 30 inches away from the packing-box platform base, with uprights *D* directly in line with uprights *A* (Fig. 549), and connect the uprights with the cross-pieces *G* and the handrails *H*.

Setting Up the Framework. With the framework of the platform and steps completed, select a good location for your toboggan-slide; then place the framework upon a sled and pull it over to that spot and set it in position. One good thing about this form of framework is its compactness, and

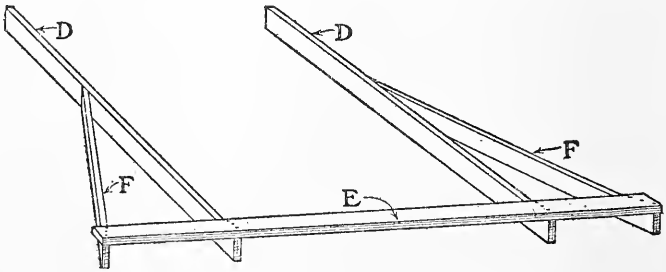


Fig. 551. — Supports for Step-Railings

the ease with which it may be taken from one place to another. You may build a toboggan-slide in your own back yard one time; then another time, if you decide that conditions are better in your chum's back yard, all you will have to do will be set the framework upon your sled and haul it over to his yard.

While you have been making the platform framework, your companions should have busied themselves with

Collecting Snow for the Slide. The snow is gathered most easily by rolling it into balls, starting with small balls some distance away from the position selected for the toboggan-slide, and gradually working them over toward that spot as you roll them. Each boy may start a ball and roll it until it becomes too heavy for him to manage alone;

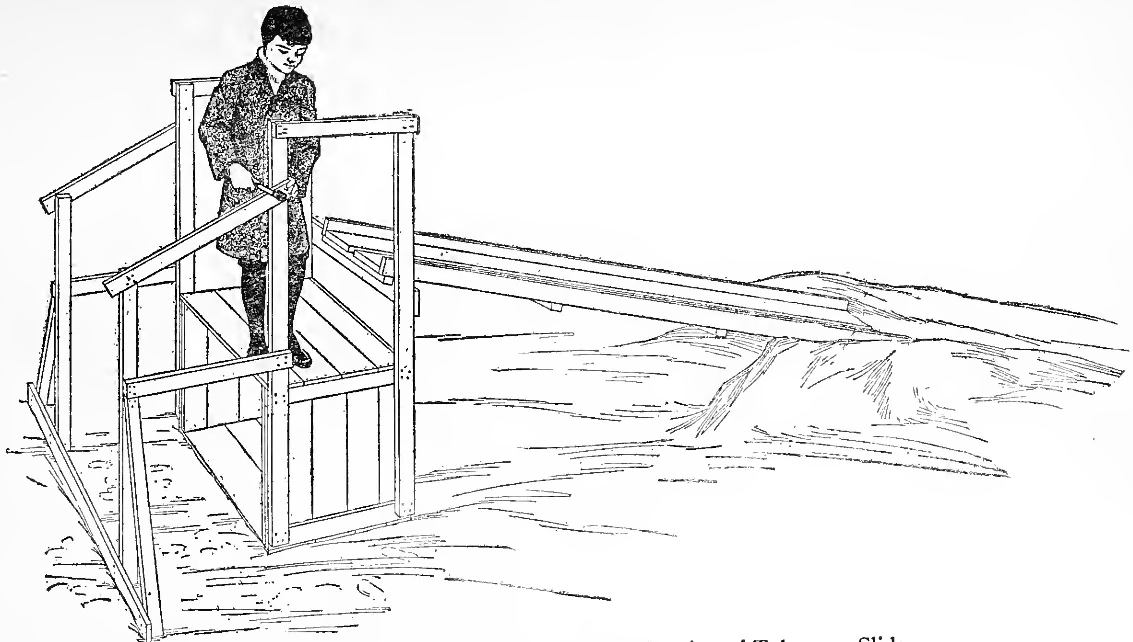


FIG. 552. — Planks Used for Upper Portion of Toboggan-Slide

then two or more boys should work together, and, when the balls are of the right size, roll them into position. The size of the balls should diminish in the proportion necessary to give the proper slope to the slide.

Fill in the spaces between the balls with snow, and tamp it down with a stick; then level off the tops. If the snow is too dry to pack well, pour water over the slide as you construct it. The more compact you make the slide, the more substantial it will be, and the longer it will last.

The Platform. Pile upon the packing-box the amount of snow necessary to make the platform of the height desired; then build

A Set of Steps as shown in Fig. 548. Make the steps broad, and pitch them slightly toward the back. Do not pour water on them, because it will make them slippery. They will wear down, of course, but they can be repaired quickly. If a board is built into the top of each step, they will be more durable.

The Surface of the Slide should be made slippery by pouring water upon it, but, before this is done, tracks should be formed by running a sled down the slide a few times. Make these tracks wide enough so that sleds of different widths will fit them. It is a good idea, also, to bank up the snow along each side of the slide to form a ledge, so there will be no possibility of a sled running off of the slide in case it leaves its tracks.

If There is a Scarcity of Snow, much may be saved by filling in a portion of the base of the slide with a barrel or with boxes. The snow placed upon the top of the barrel or boxes will form an arch over them that will make the slide as firm as though it were built entirely of snow.

A Plank Slide. A couple of planks may be used for the upper portion of the slide, to save snow (Fig. 552). These may be either 10-inch or 12-inch planks of whatever length you can get. Fasten them together with wooden battens placed about 3 feet apart, as shown in Fig. 553, and nail a

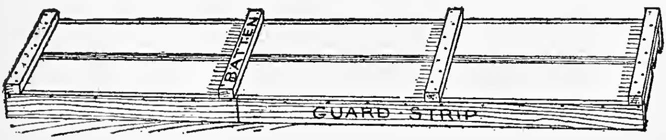
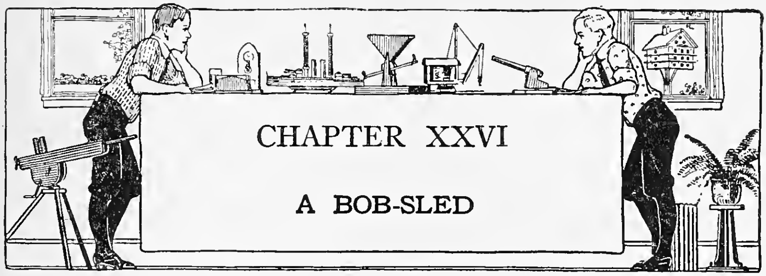


Fig. 553. —How to Batten Together Planks for Upper Part of Toboggan-Slide

strip to each edge, as shown, to form a guard with a 3 or 4-inch projection. If 10-inch planks are used, they may be placed 2 or 3 inches apart, in order to make the slide that much wider (Fig. 553). The width of a sled is greater than that of one plank, so the runners could not possibly run into the opening left between the planks. Nail a board across uprights *B* of the platform framework (Fig. 552) to support the upper end of the planks. Then build up a snow slide at the end of the planking, as shown in Fig. 552, to make the slide as long as is desired, and embed the end of the planks in the snow.

These ideas have been worked out in a very simple form, but if any of you want to build

A More Elaborate Toboggan-Slide, longer, and with a higher platform, you will readily see that its construction will be similar. A number of packing-boxes may be fastened together to make the platform as large as is desired, while several lengths of planking may be used for the slide, supported at the ends on snow *piers* — just as a long bridge is supported upon piers of masonry. If several packing-boxes are fastened together for a large platform, they should be bound with wooden strips. If the top boxes are made of thin wood, a flooring of boards should be nailed across them to distribute the weight of the coasters who are to stand upon them, and thus prevent the possibility of breaking through the boxes.



CHAPTER XXVI

A BOB-SLED

THERE are two ways of building a bob-sled. One way is to knock together a pair of coasters out of any sort of material that happens to be at hand, and connect the pair with a plank or board, in the shortest time possible; the other way is to use the best material that you can get, and assemble this so as to produce the most substantial sled you know how to make, regardless of the time the work requires. The first method is all right for a rough-and-ready bob, but the latter method is the one to follow if you want a sled that will serve not only through the winter season of the current year, but for years to come.

In building the model shown in the photograph of Fig. 554, the author worked out every detail with strength and durability uppermost in mind, and if you will carefully follow the working-drawings and instructions your completed bob-sled will be something of which you can be mighty proud.

The Material Required will not cost a great deal; possibly you have the right sort of stuff at hand for the greater part of the sled. The model in the illustration is upholstered, with a top covering of imitation leather. Upholstering is such an easy thing to do that I would advise you to upholster your bob-sled; however, you can use cheaper material than imitation leather. Oilcloth, burlap, or a strip of carpet will answer the purpose.

Two boards 10 inches wide and 12 feet long, out of which to cut sled runners, crosspieces, seats and hand-rails; and a piece of 2-by-4 for connecting blocks, will be all of the lumber that you will need. Then, in addition, you will have to have eight corner irons for bracing the sled runners, a 3/4-inch carriage-bolt 7 inches long with which to pivot the bob-sled seat to the bow sled, a pair of 4-by-4-inch steel hinges for hinging the bob-sled seat to the stern sled, fourteen stove-bolts 1 inch long and eight 2 inches long, for bolting the hinges and hand-rails in position, 3/4-inch and 1 1/2-inch screws, 1 1/2-inch and 2-inch common nails, four pieces of half-oval iron strips for runner *shoes*, a piece of iron jack-chain 2 feet long with which to check the bow of the rear sled, and four 3/4-inch screw-eyes. For upholstering the bob-sled seat, you must have excelsior, covering material, and tacks.

Figure 555 shows a detail of the completed sled, with one-half (the bow) drawn in *section*, and the other half (the stern) drawn in *elevation*. All parts are lettered on this detail, and correspondingly lettered on the smaller working details (Figs. 556 to 570), to make clear the assembling.

The Sled Runners should be prepared first of all (*A*, Fig. 558). Figure 561 shows a pattern, with the ends ruled off into squares to simplify the laying out of the curved bow and stern. Take a cardboard box-cover, and make similar

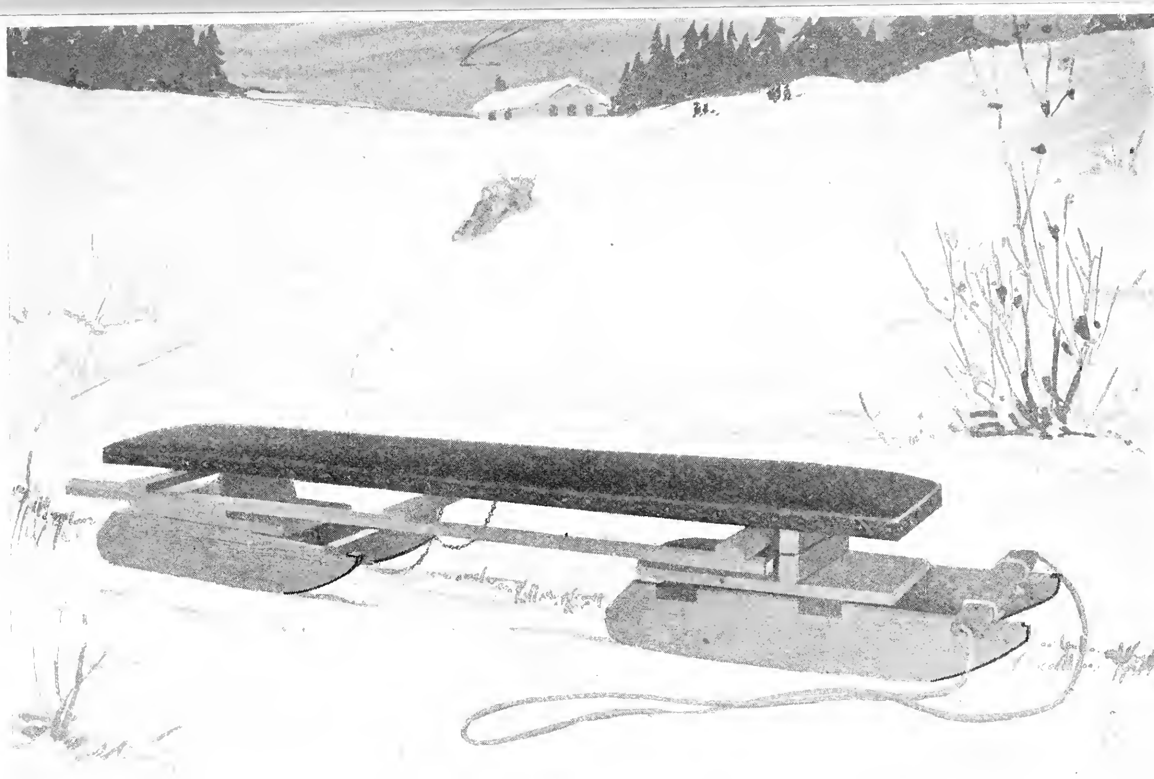


Fig. 554.—A Bob-Sled of Which Any Boy Might Be Proud.

patterns for the bow and stern, ruling off the same number of squares, 1 inch square, then locating on the lines separating the squares points corresponding to points at which the curve intersects the lines on the pattern illustrated. With the points located, it will be an easy matter to connect them with a curved line.

Locate the pair of notches in the top edge, for the connecting crosspieces *B* (Fig. 558), and carefully cut out the

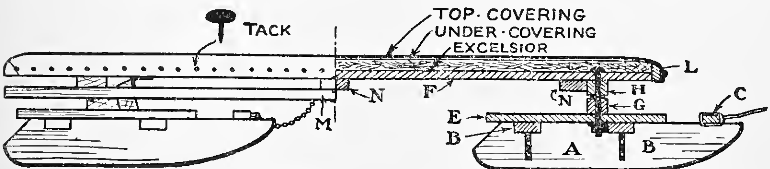


FIG. 555

FIG. 556

FIG. 555. — Side View and Longitudinal Section
FIG. 556. — Detail of Runner Shoe

pattern. Splice two pieces of cardboard end to end if you cannot get a long enough piece of single length for the

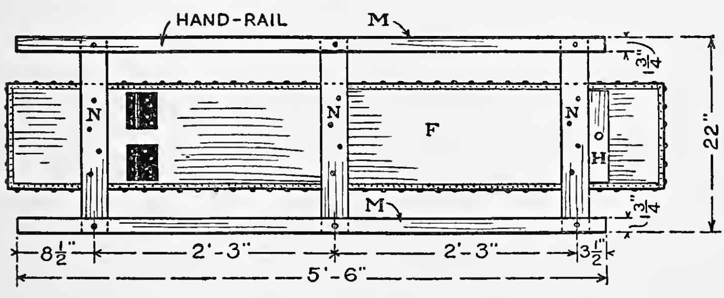


FIG. 557. — Plan of Under Side of Bob-Sled Seat

pattern. With a saw, cut out the ends, sawing to within about ⅛ inch of the line, then finish up to the line with a plane, and sandpaper. Cut the sides of the notches with a saw, and split out the wood between the cuts with a chisel. Cut

The Connecting Crosspieces *B* of the length shown in Fig. 560, by the width of the notches, and nail them in place. Then brace the ends of each with the corner irons *D* (Fig. 559), screwing these to the runners and to the crosspieces, in the positions shown.

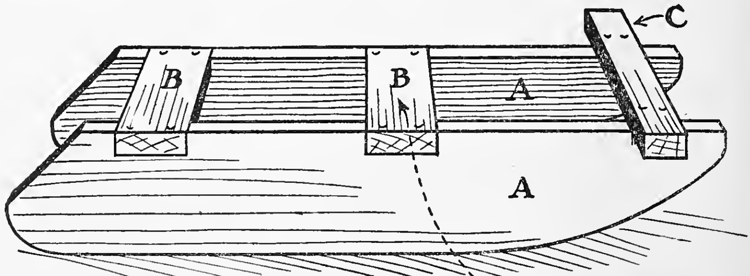
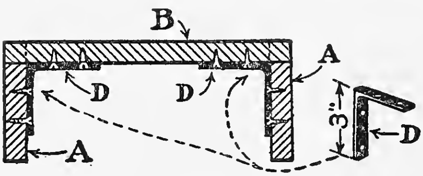


Fig. 558



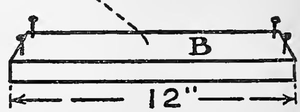


Fig. 559 Fig. 560

Fig. 558. — Detail of Bow and Stern Sleds
Fig. 559. — Cross-Section Fig. 560. — Runner Connecting Crosspieces

Crosspiece *C* on the bow sled (Fig. 558) is

The Foot-bar. Cut it 18 inches long. The boy who steers the bob-sled rests his feet against the projecting ends of the foot-bar. After nailing the bar in place, drive a screw-eye into each end, as shown in Fig. 568. Tie

The Steering-Line ends to the foot-bar just inside of the runners, then run them over to and up through the screw-eyes, as shown. By this arrangement, the feet of the boy who steers will be kept from slipping off of the foot-bar by the steering-lines.

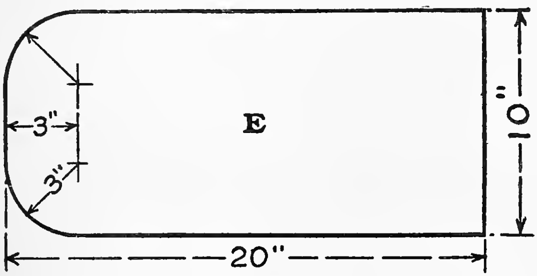


FIG. 562

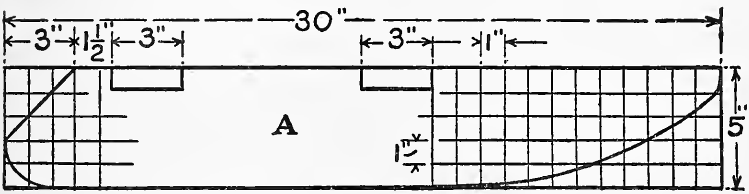


FIG. 561

FIG. 561.—Pattern for Sled Runners FIG. 562.—Pattern for Sled Seats

Figure 562 shows a pattern for

The Sled Seats. The stern end may be left square if you like, but rounding it as shown will give it more style. Nail the seats in place, using long enough nails to clinch upon the under side of the braces.

With the sleds completed, prepare

The Bob-Sled Connecting Seat (*F*, Fig. 563) of the size shown, then the connecting blocks *G*, *H*, *I* and *J* (Figs. 563, 564 and 565). Make blocks *G* and *H* in one piece (Fig. 566), bore a ¾-inch hole through the piece at the center of its length, for the *king-bolt*, and rip in half as indicated by dotted lines. Nail block *H* to the under side of seat *F*, and block *G* to the seat of the bow sled. Bore a hole through seat *F* directly over that in block *H*. Figures 563 and 564 indicate how the king-bolt runs down through

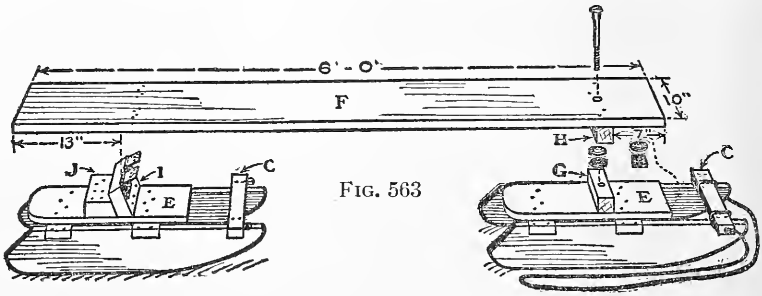


FIG. 563

FIG. 565 FIG. 564

FIG. 563. — Detail of Bob-Sled Seat
FIG. 564. — How Bow Sled is Bolted to Seat
FIG. 565. — How Stern Sled is Hinged to Seat

seat *F* and block *H*, then through two iron washers, through block *G*, seat, *E*, a third washer, and the nut.

Block *I* is beveled upon its side edges to make it fit across the stern seat at the angle shown in Fig. 565. Nail it securely to the seat, then brace it with the block *J*, beveling the edge of *J* so it will fit squarely against block *I*. Block *I* must be hinged to seat *F* by means of 4-by-4-inch hinges. Bolt the hinges in place with stove-bolts of the length specified. The stern sled is hinged to make it rise and fall independently of the bow sled when the bob-sled runs over uneven ground, or when it has reached the foot of a coasting hill or toboggan-slide. Connect the bow of this sled to the under side of the bob-sled seat, with *check-chains* (Figs. 554 and 555), driving screw-eyes into crosspiece C and into the under side of seat F, to connect the chains to.

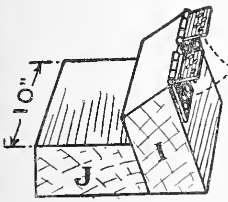


FIG. 567. — Blocks for Connecting Stern Sled to Bob-Sled Seat

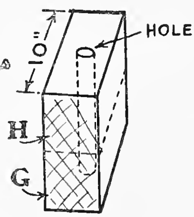


FIG. 566. — Blocks for Connecting Bow Sled to Bob-Sled Seat

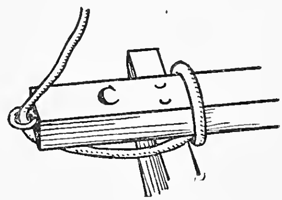


FIG. 568. — How to Attach Steering-Line to Foot-Bar

Upholstering the Seat. If you upholster the bob-sled seat, you must nail strips K and L (Figs. 569 and 570) to its edges, to hold in the upholstering material. Cut these strips 2 inches wide, and round the outer edge of the top of each, as shown in Fig. 570, to give a rounded edge to the upholstering. Miter the ends of the strips, to make mitered corners.

Spare neither time nor pains in packing in the excelsior padding, because only with painstaking care, adding here and there in low places, and removing from high places, will you get a good job. Dampen the excelsior to make it pack solidly. When you are satisfied that all is in readiness for the covering material, get a piece of ticking or other heavy material, and spread it over the excelsior; then examine the work, and you will be surprised to find low places that you did not notice before. The excelsior must be packed in tightly along the side edges, so that the edges of strips *K* and *L* cannot be felt, and along the center to make it higher there than along the edges. With the low places filled out, tack the covering along the remaining sides. Then spread the top covering over this under covering, bring its

Fig. 569 Fig. 570

Fig. 569 and 570. — Details Showing Strip around Edge of Seat to Hold in Upholstering Material

edges down over the sides, and tack to the under side of seat board *F* (Fig. 557).

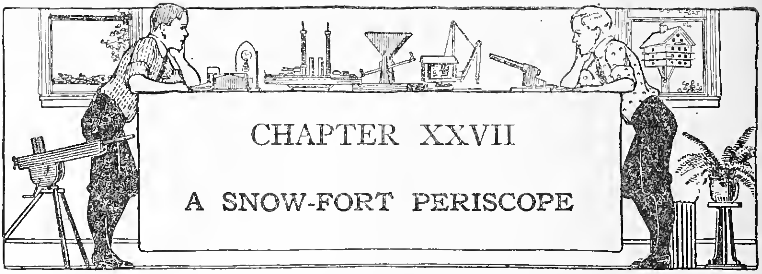
In the photograph of Fig. 554 you will see how the edges of the upholstered seat can be improved by the addition of upholstering-tacks. If you use an imitation leather covering, you can buy tacks with heads that match If you use other material, you can buy tacks with large brass heads. Space the tacks about 2 inches apart (Figs. 555 and 557).

With the upholstering completed, prepare

The Hand-Rails *M* (Fig. 557) of the size shown, and round off their edges with a plane to make them easy to grip. Then prepare the cross-pieces *N* (Fig. 557) 3 inches wide, by the length shown. The hand-rails must be bolted to the crosspieces in the positions indicated in Fig. 557, with the 1-inch stove-bolts specified in the list of material. Use care in boring the bolt holes, to get them in corresponding positions. After bolting the rails to the crosspieces, remove the king-bolt, and the hinge bolts, thus releasing the seat, and screw crosspieces *N* to the under side of the seat.

Runner Shoes. Buy *half-oval iron* strips ¾ inch wide, long enough to turn up and over the bow and stern as shown in Fig. 556, for runner shoes, and have a couple of holes drilled through each, near each end, for screws, for screwing to the under side of the sled runners.

Painting. With the bob-sled's construction completed, protect the wood with paint. The author suggests that you select red for the color. This and a green upholstering material, such as was used upon the model illustrated, make a mighty striking sled, and if your workmanship is good, you will have a job which will make envious all of the boys in your neighborhood, and all around town, who have not built similar sleds.



CHAPTER XXVII

A SNOW-FORT PERISCOPE

WHEN you defend a snow-fort, or "snow-trench" to be modern, you not only want to keep the enemy's attacking party at a distance by well-aimed snowballs, but also to escape from being hit by their snowballs. By building the walls of your fort or trench breast high, you need expose only your head and shoulders when throwing, and you can quickly "duck" behind the wall when you see a snowball coming. But the author well remembers how the lads attacking a snow fort used to wait for the defenders' heads to appear — in fact, got to know just when they would appear, — and "soaked" them before there was a chance to get into a throwing position. Probably you have had the same experience. Although this adds excitement to a snow fight, the fun is all on the side of the boys attacking. By the use of periscopes, however, the defenders can have the advantage on their side.

With a periscope, you know, a soldier sees what is going on outside of the trench, or other fortification, without exposing his head to the enemy's fire. Just so with the home-made snow fort periscope. With its top projecting above the wall of your snow fort, as shown in Fig. 571, you watch the enemy while fully protected by the fort,

Fig. 572.—Front View of Periscope.

Fig. 571.—While Protected by the Snow Fort, You Watch the Enemy Through the Periscope.

and you expose yourself only when you see that nobody is prepared to throw at you. One periscope will serve several boys if one boy acts as *observer* and directs the "fire."

Figure 571 shows a rear view and Fig. 572 a front view of the home-made periscope in use, Fig. 573 shows a working detail of the completed periscope, and Fig. 577 shows a vertical *section*.

Material Required. Boards ⅝-inch thick were used in making the periscope model illustrated, but even thinner

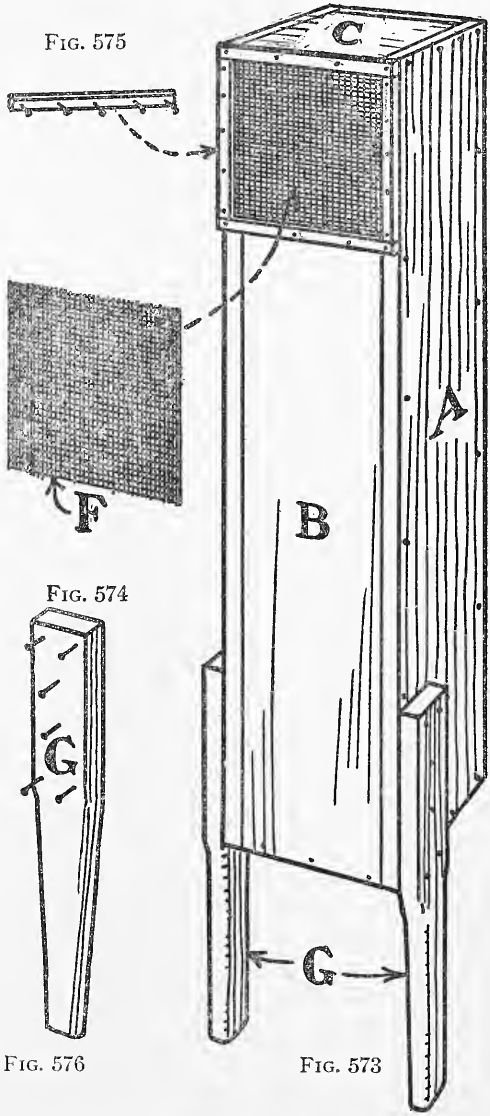


FIG. 575 FIG. 574 FIG. 576 FIG. 573

FIG. 573.—Complete Periscope. FIG. 574 and 575. — Detail of Screened Front FIG. 576. — Handle

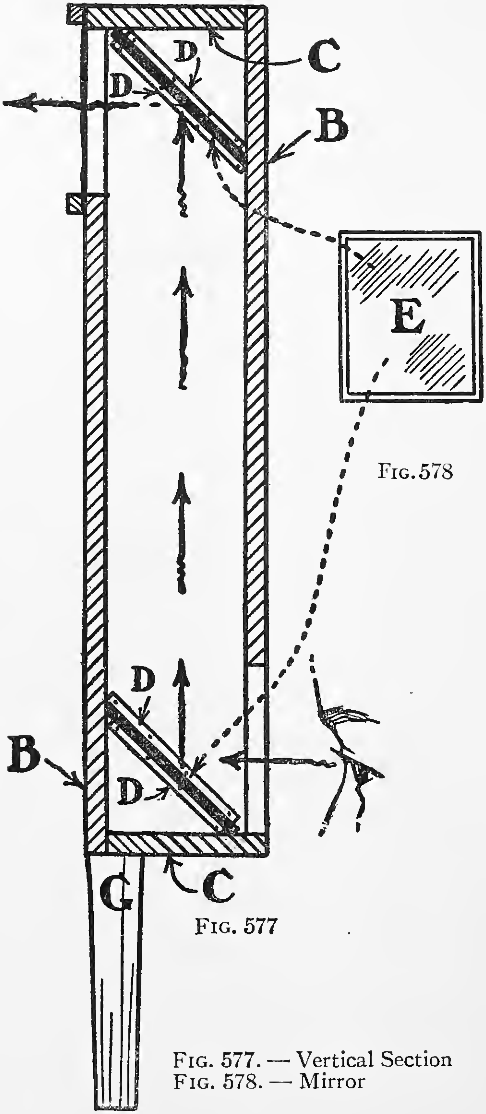


FIG. 578

FIG. 577

FIG. 577. — Vertical Section
FIG. 578. — Mirror

boards than this will do. The lighter the weight is, the easier it will be to handle the periscope. Perhaps you can find a packing-box made of ⅜-inch boards which you can break up for the purpose.

Two mirrors are needed. Those used for the model were bought at 5 cents apiece at a 5-and-10-cent store. They are 5 inches wide and 6 inches long. Get the mirrors before you construct the periscope box, because if they don't measure 5 inches wide and 6 inches long you will have to alter the dimensions of the side pieces to suit them.

Cutting Out the Parts. After cutting side pieces *A*, the front and back pieces *B*, and the ends *C* (Fig. 573), by the patterns of Fig. 579, cut eight narrow strips (*D*, Fig. 579) for cleats on which to support the edges of the mirrors.

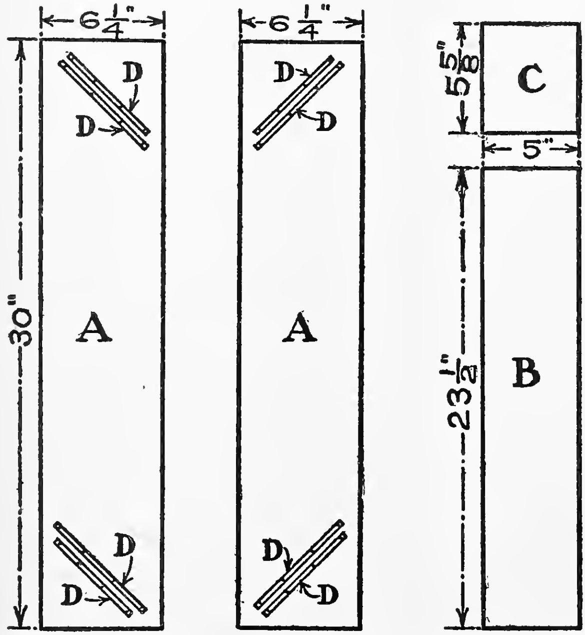


Fig. 579. — Patterns for Sides, Front, Back and Ends of Periscope

These strips may be cut out of cigar-box wood. Fasten the strips with brads to sides *A* at an angle of 45 degrees, placing a pair at each end, just far enough apart so the mirrors will slip between them, and so the ends will be far enough away from the edges of sides *A* to allow for the thickness of the front, rear, and end boards which are set against them. It is absolutely necessary to place the strips at one end exactly parallel with the pair at the opposite end, so that the reflecting surfaces of the mirrors will be parallel with one another, and, also, to place the strips on one board at the same height as those on the other board. Fasten the strips to one board, first, then use the same measurements for locating the strips upon the other board.

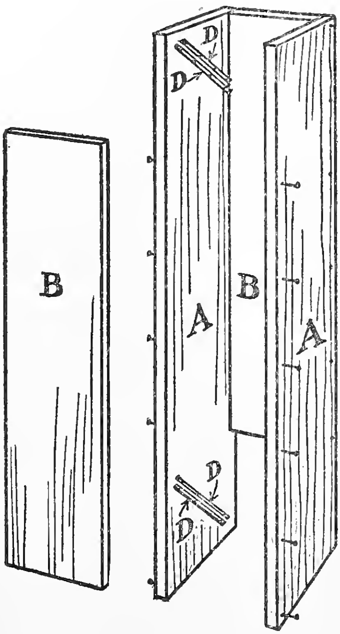


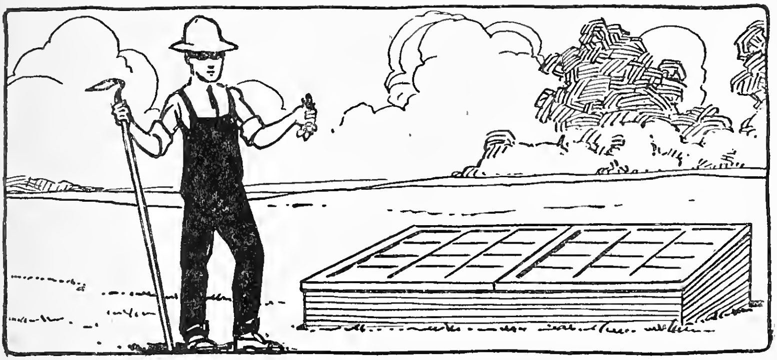
Fig. 580. — How to Assemble the Periscope Parts

To Assemble the Box, first nail sides *A* to the edges of back *B* (Fig. 580), then to the edges of front *B*. Notice that the back piece comes even with the tops of the sides, and that the front piece comes even with the bottoms of the sides. With pieces *A* and *B* nailed together, fasten ends *C* between them. These pieces will hold the mirrors in position.

The Openings. The opening in the back of the periscope box is the one that you look into, the one in the front is turned toward the object you wish to view. As the upper mirror will be exposed it must be protected from snowballs by a piece of screen wire tacked over the opening (*F*, Fig. 574). A frame of narrow wooden strips (Fig. 575) tacked over the edges of the wire will hold the wire in place.

Handles nailed to the lower portion of the box (*G*, Fig. 576) will complete the periscope.

Paint the Periscope Box white so that it will be invisible from a distance, against the snow background.



PART IV
Garden Craft

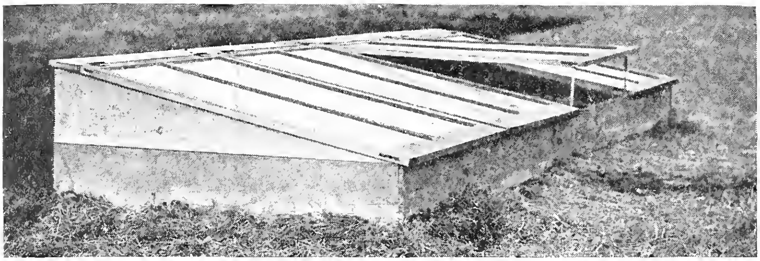


Fig. 581.—A Four-Sash Hot-Bed (See Chapter 28).

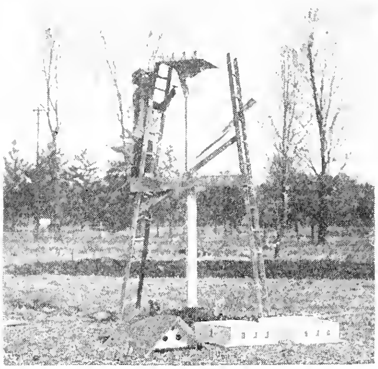
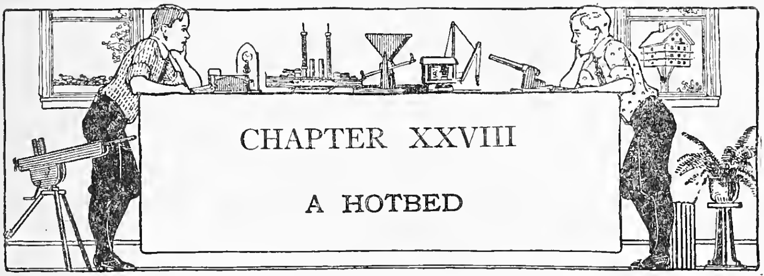


Fig. 711.—First Story in Place.

Fig. 712.—Adding the Second Story.

Fig. 713.—Third Story.

Fig. 714.—Ready for the Martins. See Chapter 40.)



CHAPTER XXVIII

A HOTBED

THE growing season never arrives early enough for the enthusiastic boy gardener, so he provides himself with a hotbed, by which means it is possible to have radishes, lettuce, and other early vegetables a month before they can be raised outdoors. Now, a hotbed is such a simple piece of garden equipment to make, and so easily operated, that there is no reason why every boy who goes in for gardening should not have one.

A hotbed is in reality a small greenhouse, heated by fermenting manure. It consists of a pit from 2 to 3 feet deep, filled with manure to within 6 inches of the ground level, with a 6-inch top dressing of garden soil. The front wall of the frame extends 6 inches above ground, the rear wall 12 inches, the sides slope from the height of the front wall to the height of the rear wall, and the open top is protected by glazed sash.

The Size to Make the Hotbed will be determined by the size and number of sash at hand. Storm-sash or old window sash will do. Regular hotbed sash can be purchased at a door-and-sash mill, and from dealers handling garden accessories, in size 3 feet wide and 6 feet long.

A Single-Sash Hotbed is shown in Fig. 582. If a larger bed is wanted, the frame can be made two or three times as wide, and two or three sash used. Figure 581 shows a four-sash hotbed.

The Framework. Figure 583 shows a longitudinal section of the hotbed frame and pit. Corner posts *A* of the framework (Fig. 584) are 2-by-4s, side boards *B* and end boards *E* and *F* (Fig. 584) are cut from 1-by-8s, and boards *C* and *G* are 1-by 6s. Rip a triangular strip from the upper edge of boards *B*, as shown in Fig. 585, so one end will

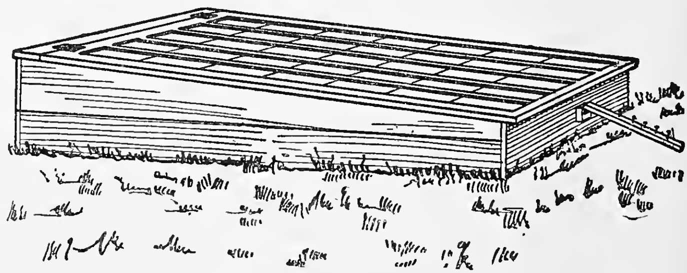


Fig. 582. — Single-Sash Hotbed

measure 1¾ inches wide, the other end 7¾ inches wide. The framework must be made enough narrower than the sash so the sash will lap over the sides, and 2 or 3 inches longer than the sash to allow for the strip *H* (Fig. 583), which is nailed across the top as a hinge-strip to screw the sash hinges to. Side pieces *B* will be of the right length for sash 6 feet long, if cut as shown in Fig. 585.

To Assemble the Framework nail side boards *B* and *C* to corner posts *A*, then connect the two frames thus formed with boards *E, F,* and *G.* Batten the side boards at their centers with pieces *D.*

Dig the Hotbed Pit of the right depth so the lower edge of framework boards *C, E,* and *G* will come 2 inches below the ground surface.

Filling the Pit. Procure enough horse manure to fill the pit to a depth of 2 feet (Fig. 583). Pile it up in a heap

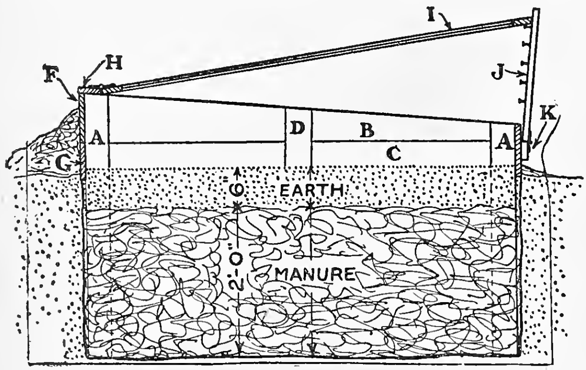
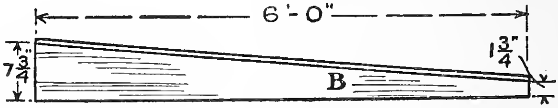


Fig. 583. — Longitudinal Section of Hotbed Fame and Pit

beside the hotbed, sprinkle it with water, and allow it to remain exposed to the air for two or three days, so the fermenting process will get well under way. Then throw the manure into the hotbed pit, and close down the sash. The action of the sun's rays passing through the glass will increase the fermenting, and the temperature within the hotbed will be raised considerably above 100 degrees. Before the top soil is spread over the manure, the temperature must be reduced to about 90 degrees, which temperature must be taken with a thermometer. To reduce the temperature, raise the sash. Make the top dressing 6 inches in depth. Use the best garden soil that you can get. If

FIG. 585.



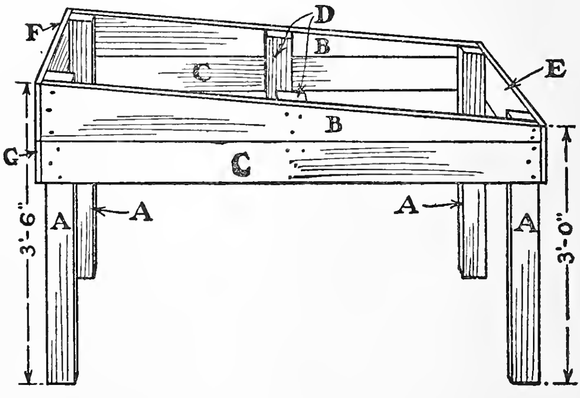


FIG. 584

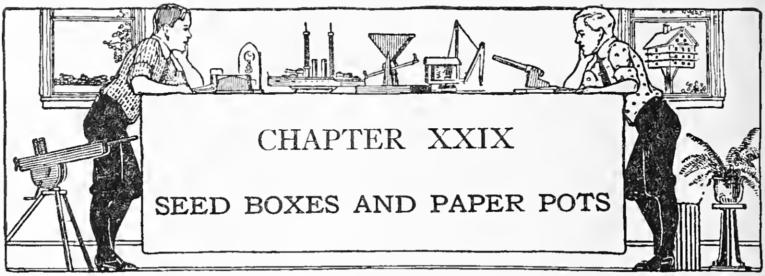
FIG. 584. — Detail of Hotbed Frame
FIG. 585. — Detail of Upper Side Piece of Frame

your soil is heavy, add a little sand to it. Bank up earth around the outside of the hotbed frame for insulation.

The temperature of the soil must not be too great, else the plant roots will burn out. This must be regulated carefully by raising the sash when necessary, to allow excess heat to escape. Raising the sash will also provide the plants with necessary fresh air, but you must use judgment in opening the sash, lest you freeze your plants. Keep the sash closed at night during severe weather, and cover it with pieces of carpet or with straw mats, for additional protection.

Water the hotbed regularly, after the seeds have sprouted, doing this about mid-day so the leaves will dry off before sundown.

A Cold-Frame differs from a hotbed only by the omission of the manure heating-agent. Sunlight alone is depended upon for heat. Consequently, the cold-frame can be depended upon only for forcing plants after the severe weather has passed. You can use the hotbed as a cold-frame after the manure has cooled.



CHAPTER XXIX

SEED BOXES AND PAPER POTS

PLANTS raised from seed started indoors during late winter or early spring can be brought to maturity so many weeks ahead of plants started outdoors when the season is far enough advanced to permit doing so, that it is a prac-

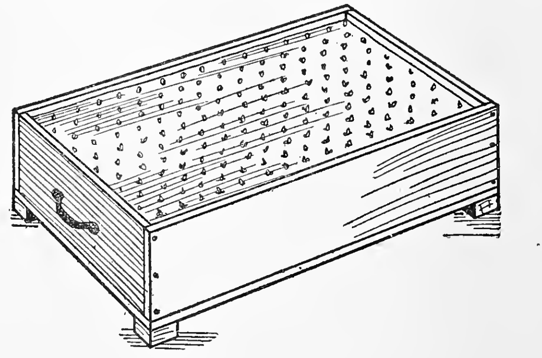


FIG. 586. — Seed-Flat

tice well worth while to use seed boxes and paper pots if you haven't built a hotbed. Radishes, lettuce and other early vegetables can be started in these boxes, and you can raise your tomato plants, and have them ready to set out the minute danger from frost has passed.

Two or three grocery boxes filled with earth are all that you require for seed boxes, or

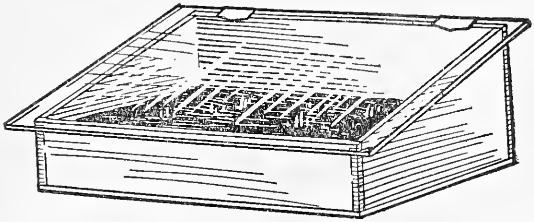


FIG. 587. — A Miniature Greenhouse with a Lean-to Roof.

Seed-Flats—as the green-house man calls them. Most grocery boxes are too deep, but it is a simple thing to cut them down. Four inches is just about right.

Figure 586 shows a seed-flat. Drill several holes through the box bottom near the center, for drain-holes, and nail blocks to the bottom at the corners for feet, to raise the box enough above the surface it is to stand upon so a tin can be slipped beneath to catch the water that will run out of the drain-holes. Screw a pair of handles to the box-ends. Give the box two coats of paint inside and out, to preserve the wood and fill up joints.

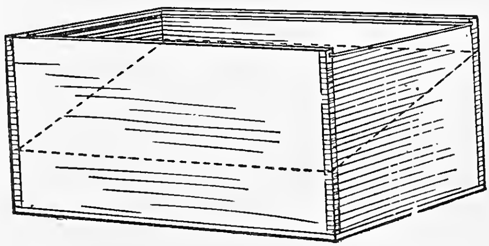


FIG. 588. — The Dotted Lines Indicate Where to Cut the Box Sides.

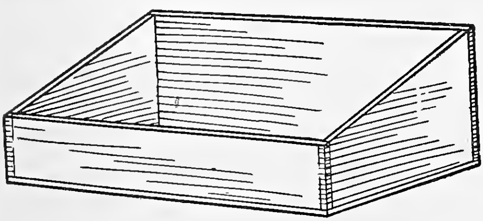


FIG. 589. — The Cut-down Base Ready for Glass Roof

Filling. Seeds will germinate in almost any kind of wet soil, but in order to have them develop into sturdy plants, the soil must be prepared with care. Soil from last summer's garden, enriched with leaf-mold, or prepared fertilizer, will be just right. Over the bottom of the box, spread a layer of coarse stone, to insure good drainage. Then fill in the soil over this to a depth of 3 inches. Level off the top surface with a small block of wood, before planting. Plant as directed on the seed packages. With a ruler and nail you can scratch lines in the surface, for planting rows. Of course you can plant the seeds thickly for the purpose of germinating them, then transplant them into other boxes as soon as the second true leaf has appeared. Keep the soil moist, while the seeds are germinating, but never puddle it, and keep a newspaper over the box until the leaves show above the surface.

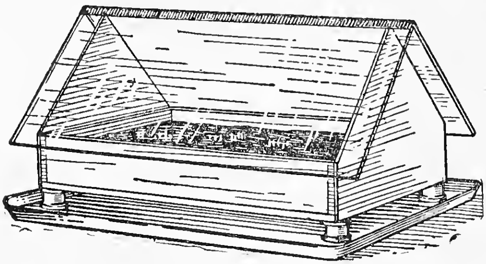


FIG. 591. — A Greenhouse with a Gable Roof

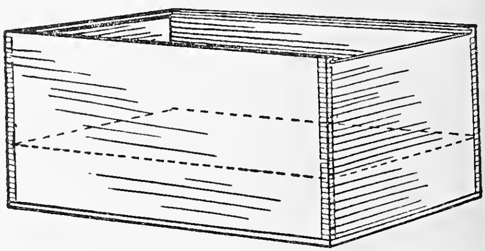


FIG. 592. — The Dotted Lines Indicate Where to Cut the Box Sides

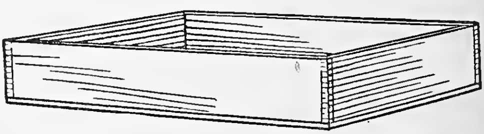


FIG. 593. — The Box with Sides Cut Down

A novel arrangement for starting seeds indoors is to make **Miniature Greenhouses** like those shown in Figs. 587 and 591. Starch boxes, are of about the right size for these. It is better to use small boxes than large ones because it will be easier to put on the glass roofs.

Figure 587 shows the simpler model —

A Greenhouse with a Lean-To Roof. Cut the top of the

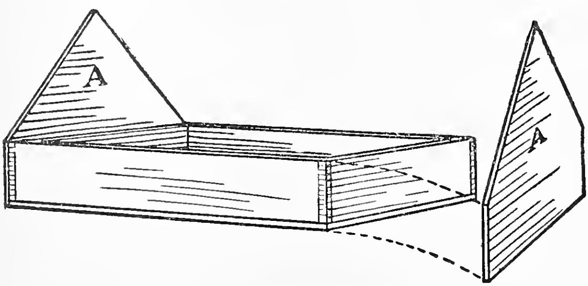


FIG. 594. — Put on the Gable Ends Like This

starch-box ends slanted so that the front edge is about 2½ inches high and the rear edge 5 inches high, and cut down the front and back even with the edges of the ends, as indicated by dotted lines in Fig. 588.

With the cutting done, get a piece of glass large enough to fit over the top and project a trifle over the front and ends. Possibly you can find an unused picture-frame with a glass of the right size, or several camera plates that can be fastened together with adhesive-tape to make a piece large enough to cover the box; if not, a painter will sell you a piece. Hinge the glass with strips of adhesive-tape, (Fig. 587).

The Greenhouse with a Gable Roof, shown in Fig. 591, looks more like a florist's greenhouse. The starch-box which forms the foundation must be cut down as indicated by dotted lines in Fig. 592, so the remaining depth will be about 2½ inches (Fig. 593).

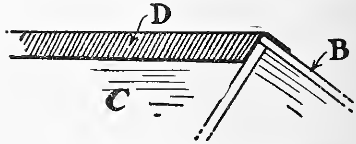


FIG. 595. — Hinge the Halves of the Glass Roof Like This

With the box thus prepared, cut two end pieces out of thin box boards (*A*, Fig. 594), and tack these to the box ends. Make the peak of each end piece 8 inches above the bottom edge. The box may be stood on end upon the boards for the purpose of marking out the lower portion of end pieces *A*. When the board ends have been marked out, cut, and tacked to the box ends, procure two pieces of glass of the right size to project over ends *A* and the sides of the box, as shown in Fig. 591. Join these two pieces (*B* and *C*, Fig. 595) at the peak with a strip of adhesive-tape lapped over them (*D*, Fig. 595).

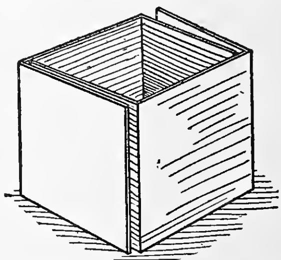


FIG. 596. — Paper Pot for Seedling Transplantings

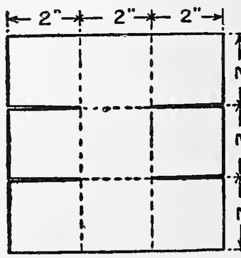


FIG. 597. — Pattern for Paper Pot

Unless the boxes are metal lined, they are likely to leak after you water the planted seed, so it is a good idea to place beneath each a cake-tin to catch drippings (Fig. 591); also, it is well to attach spool feet at the corners to keep the box bottoms high and dry.

Paint the Greenhouses with a couple of coats of green paint, or with two coats of white paint and one coat of white enamel.

Paper Pots are extensively used for seedling transplantings (Fig. 596). The seedlings are transplanted from seed-

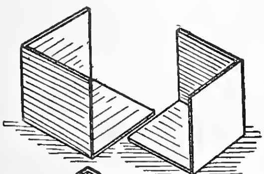


FIG. 599. — How to Make Pot out of Box Corners

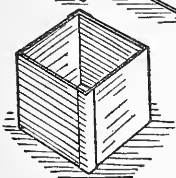


FIG. 598. — Pot Made from Cardboard Box

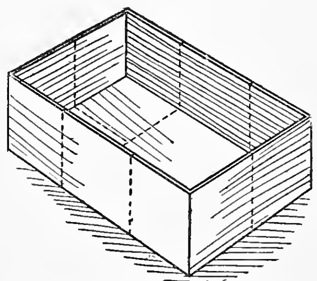


FIG. 600. — How to Cut away the Box Corners

flats to these earth-filled paper pots, and then, when they are large enough to set outdoors, the pots are planted without disturbing the roots of the seedlings.

Paper pots can be made of heavy wrapping-paper. Small pots may be 1½ inches square, large pots 4 inches square. Figure 597 shows a pattern for a 2-inch pot. Cut along the heavy lines, fold along the dotted lines, and paste the overlapping surfaces.

Figure 598 shows

A Pot Made From a Cardboard Box. A box will furnish material for two pots. Cut the box as indicated by dotted lines in Fig. 600, and place the corners together as shown in Fig. 599. Fasten by gluing strips of paper over the edges, then reinforce the corners by sewing with heavy linen thread.

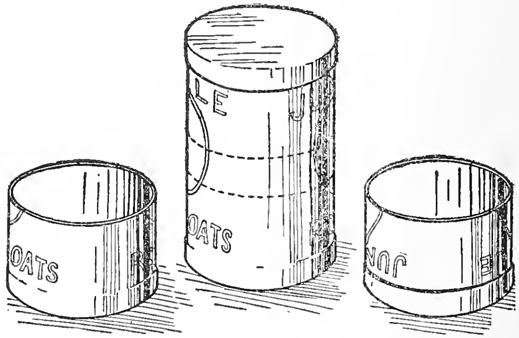
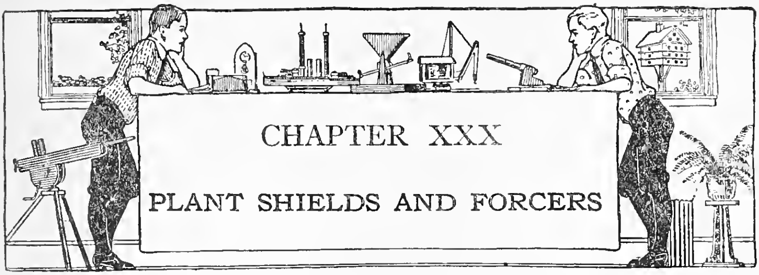


Fig. 601 Fig. 603 Fig. 602

Figs. 601-603. — Circular Pots Made from Cereal Carton

Circular Pots can be made from cereal cartons (Figs. 601 and 602). One carton will produce two pots. Glue and stitch the cover on to the carton, then cut a pot from each end, as indicated in Fig. 603.



CHAPTER XXX

PLANT SHIELDS AND FORCERS

It is necessary to protect transplantings from the sun until they have taken root and are able to stand the

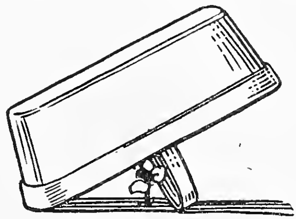
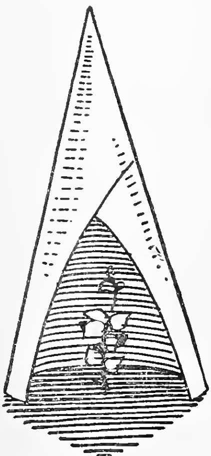


Fig. 606



Gig. 604

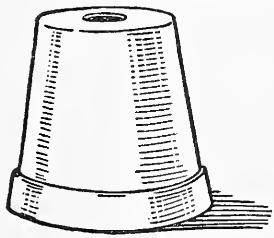


Fig. 605

Figs. 604 to 606. — Three Methods of Shielding Transplantings until they have Taken Root.

heat without wilting, and for early Spring transplanting before the season has become far enough advanced to make frost an impossibility, it is necessary to provide frost protection. The protectors shown upon the following pages have proved practical for these purposes, and you will find them easy to make.

The Paper-Funnel Shield shown in Fig. 604 is so rolled that one side, left open, can be turned away from the sun to admit light and air. Make the funnels out of pieces of heavy wrapping-paper.

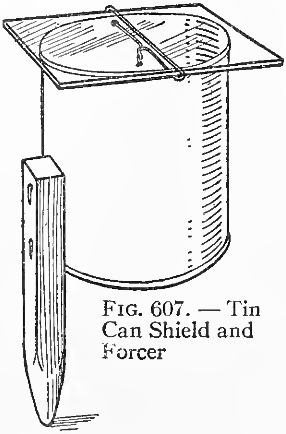


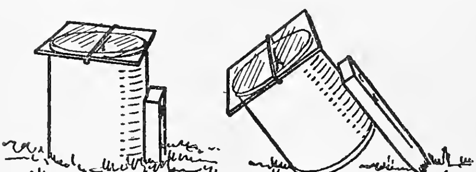
Fig. 607. — Tin Can Shield and Forcer

The Flower-Pot Shield (Fig. 605) is commonly used for short plants, because flower-pots are almost always at hand.

The Basket Shield shown in Fig. 606 is a good type of sun shield because, while it gives protection, it admits lots of light and air. Of the three shields, the paper-funnel shield is the one to use if you have a great many transplantings to protect.

The Tin Can Shield and Forcer shown in Fig. 607 is useful not only to protect transplantings from frost and the sun, but also as a small cold-frame to force a plant's growth in the early Spring while the weather is yet cool. The sun's rays passing through the glass top of the forcer will carry heat to the plant in the same way that heat is carried to the plants in the cold-frame.

Fig. 608 Fig. 609



Figs. 608 to 609. — Tin Can Shield and Forcer in Use

Tomato cans are of the best size for the tin can forcer, and 4-by-5 inch camera plates are of the right size for the glass tops. If you cannot get used camera plates, any broken pieces of glass that you can find will do. If the can ends are *crimped* on, as most cans are now made, cut the ends open with a can opener. Punch a nail-hole in opposite sides of the can near one end, place the glass on the can, pass a a piece of wire over it, and stick the wire ends through the holes; twist the wire ends as shown in Fig. 607, and the wire will hold the glass in place. Nail the side of the can to a stake whittled to a point on its lower end.

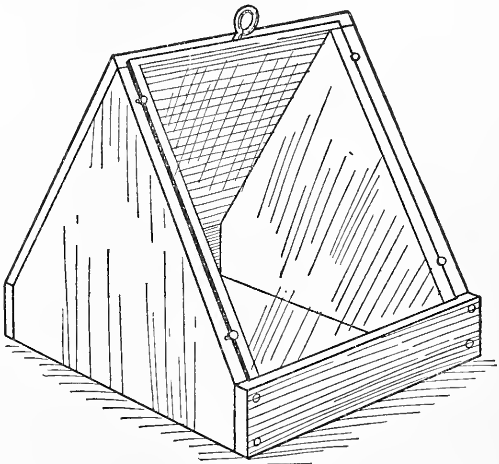


Fig. 610. — A Plant Forcer

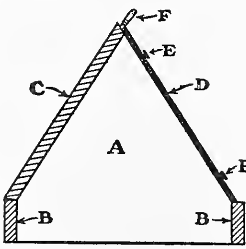


Fig. 611

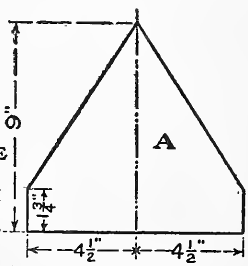


Fig. 612

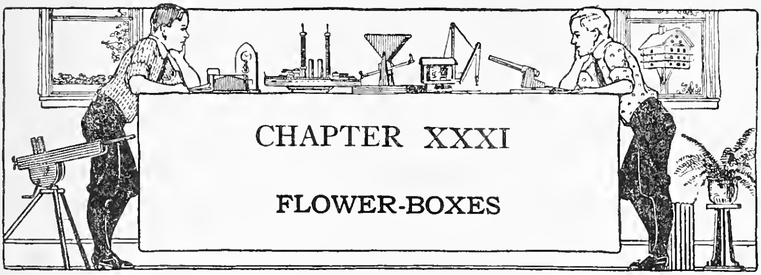
Fig. 611. — Cross-Section of Plant Forcer
Fig. 612. — Patterns of Pieces Required

Figure 608 shows the forcer set close to the ground; Fig. 609 shows it raised for ventilation When the nights are cold, spread heavy paper over the plant, then set the can down over this, for extra protection When the weather warms up, and you wish to shield the plant from the sun, slip a piece of paper under the glass top

The Plant Forcer in Fig. 610 requires more time to make than the tin-can forcer. It has the advantage of being roomier. The size of glass you obtain will determine the size of the parts. In the model shown, I used a 6½-by-8½-inch camera plate, and the dimensions on the pattern of Fig. 612 are correct for glass of this size. Go to a paint shop and see what you can get in small pieces of glass. Possibly you can get scraps that will not cost much.

The cross-section (Fig. 611) shows how the pieces go together. Prepare end pieces *A* and front and back strips *B* by the patterns (Fig. 612), and nail them together. Then cut back piece *C* to fit, and nail it to end pieces *A*. The glass rests upon front strip *B*, and it is held in place by four nails (*E*), driven into the edges of the end pieces *A* so the heads overlap the glass. The screw-eye *F* in the top edge of piece *C* helps hold the glass in place.

When you have completed the forcer, give it a coat of paint. Green is the best color for garden accessories, but if you have another color on hand, make it do.



CHAPTER XXXI

FLOWER-BOXES

HAVE you ever made flower-boxes to sell? It is an excellent way to earn money in the Spring, for then everybody is planting them, and there is so much demand for boxes of various types that there is not much trouble in making sales. An energetic boy usually can dispose of all of the boxes that he has time to make.

Boxes of good design and proportions are almost as pleasing to look upon as the plants and vines which they contain. They require more care in the making than the square-cornered grocery-box type, but the work is simple, and you will find a readier sale for them among garden lovers.

Material for Boxes. Cypress, often spoken of as "the wood eternal" because it is so little subject to decay, is the best flower-box material obtainable. Florists use it for their greenhouse boxes and troughs, it is used in the construction of greenhouses, and it is extensively employed in every form of building for parts exposed to moisture. The grain of cypress is exceedingly pretty, especially when the wood is stained with one of the modern wood finishes.

Finishing. There are several ways to finish the wood of a flower-box. You can use an oil-stain made by mixing oil-paint with turpentine or kerosene, or you can buy ready-mixed stain; you can white-enamel the wood or paint it the color your customer selects; or, if the wood has a pretty grain, like cypress, you can leave it in its natural color, and finish with a coat of white shellac and another of varnish.

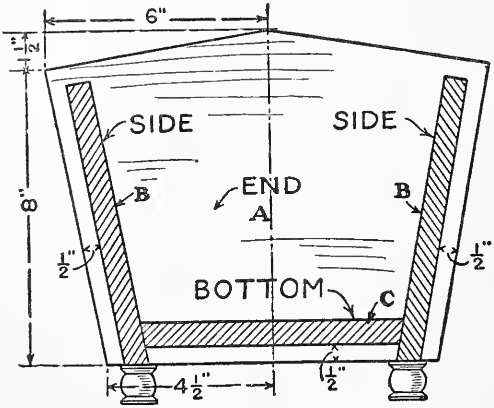


FIG. 618. — Cross-Section of Window or Porch Box Shown in Fig. 613

A Window or Porch Box. The long box with tapering sides shown in Fig. 613 is of a pleasing design for a window-sill or porch-rail. The cross-section of Fig. 618 shows the pattern for the end pieces (*A*), and shows the positions for the sides (*B*), and the bottom (*C*). Be careful to get the end pieces alike. Lay out one piece accurately, then use it for a pattern for marking out the other piece. With the ends cut out, cut the side pieces and fasten them between the ends. Then cut the bottom board to fit between the sides. The length of the sides and bottom will

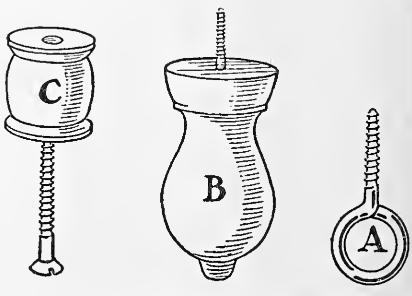


FIG. 619.—Three Forms of Feet for Boxes

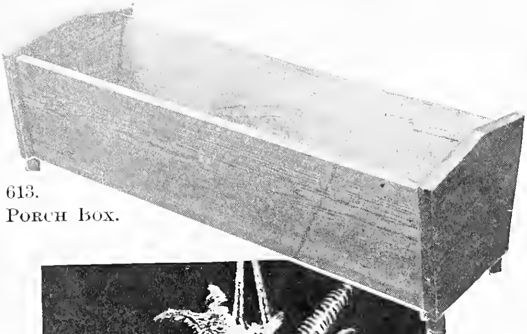


Fig. 613.
WINDOW OR PORCH BOX.

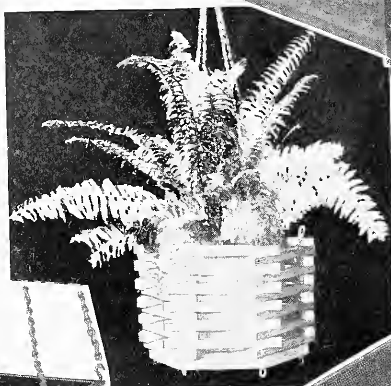


Fig. 617.
HANGING-
BASKET.

Fig. 616.—HANGING-BOX.

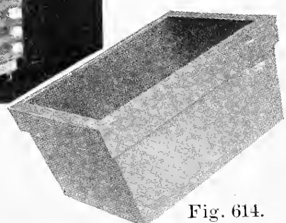


Fig. 614.
PLANT-TUB.

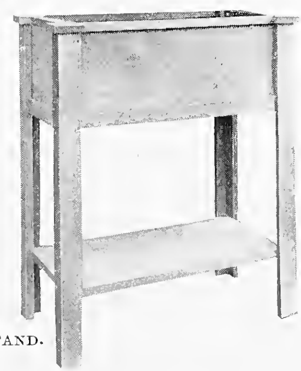


Fig. 615.—PLANT-STAND.

be determined by the size of box wanted. Cut the sides 7¾ inches wide. The edges of the bottom board must be beveled to make them fit squarely against the side pieces. If you will mark out the positions for the side pieces upon the end pieces, it will simplify the matter of assembling. Nail the pieces together with finishing-nails and *set* the nail-heads below the surface.

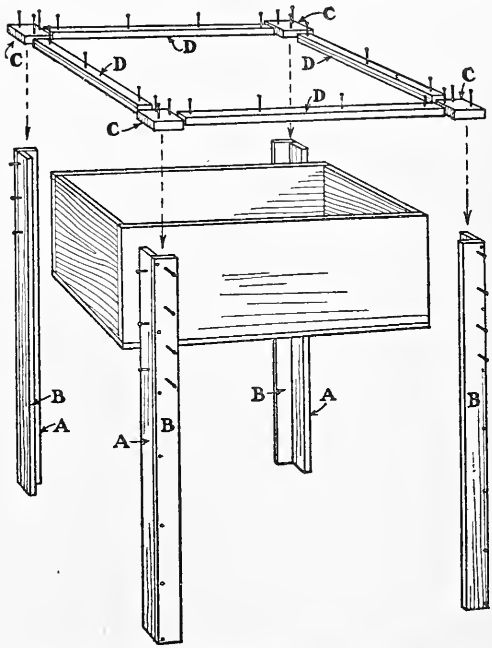


Fig. 620. — Detail Showing Assembling of Plant-Stand Shown in Fig. 615

Feet. It not only adds to the appearance of a flower-box to provide it with feet, but makes provision for a circulation of air beneath it, which will keep dry the bottom, and the railing or window-sill upon which the box stands. The screw-eye foot (*A*, Fig. 619) answers very well; foot *B* is a rubber-tipped *base knob* such as is used to screw into baseboards for doors to strike against; and foot *C* is a spool attached by means of a long screw run through its center hole. If the box is to be placed upon a ledge too narrow for all four feet to stand upon, the feet must be omitted.

A Plant-Tub (Fig. 614). This short box with tapering sides owes its substantial appearance to the wide band around its top. It is of a good design for a box built for the top of a balustrade post. No dimensions have been shown for this box, because you will want to make it of the right size to fit the post it is to stand upon. Eight inches is deep enough. To get the right taper for the sides, make the bottom edge of each side piece 2 inches shorter than the top edge. Mark out one side, saw it out, and use it as a pattern for marking the ends of the other side pieces. Lap the sides over the end pieces. When the sides and ends have been nailed together, cut a bottom board to fit between. By fastening this bottom board about ½ inch above the bottom edges, there will be a good chance for water to drain from the box.

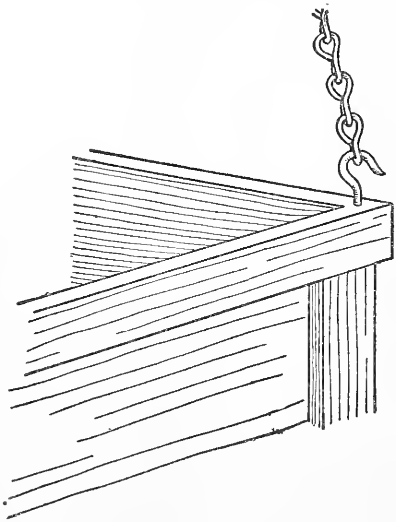


FIG. 621. — Corner Hook and Chain for Hanging-Box Shown in Fig. 616

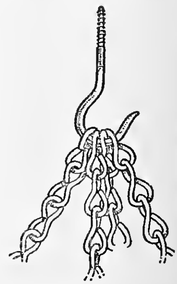


FIG. 622. — How Chains Fasten to a Hook Screwed into Ceiling

Holes may be bored through the bottom, to facilitate drainage. Pieces of broken flower-pot placed over the holes will keep the earth from washing out.

The Plant-Stand shown in Fig. 615 was made 29 inches high, or table height. If the one you build is to stand in front of a window, make it of about the same height as the window-sill. The detail drawing (Fig. 620) shows how the plant-stand is built with a grocery-box as a foundation. The pairs of strips *A* and *B* are nailed together to form the legs. Cut strips *A* 1½ inches wide, strips *B* 2 inches wide. The tops of the legs are finished off with the blocks *C*, which are cut of the right size to project about ½ inch over the sides of the legs; and the top edges of the box are finished with strips cut of the right length to fit between the corner blocks, and of the right width to project ½ inch over the box sides. If the box used for the stand is 12 inches wide or narrower, the lower shelf can be a single board, cut the exact width and length to fit in the corners formed by the leg strips. The shelf will brace the lower ends of the legs. Conceal the edge of the box-bottom boards with a narrow strip of wood cut to fit between the corner strips.

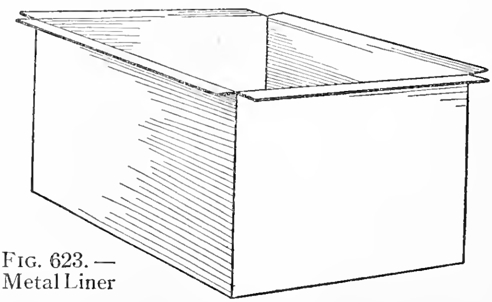


Fig. 623. — Metal Liner

The Hanging-Box shown in Fig. 616 is another example of how a grocery box can be used advantageously in the construction of plant boxes. The hanging-box is made by nailing a band of wooden strips around the top edge of a box, even with the top, and another band around the bottom, then fitting strips between the bands, at the box corners. Make the bottom band project about ½ inch below the box bottom. This band conceals the edges of the box-bottom boards, and the corner strips cover the edges of the box-side boards. Cut the upper and lower band strips out of boards ⅝-inch thick, making the lower strips 2½ inches wide, and the upper strips 3 inches wide. Cut the corner strips out of boards ⅜-inch thick, making one strip of each pair ⅜ inch narrower than the other, to allow for the lapping edges. Nail the corner strips together, then nail them to the box.

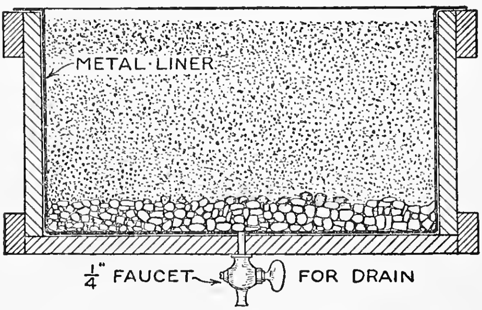


Fig. 624. — Cross-Section of Box Fitted with Metal Liner and Faucet for Drainage

Suspend the Box by chains attached to screw-hooks screwed into the top edge of the box at the corners (Fig. 621), and hooked onto a screw-hook screwed into the porch-ceiling or wherever the box is to hang (Fig. 622). Buy hooks 3 inches in length, and *No. 12 Iron jack-chain.* The bright iron hooks and chain may be enameled with screen-wire enamel to prevent rusting.

Metal Liners. As a grocery box is loosely made, one used for a hanging-box will leak more or less after each watering. If the position in which the box is to hang makes this objectionable, a galvanized-iron liner like that shown in Fig. 623 should be provided. You can get a liner made at almost any hardware store. The liner should be just a trifle smaller than the box so that it will drop in without forcing, and the upper edge should be bent over, as shown, to form a projecting rim all around that will rest upon the top edge of the box (Fig. 624).

When a box is provided with a metal liner, care must be taken not to pour too much water upon the soil at one time, else the

Surplus Water Will Become Stagnant in the bottom of the box, and probably result in loss of the plants. The nursery man will tell you that the proper way to do is to pour on just enough water so the top soil will be damp, not puddly.

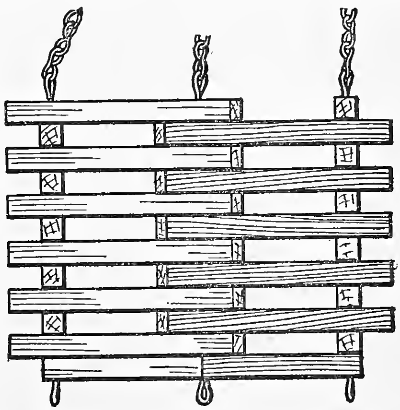


Fig. 625. — Side View of Hanging-Basket Shown in Fig. 617

A Satisfactory Drain, for taking care of the surplus water in the bottom of a metal-lined flower-box, can be provided as shown in Fig. 624. Get a ¼-inch brass *air-cock* and get a threaded piece of brass tubing to fit it. Cut the tubing of the right length to run through the box bottom, and solder it in a hole cut through the liner. Be careful to get the hole in the box bottom directly under the hole in the liner.

Before Planting Metal-Lined Boxes, cover the bottom to a depth of 1 inch or so with coarse gravel or small pieces of crushed stone. Surplus water percolating through the stones will be freed of earth particles, and when drawn off through the faucet will be clear. This will prevent stoppage.

The Hanging-Basket shown in Fig. 617 was designed for a potted fern. Omit the chain hangers, and screw four base-knobs into the bottom for feet, and you will have an excellent low pedestal box. Lengthen two opposite sides, and you will have a box suitable for a porch-rail or window. If plants are to be placed in the hanging-basket, pedestal box, or window box, without a pot, a moss lining must be provided to keep earth from falling through the spaces between the side sticks. The moss can be procured from a florist if you cannot find it in the woods.

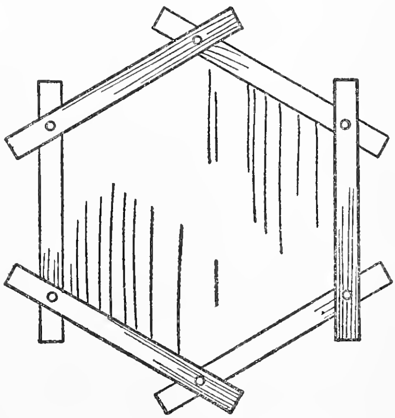


Fig. 626. — Top View of Hanging-Basket Shown in Fig. 617

By the side view of Fig. 625, and the top view of Fig. 626, you will see that the sides of the hanging-basket are built log-cabin fashion. Figure 627 shows a pattern for the bottom, which, as you will see, is hexagonal-shaped. Cut the piece out of a board ⅞ inch thick. Probably you know how to mark out an inscribed hexagon by describing a circle, then laying off the radius dimension six times upon the circumference, and connecting the points with straight lines. Figure 627 shows the method. When you have marked out the piece, saw it out a trifle outside of the lines, and finish up the edges with a plane.

At each corner of the bottom piece, bore a hole through which to run the wire connecting rods (Figs. 627 and 630). Make the holes 3/16 inch or 1/4 inch in diameter, and locate them exactly where shown.

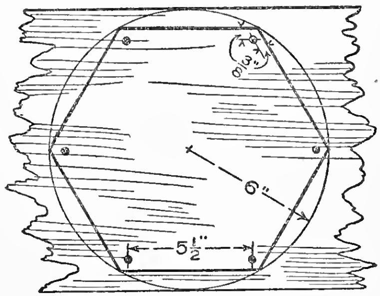


Fig. 627. — Pattern of Bottom for Hanging-Basket

The side sticks, of which you will need thirty-five, should be of the dimensions given in Fig. 628. If you can get several strips of a square moulding, you will only have to saw them up into pieces of the right length, smooth up the ends and edges, and bore holes for the connecting rods. Though of slightly different proportions than those given, *parting-strips*, used for window-frames, will serve the purpose nicely. You can get them at any planing-mill. If you make a number of these boxes, it will pay you to buy these stock strips, or have strips ripped up and surfaced. With the strips care-

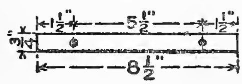


Fig 628

Fig. 630

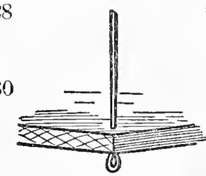


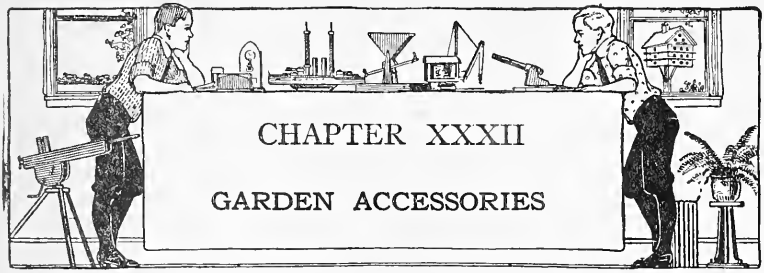
Fig. 628. — Pattern of Side Sticks of Hanging-Basket

Fig. 629

Fig. 629 and 630. — Details of Corner Connecting Rods fully marked out upon a board, there is no trick to ripping out enough for one or two boxes. It is best to rip long strips, then cut these into short lengths.

The positions for the holes are indicated in Fig. 628. Upon the care with which these holes, and the holes near the corners of the bottom board, are bored, depends the nicety with which the box fits together. Make a marker out of a strip of cardboard, and use this for locating each pair of holes. In boring the holes, be careful to bore them straight.

Cut the six corner connecting rods out of No. 8 galvanized wire, of the length shown in Fig. 629. Bend one end of each rod into an eye. Slip a rod through each of the corner holes in the bottom board, then slip the side sticks over the wires, piling them log-cabin fashion. When six sticks have been stacked up on each of the six sides, bend over the upper end of each rod into an eye, thus binding all sticks close together. Attach chain hangers to four of the six rod ends. *Number 12 iron jack-chain* is the right kind to buy.



CHAPTER XXXII

GARDEN ACCESSORIES

LACKING a sprinkling-can, one of the best substitutes the author knows of is a tin can with perforated bottom,

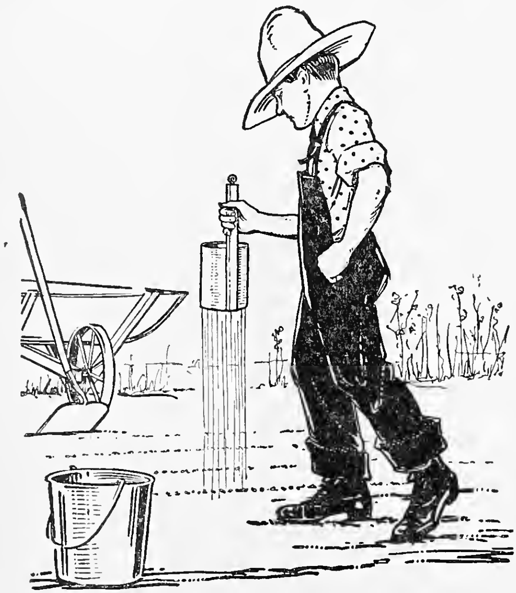


FIG. 631. — Tin Can Garden Sprinkler

and a stick handle fastened to the side (Fig. 631). For some purposes

A Tin Can Sprinkler like this is handier than a regular sprinkling-can. Because it is so simple to make, every gardener might own several. The number, size, and

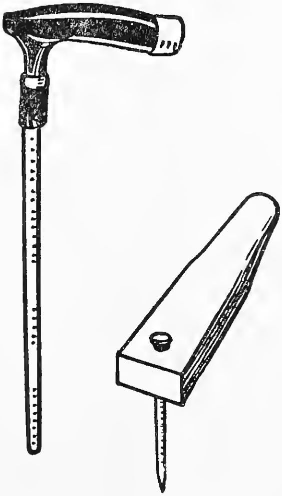


FIG. 633 FIG. 632

FIGS. 632 and 633. — Dibbles

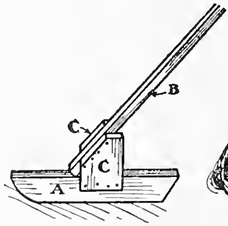


FIG. 635

FIG. 634

FIG. 634. — Using a Planting Trencher
FIG. 635. — Detail of Trencher

location of the perforations can be regulated to suit the kind of spray wanted. Use the point of a nail or awl for making holes. Drive nails through the can into the stick handle.

Many gardeners prefer.

A Dibble to a hoe or rake, for making holes for large seeds, for planting bulbs, and for transplanting seedlings. Figure 632 shows one easily made. Whittle a stick handle like that shown, and drive a 16-penny nail (a nail 3½ inches long) through it near the end. This is a good form of dibble for seed planting.

An Umbrella-Handle Dibble like that shown in Fig. 633 is excellent for making holes for bulbs and transplantings. Cut off about one-half of the length of the rod.

For making trenches preparatory to planting rows of seed, or transplanting,

A Planting Trencher like that shown in Fig. 634 is handy. This requires the runner *A* (Fig. 635), 16 inches long, the stick handle *B*, 3 feet long, and the pair of braces *C*, by which the handle is fastened to the runner. With this little tool you can make trenches quickly.

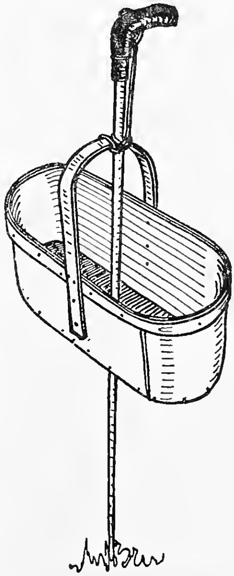


Fig. 636.—Seed Basket

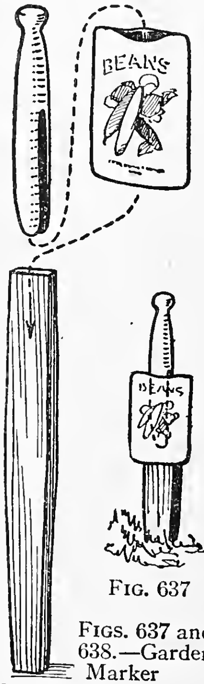


Fig. 637

Fig. 638

Figs. 637 and 638.—Garden Marker

A Seed Basket, made of a fruit basket supported upon

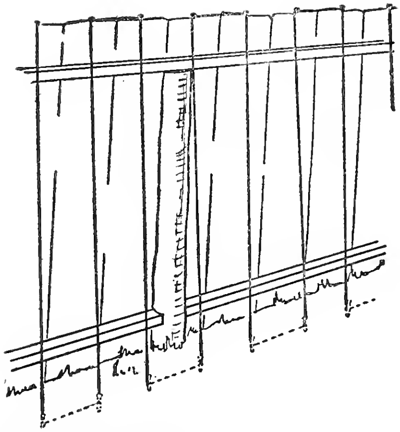


FIG. 639. — How to Put Up Strings for Vines

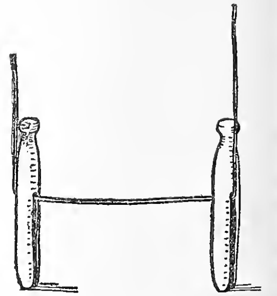


FIG. 640.—Use Clothespins with which to Pin Vine Strings to the Ground

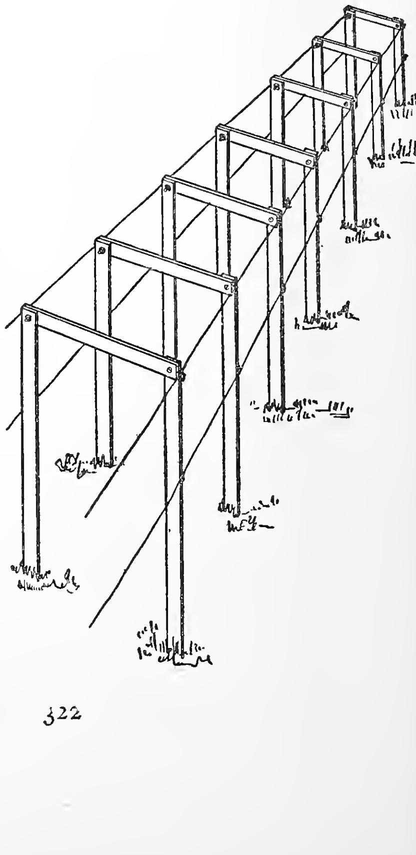


FIG. 641. — Tomato-Racks

the rod of an umbrella as shown in Fig. 636, holds the seed packages within convenient reach for planting. Punch a hole through the basket bottom for the rod to run through, and tie the basket handle to the umbrella rod and handle.

Garden Markers. Clothespins are useful for pinning the names of seeds planted, to the tops of stakes used for garden markers (Fig. 637). Cut the stake top thin enough for the clothespin to slip over. Tear the bottom out of the seed envelope, slip the envelope over the stake, and slip one prong of a clothespin down over the stake top (Fig. 638).

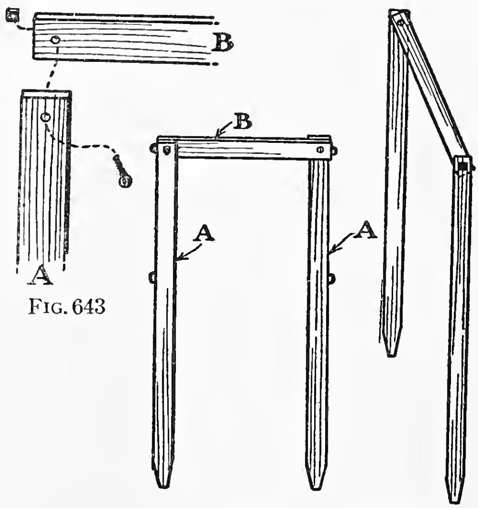


Fig. 643

Fig. 642 Fig. 644

Figs. 642-644.—Details of Folding Tomato-Rack

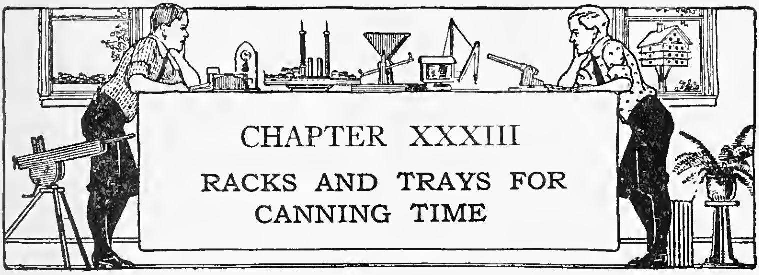
Figure 639 shows **How to Put Up Strings for Vines** planted along a fence. Instead of running a separate string for each vine, the method illustrated, which is a saver of time, consists in starting where the first vine is planted, and tying the end of the string to a nail driven into the fence top directly over the vine, then running the string down to and tying to a stake driven into the ground beside the vine, crossing over to and tying to a stake driven into the ground beside the next vine, running the string up to and over a nail in the fence top directly above the vine, over to a nail in the fence top directly above the next vine, down to a stake driven close to that vine, and continuing in this manner until a string has been provided for each vine.

Figure 640 shows how clothespins can be used for pinning down the strings to the ground. By using these it is not necessary to tie the strings.

If you will make your

Tomato-Racks so they can be folded up for storing during the winter season, they will last indefinitely, and in the long run you will be repaid for the time you spend now in making them. Figure 641 shows a row of folding racks. Use laths for the vertical and cross strips *A* and *B* (Fig. 642), and buy ¾-inch stove-bolts for fastening them together. Bore holes through the strips near the ends, for the bolts to slip through (Fig. 643), and drive a double-pointed tack into the ends of crosspiece *B*, and another into the side edge of vertical pieces *A*. Point the lower end of strips *A* so they will push into the ground with little resistance.

Figure 641 shows the racks in position, with string braces tied to the double-pointed tacks. Additional strings can be fastened to the racks if found necessary.



CHAPTER XXXIII

RACKS AND TRAYS FOR CANNING TIME

Probably you do not know anything about the canning and drying of vegetables, but mother does, and you can help her to the extent of making the necessary racks and trays.

For the cold-pack method of canning, the usual home-made equipment for sterilizing fruits and vegetables is a wash-boiler fitted with a wooden rack on which to stand the filled jars (Figs. 645 and 646). Figure 647 shows a detail of

A Wash-Boiler Rack made of laths. Dimensions for the strips are not given on the diagram because wash-boilers vary in size, and you must make the rack to fit the bottom of the wash-boiler that it is to be used in. Make the rack enough shorter and narrower than the boiler so it will fit loosely in it. Cut strips *A* of equal length, also strips *B*. Cross strip *A* with strips *B*, spacing them at equal distances apart, not to exceed 2 inches. Nail with nails long enough to go through the over-lapping strips and bend over. Cut side strips *C* and nail them to strips *A* at the ends. Then trim off the ends of the strips as indicated, to make the rack fit the round ends of the wash-boiler.

For drying corn and sliced vegetables,

A Rack Suspended Over a Stove (Fig. 648) is much used. The screened tray is easy to make. For a medium-sized gas-range, a tray of the dimensions shown in Fig. 649 is about right for use over a single burner Lap the ends of the side strips over the ends of the end strips. Tack screen wire to the bottom edges of the tray. One screw-hook in

Fig. 646

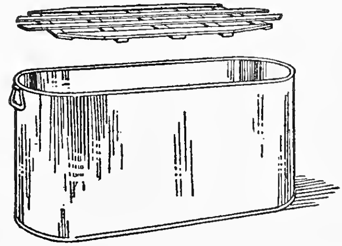


Fig. 645

Figs. 645 and 646. — Wash-Boiler Rack for Cold-Pack Method of Canning

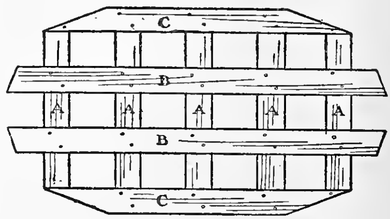


Fig. 647. — Detail of Rack for Wash-Boiler

the ceiling directly over the center of the gas-burner is sufficient to support the swinging tray, provided you screw the hook into one of the ceiling *joists*, and of course you must do that to fasten the hook securely. Screw a pair of screw-eyes into each end of the tray, and attach a chain to each screw-eye long enough to extend to the ceiling hook when the tray is suspended 12 inches or so above the burner.

A Drying-Tray to Stand Upon a Stove must have metal legs. Figure 650 shows a tray with shelf-bracket legs, and Fig. 651 shows how to attach these.

The sun-drying method of preserving vegetables is extensively used. Figure 652 shows

A Sun Dryer, consisting of two screened frames, one inverted over the other (Fig. 654), supported on a rack (Fig. 656). The vegetables to be dried are spread out upon the screen wire of the lower frame, and the upper frame covers them and protects them from flying insects. Crawling insects can be kept away by standing the legs of the dryer-rack in tin cans filled with water (*F*, Fig. 653).

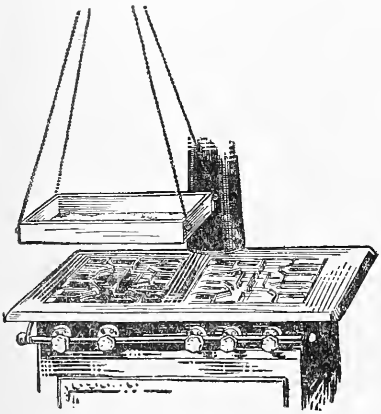


Fig. 648. — Suspended Tray for Drying Vegetables

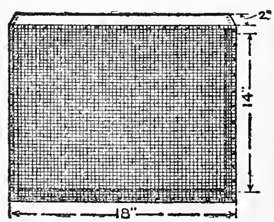


Fig. 649. — Detail of Drying-Tray

Make the pair of screened frames, first, then the rack of the right size to accommodate the frames. Figure 655 shows the dimensions of side strips *A* and end strips *B*, used for the frames of the author's dryer shown in Fig. 652; and Fig. 657 gives the correct dimensions for legs strips *C*, and connecting crosspieces *D* and *E* of the rack. If you make the frames of different proportions than these, you can figure out the length dimensions for the crosspieces of the rack after the frames have been put together.

Figures 653 and 656 show how the rack members are assembled. Set crosspieces *D* 4 inches below the tops of

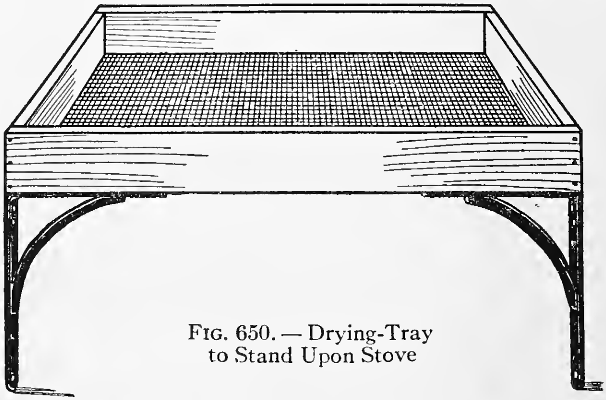


Fig. 650. — Drying-Tray to Stand Upon Stove

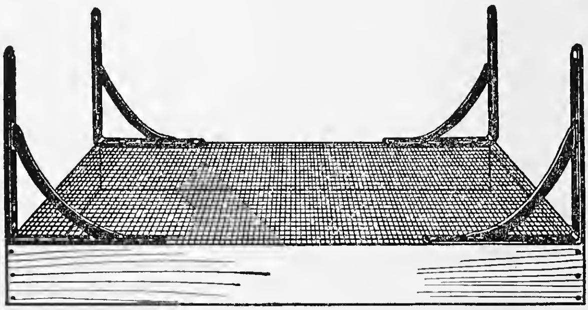


Fig. 651. — How the Shelf-Bracket Legs are Fastened on

legs *C*, so the upper screened frame will come even with the tops of the legs. The frames rest upon crosspieces *D*, and crosspieces *E* and the upper ends of legs *C* hold the frames in place.

Before covering the frames with screen-wire, give them and the rack a coat of green paint. Galvanized screen-wire is better than Japanned wire for covering the frames. Two yards of wire 24 inches wide will be required. Stretch the

FIG. 657

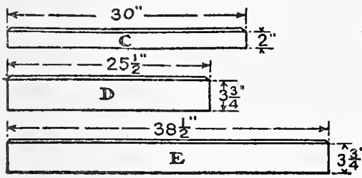


FIG. 655

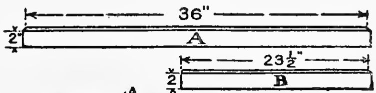
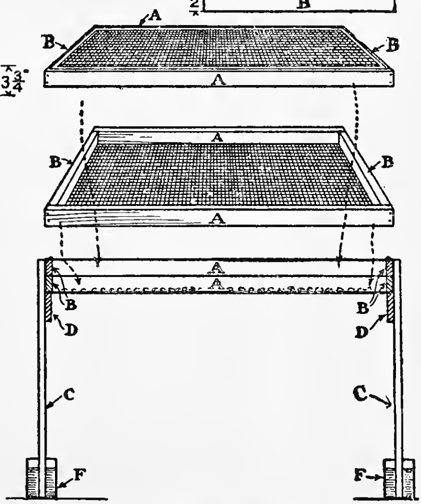


FIG. 654



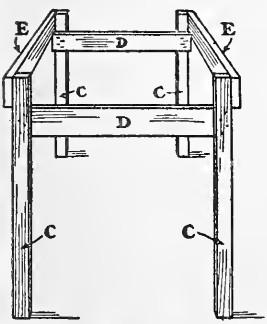


FIG. 656

FIG. 653

FIG. 653. — Cross-Section of Sun Dryer Shown in Fig. 652.
FIG. 654. — Screened Frames
FIG. 655. — Frame Strips
FIG. 656. — Dryer Rack
FIG. 657. — Rack Strips

wire tight over the frames, and after tacking it in place, cover its edges with the narrow moulding used upon window and door screens. Fasten this moulding with brads.

Instead of screening the upper frame, you can glaze it.

Glass intensifies the sun's heat, and thus speeds up the drying process. But if you do glaze the upper sash, cut openings in the side edges of the frames to permit a free circulation of air over the vegetables.

Besides serving as a dryer, this apparatus can be used in the Fall as

A Rack for Ripening Tomatoes that have been picked green to save them from frost.

Making Racks and Trays to Sell. If you have time and want to earn money, the author suggests that you canvas among gardeners of your community for orders for dryers. If you own a wagon, you can take your dryer with you as a sample; or, if you do not want to bother doing this, you can make a miniature model of a size handy to carry under your arm.

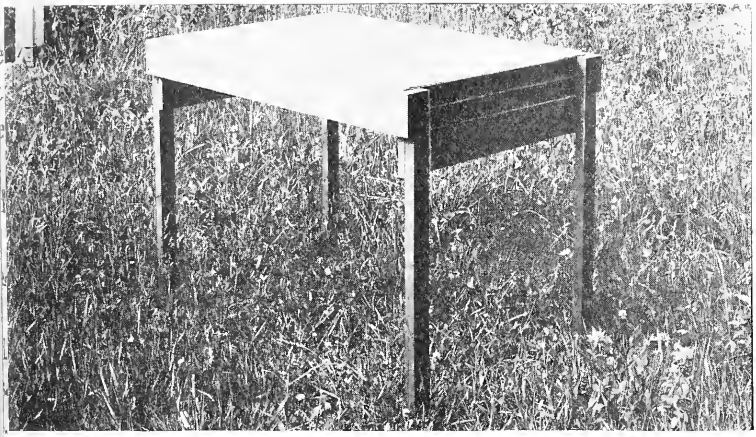
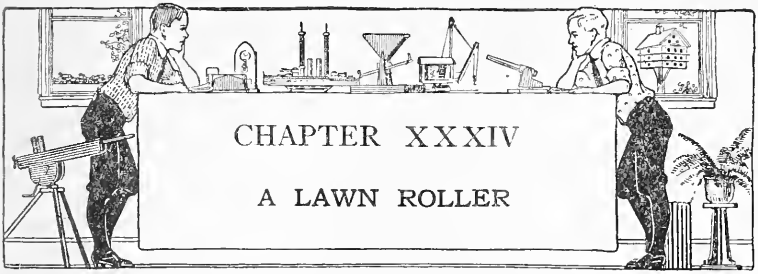


Fig. 652.—Sun Dryer for Vegetables (See Chapter 33).

Fig. 658.—A Concrete Lawn-Roller (See Chapter 34).



CHAPTER XXXIV

A LAWN ROLLER

If you will take the time to make a concrete lawn-roller like that shown in the photograph of Fig. 658, you will find no end of employment next spring, and in following springs. Owners of well-kept lawns have them gone over to roll out uneven places, caused by the action of frost, and newly planted lawns must be rolled, also, to make the surface level and compact. If you will happen round at the right time, you will probably be able to land the jobs. Take your chum into partnership. You will be able to cover twice as much territory in soliciting work, and you will need his additional fraction of horse-power to add to your own to operate the roller.

The Material Required will be as follows: One 2-foot length of 12-inch *tile sewer-pipe* (*A*, Fig. 659), one piece of $1\frac{1}{4}$-inch iron pipe 26 inches long (*B*), two pieces of $\frac{3}{4}$-inch iron pipe $27\frac{1}{2}$ inches long (*C*), two pieces of $\frac{3}{4}$-inch iron pipe 4 feet 6 inches long (*D*), two *90-degree elbows* (*E*), two *street elbows* (*F*) and two *unions* for $\frac{3}{4}$-inch pipe (*G*). Pipe is known by its inside diameter. Three-quarter-inch pipe. is $\frac{3}{4}$ inch in diameter, inside, 1 inch in diameter, outside. The ends of lengths of pipe *C* and *D* must be threaded.

You can get them cut and threaded at any plumbing shop, and you can procure the fittings there.

For the concrete mixture for the tile pipe, you will require about one wheelbarrow of crushed stone (½-inch or ¾-inch), three-quarters of a wheelbarrow of torpedo sand, and one-quarter sack of Portland cement. You can procure this material from a builder in your vicinity.

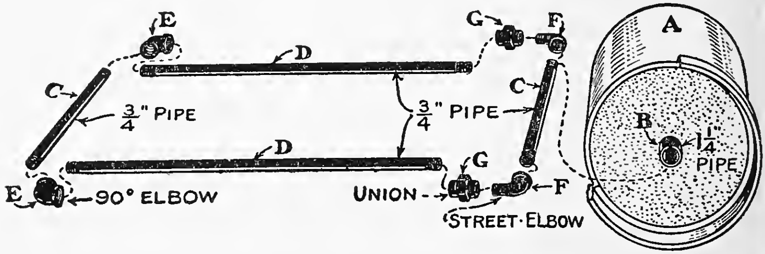


FIG. 659. — Detail of Parts Required for Lawn-Roller

In addition to the above, you will need some boards out of which to make centers for centering iron pipe *B* within tile pipe *A*, and for making a concrete mixing-platform.

Figure 659 shows a detail of all of the parts required for the roller. Figure 660 shows the tile pipe with the pipe axle-casing centered ready for pouring the concrete, and Fig. 661 shows

The Centering Platform. Making the platform is the first operation. Fasten together several boards with the pair of battens *H*, placing the battens so they will fit close against the sides of the small end of the tile pipe when the pipe is stood upon the boards. Nail the pair of blocks *I* to the platform so they will fit close against the sides of the pipe, also.

The next thing to do is

To Locate the Center for the Axle, upon the platform, between battens *H* and blocks *I*. This must be the exact center, else your roller axle will be off center and your roller will not run evenly. The center can be located by a pair of dividers, ruler, or piece of string. When you are absolutely certain that you have located the center correctly, cut a hole 1¼-inch in diameter for the end of iron pipe *B* (Fig. 664) to fit in. If you haven't an expansive-bit, bore several small holes and trim up to the larger diameter with a chisel.

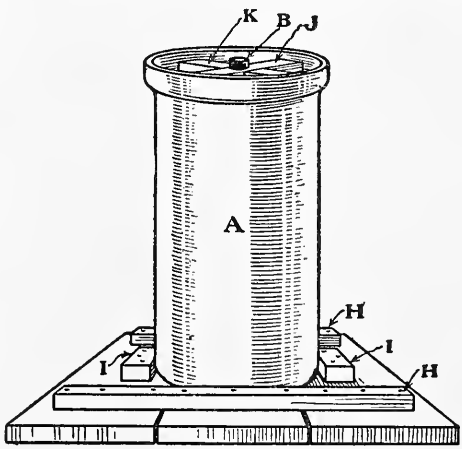


FIG. 660.— Tile Pipe with Pipe Axle-Casing Centered Ready for Pouring the Concrete

The Center of the Flange End of the tile pipe is located by means of the crossed strips *J* and *K* (Fig. 660). Cut these strips to fit inside of the tile pipe at the center of the end, of the right length to rest upon the inside shoulder of the flange. Cut a 1¼-inch hole through the exact center of each strip, then *halve* the two pieces together in the manner shown in Figs. 662 and 663.

With the tile pipe placed in position, and the iron pipe axle-casing *B* fitted in the centering holes, all will be ready for pouring the concrete.

The Concrete Mixture should be made in the proportions of 1 part cement, 3 parts sand, and 4 parts stone. You can use a pail for measuring. Mix the sand and cement together, first, by shoveling the two over and over. Then add the stone and mix thoroughly, then add enough water to make a fairly sloppy mixture that will pour readily.

Pouring the Concrete. Pour the concrete mixture into the tile pipe, between strips *J* and *K*, and with a stick tamp the material down solid. Be careful to have all spaces between the stone particles filled; also to get the sand and cement between the stone and the sides of the tile pipe. Fill the tile pipe to the level of the under side of strips *J* and *K*.

FIG. 663 FIG. 664

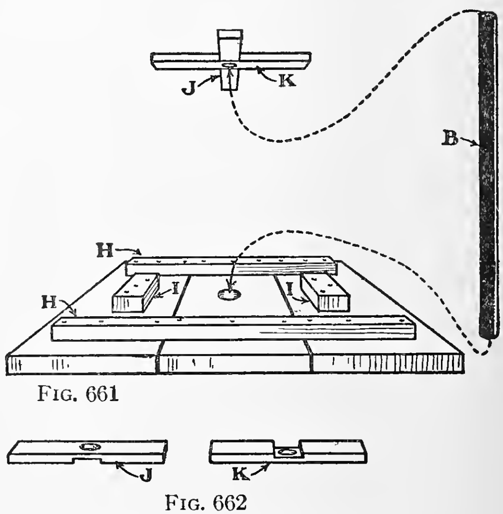


FIG. 661

FIG. 662

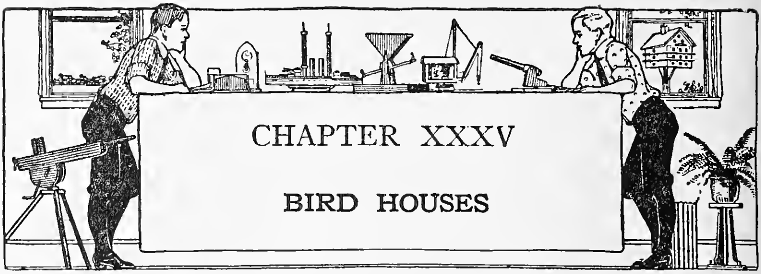
FIG. 661. — Detail of Centering Platform
FIGS. 662 and 663. — Detail of End Strips for Centering Axle-Casing End
FIG. 664. — Pipe Axle-Casing

The Initial Set of cement usually occurs within an hour's time after pouring; but allow the concrete-filled pipe to stand for several days before disturbing it.

Removing the Tile Pipe. The tile pipe may be removed by cracking it off, but the author suggests that you leave it on, as it makes the roller larger in diameter, and will give it a smooth surface that will last a long time. When the tile does crack, you can break it off. The flange must be removed, of course, as soon as you are ready to complete the roller. This can be broken off, and the end chipped off level with the concrete, by the careful use of a cold-chisel.

The Iron Pipe Handle Frame is shown in detail in Fig. 659. In this detail you will find the relative positions for the pieces of pipe, and for the fittings included in the material list. Screw elbows *E* onto the ends of one of the pieces of pipe *C*; slip the other length of pipe *C* through pipe *B*, and screw street elbows *F* onto its ends. Screw pieces of pipe *D* into elbows *E*, and screw unions *G* onto their ends and onto elbows F.

Paint the Handle Frame to keep the iron pipe from rusting.



CHAPTER XXXV

BIRD HOUSES

NATURE provided our native birds to keep the proper balance in insect life, but, because we have neglected to afford necessary protection, the birds have decreased and insects have increased to an alarming extent. It is our patriotic duty, therefore, to work for a re-establishment of nature's balance, and one way to aid in bringing this about is to give the birds all possible protection during the nesting season, by providing houses for those that nest in houses, and by making war upon bird enemies.

Bird-House Campaigns. The bird-house campaign has developed into a national movement, so much so, in fact, that the school which cannot boast of bird-house building activities is reckoned unprogressive. In a recent campaign in Pittsburgh, the boys of the public schools built more than 6,000 bird houses. An exhibit of some of the houses is shown in the photograph of Fig. 665. It is estimated that more than 15,000 houses were made in one year by the boys of Allegheny County, Pennsylvania; in St. Paul, nearly 4,000 houses were entered in a contest held by the Board of Education; in Seattle, enough houses were disposed of by

Fig. 665. — Bird-Houses Entered in a Contest Held by the Pittsburgh Public Schools
(The Bird Castles and Bird Towers were built from Plans in the Author's Book "Handicraft for Handy Boys")

one school to make possible the purchase of a first-class printing outfit and many other good records have come to the author from schools, communities, and individuals to whom his bird-house plans have been supplied.

If your community has not had a bird-house building contest, write to the editor of your newspaper and ask him to start a campaign. He will recognize in this feature material that will interest a large percentage of readers, and, if his space will permit, he may comply with your request. Public-spirited business men are generally glad to donate prizes for the best houses entered in contests, and of course prizes stimulate interest, for what boy will not "work his head off" to win a prize?

FIG. 666.—League Button

Bird-house building is

A Good All-the-Year Around Activity. It is never too late or too early to put out houses. If too late for the nesting season, the houses at least improve the appearance of the home grounds. Weathering not only makes the houses fit in better with the surroundings, but also renders them more acceptable next season to the birds.

Besides building bird-houses yourself, you can serve the birds by encouraging others to do likewise. In fact, you can get other boys to work with you. For the purpose of enlisting every bird-lover in the work, the author founded

The American Bird-House League,* and the league's slogan "A home for every native house-nesting bird" gives

*If you or your teacher would be interested in full particulars concerning the American Bird-House League, a stamp sent to A. Neely Hall, Elmhurst, Illinois, will bring you a copy of "Handicraft News," which tells all about it.

promise of a goal not beyond the possibility of attainment, for already it has a widespread membership covering nearly every section of the United States and Canada.

Work To Be Proud Of. When you have enlisted your services in the national bird conservation movement, by building bird-houses and encouraging others to build them, think of your pride when you walk about town after your houses have been erected, and point them out everywhere. Father will be mighty proud of his boy craftsman, your friends will envy you, and you will gain a reputation as an expert bird-house builder.

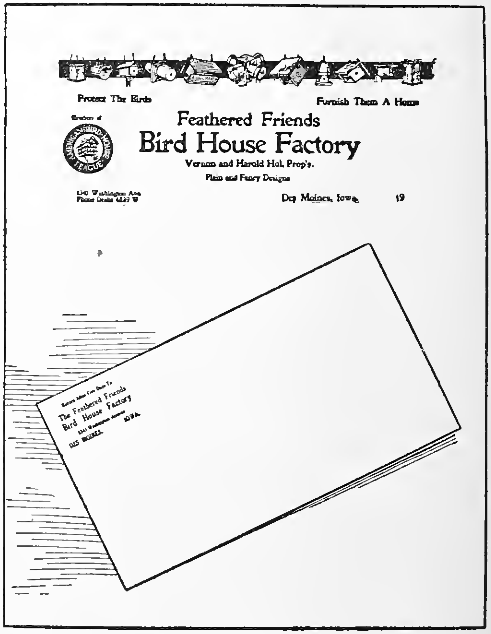


FIG. 667. — Print your Stationery Like This

It's lots of fun building bird-houses and it's lots of fun selling them because they sell readily among bird-lovers. You can establish

A Boy's Bird-House Factory with the certainty of enjoying the work and of earning lots of money, as others among the author's readers have done. The following two letters from boys who have followed the author's suggestions are convincing:

Clessand V. Mulholland of Birmingham, Michigan, writes:

"I sold about forty houses last spring from thirty cents up, and would have sold more only I sprained my ankle. We sold about twenty-three of one model at fifty cents, and it cost about two cents to make. Your plans helped us immensely. We made the large twenty-eight-room martin house and this caused considerable attention around town. We won three first prizes and two second prizes in contests. As to selling bird houses, it was easy. The Woman's Club helped push our business along. We have planned next spring's campaign, and have use of a prominent store window for our display. We are making posters telling how much good the birds do. People are always ready to buy as they know they are helping the birds as well as us."

Vernon Hol, and his brother Harold, proprietors of "Feathered Friends' Bird-House Factory, Des Moines, Iowa," report:

"We have had good success selling our houses at prices from 50 cents to $1.50, mostly wren houses. We did not get started until late last year, so we are going to go after business right this year, as we know there is big money in it. We are getting out a catalog of bird houses, also circulars and post cards and personal letters, and we will make a personal canvas of each house. The daily papers have written us up and helped us wonderfully."

Vernon and Harold own a printing-press, and their stationery, shown in Fig. 667, is a sample of the business-like manner in which they are handling their bird-house proposition.

Among the many requests which the author receives from readers for bird-house plans and building information, are those for

The Right Dimensions for Houses. It is necessary to know these, of course, before starting a house, because the proportions will vary for different species. Little fellows like the house-wren prefer small houses, and the doorway should be about the size of a quarter. Therefore, when planning a wren home, don't consider a 20-room palace, such as you would provide for martins; and don't make a larger doorway than the size mentioned above, because it will admit the English sparrow.

The Height Above Ground to Place the Houses is also of great importance. A wren, for example, prefers a house placed between 6 and 10 feet above the ground, while a martin's house must have a height of from 15 to 20 feet.

The United States Department of Agriculture has issued **A Chart of Correct Dimensions** for houses to accommodate every bird known to accept house nesting places, compiled from data supplied by our best-informed naturalists, and this chart is presented in Fig. 668 so that you will know exactly what dimensions to use for the species of birds you wish to house.

Materials for Bird-House Building can be found in every household. Tomato cans, apple and sugar barrels, fish-kegs, nail-kegs and white-lead kegs, cheese-boxes, butter-firkins, wooden pails, flower-pots, and small boxes such as soap and starch come in, will furnish all the material necessary for building many kinds of houses. You will find plans in

Dimensions of Nesting-boxes for Various Species of Birds

(From Farmers' Bulletin 609)

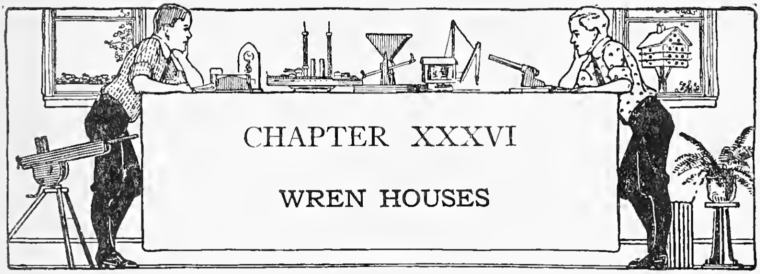
Species.	Floor of cavity.	Depth of cavity.	Entrance above floor.	Diam. of entrance.	Height above ground.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Feet.*
Bluebird	5 by 5	8	6	1½	5 to 10
Robin	6 by 8	8	(1)	(1)	6 to 15
Chickadee	4 by 4	8 to 10	8	1⅛	6 to 15
Tufted titmouse	4 by 4	8 to 10	8	1¼	6 to 15
White-breasted nuthatch	4 by 4	8 to 10	8	1¼	12 to 20
House wren	4 by 4	6 to 8	1 to 6	⅞	6 to 10
Bewick wren	4 by 4	6 to 8	1 to 6	1	6 to 10
Carolina wren	4 by 4	6 to 8	1 to 6	1⅛	6 to 10
Dipper	6 by 6	6	1	3	1 to 3
Violet-green swallow	5 by 5	6	1 to 6	1½	10 to 15
Tree swallow	5 by 5	6	1 to 6	1½	10 to 15
Barn swallow	6 by 6	6	(1)	(1)	8 to 12
Martin	6 by 6	6	1	2½	15 to 20
Song sparrow	6 by 6	6	(2)	(2)	1 to 3
House finch	6 by 6	6	4	2	8 to 12
Phoebe	6 by 6	6	(1)	(1)	8 to 12
Crested flycatcher	6 by 6	8 to 10	8	2	8 to 20
Flicker	7 by 7	16 to 18	16	2½	6 to 20
Red-headed woodpecker	6 by 6	12 to 15	12	2	12 to 20
Golden-fronted woodpecker	6 by 6	12 to 15	12	2	12 to 20
Hairy woodpecker	6 by 6	12 to 15	12	1½	12 to 20
Downy woodpecker	4 by 4	8 to 10	8	1¼	6 to 20
Screech owl	8 by 8	12 to 15	12	3	10 to 30
Sparrow hawk	8 by 8	12 to 15	12	3	10 to 30
Saw-whet owl	6 by 6	10 to 12	10	2½	12 to 20
Barn owl	10 by 18	15 to 18	4	6	12 to 18
Wood duck	10 by 18	10 to 15	3	6	4 to 20

[1] One or more sides open. [2] All sides open.

Fig. 668. — To Win the Birds to your Houses Follow the Above Dimension

HANDICRAFT FOR HANDY BOYS for houses made of the above materials, and you will find other plans that admit their use, in the chapters following this one.

Finishing. The usual method of finishing bird-houses is with a wood-stain. You can use a ready-made shingle stain, or you can make up your own stain by mixing oil paint with turpentine or kerosene. Green and brown are the colors generally used. Some people prefer to have the houses painted white. If you finish the houses with paint, use two coats. Give the inside one coat of stain or paint as a wood preservative. Putty nail-holes and cracks to keep out the rain.



CHAPTER XXXVI

WREN HOUSES

WRENS raise two broods each year, and for each brood an apartment is required, because wrens do not use the same nest twice. In fact, the second nest is begun before the

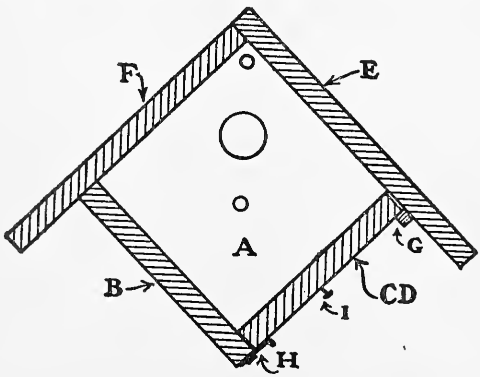


FIG. 673. — Cross-Section of Wren House Shown in Fig. 669

young birds of the first brood are ready to fly. If you build one-compartment houses, you must provide two houses for each pair of birds, if you wish to keep them with you during the entire nesting season. Wren houses are often built with several compartments, but not more than one family at a time will take up quarters there because wrens are quarrelsome and do not colonize as martins do. The only advantage of the house with several compartments is that it allows the birds a choice of quarters, and it provides for their two broods.

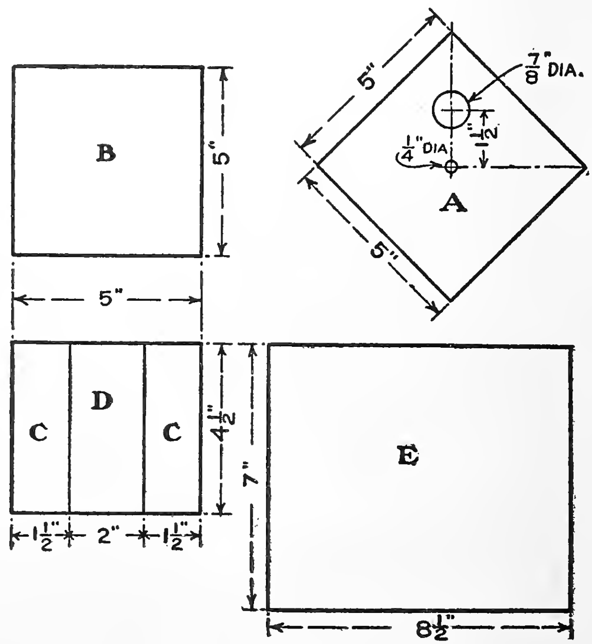


Fig. 674. — Details of Parts of Wren House Shown in Fig. 669

In the table of dimensions shown in Fig. 668, you will see that the house wren builds its nest usually at a height of between 6 and 10 feet. Bear this in mind when putting up wren houses. Also, place the houses so that the opening faces the East, as that seems to be the preferred exposure.

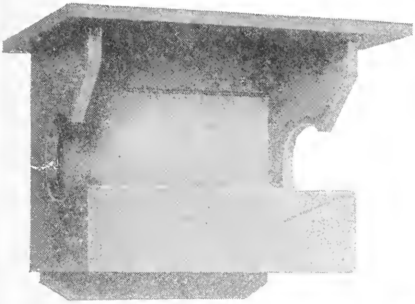
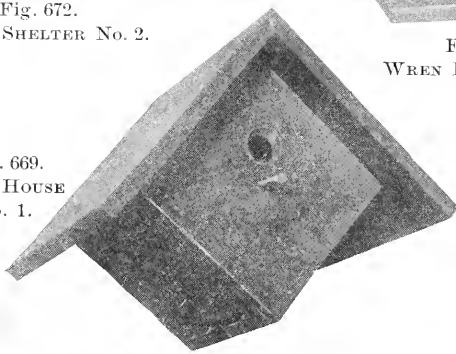


Fig. 672.
Robin Shelter No. 2.

Fig. 670.
Wren House No. 2.

Fig. 669.
Wren House
No. 1.



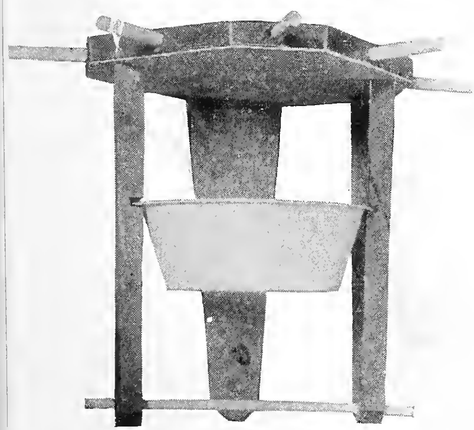


Fig. 671.—Robin Shelter No. 1.

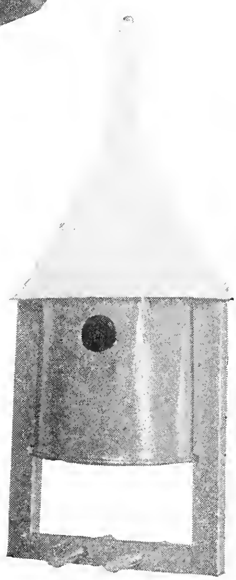


Fig. 671--Wren House No. 3.

Make the opening ⅞ inch in diameter. This is plenty large enough, and will keep out the English sparrow. Such details as these may seem trivial to you, but they are important enough to spell failure for the boy who neglects to consider them.

Wren House No. 1, shown in Fig. 669, is to be suspended from a tree limb. Figure 673 shows a cross-section, and Fig. 674 shows dimensions for the parts required. Box boards ½ inch thick are good enough working material. Bore the doorway where located in front piece *A*, and bore a ¼-inch hole below it for the perch-stick. The rear wall is of the same size as front *A*; side *B* is of the same size, also. Side *CD* is ½ inch shorter than *B*, because *B* laps over its edge; it is sawed into three parts, the outer pieces (*C*) to be nailed in place, the center piece (*D*) to be slipped between and held at the top by a block (*G*, Fig. 673), and at the bottom by a button (*H*) made of a scrap of tin. Roof board *F* is the same as board *E* (Fig. 674), but is ½ inch narrower to allow for the lapping edge of board *E*.

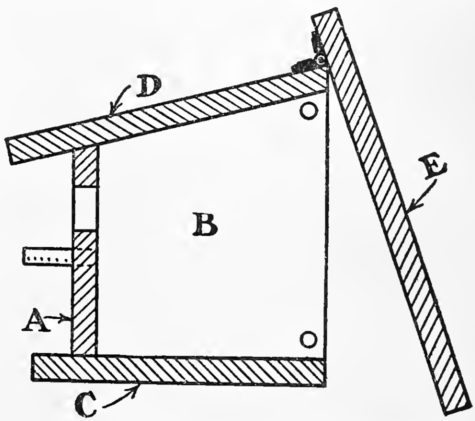


FIG. 675. — Cross-Section of Wren House Shown in Fig. 670

Nail the parts together with 1-inch finishing-nails. Use

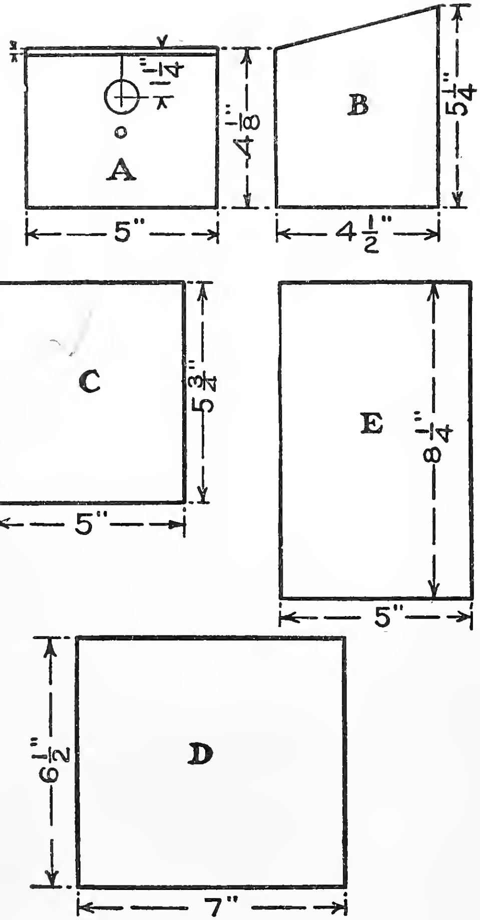


FIG. 676. — Details of Parts for Wren House Shown in Fig. 670

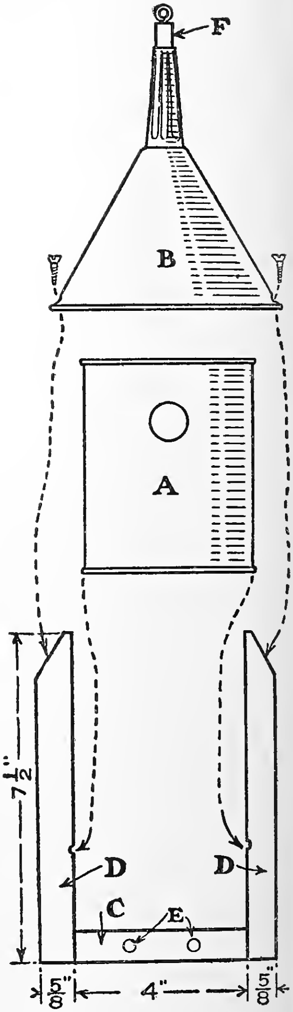


FIG. 677. — Details of Parts of Wren House Shown in Fig. 671

heavy wire for a hanger, and run it through holes bored through the house ends just below the roof. Make the holes large enough to serve as ventilators.

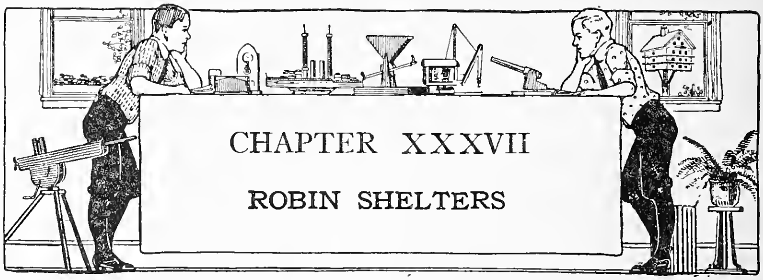
Wren House No. 2 (Fig. 670) is shown in cross-section in Fig. 675, and Fig. 676 shows dimensions for the parts. Bevel the top edge of front piece *A*, as shown, so the roof will fit it squarely, bore a ⅞-inch doorway in the position indicated, and bore a hole below it for the perch-stick.

Assemble the pieces as shown in Figs. 670 and 675. Hinge back *E* to the edge of roof board *D*, to give access for cleaning the house. It is not necessary to provide a fastener for the hinged back, because when the house is hung upon a tree trunk by passing wires through holes bored through sides *B*, as indicated in Fig. 675, running these around the tree, and fastening them, the back cannot open.

Wren House No. 3 (Fig. 671) is made of a tomato can (*A*, Fig. 677), a tin funnel 5½ inches in diameter (*B*), a wooden framework made of three strips (*C* and *D*) and two dowel-sticks (*E*), and a hanger stick and screw-eye (*F*).

Sticks *D* provide a means for fastening the funnel roof. Bevel their tops to correspond with the pitch of the funnel, and punch a pair of holes through the funnel, through which to drive screws into the sticks. Bore two ¼-inch holes through stick *C*, for perch sticks *E*. Cut hanger peg *F* to fit the funnel spout, drive a screw-eye into its top, and fasten the peg with a brad driven through the spout.

Finish the Wren Houses as described in Chapter 35.



CHAPTER XXXVII

ROBIN SHELTERS

Robins build their nests on partially sheltered ledges, as well as in trees and shrubbery. They do not take to inclosed houses. You must build nesting places for them, therefore, exposed upon two or more sides, of the type shown in the photographs of Figs. 671 and 672 (Chapter 36). They will readily accept these shelters, placed in secluded locations in the garden, or strapped to tree trunks, or fastened to the outside walls of buildings. Robins nest at heights of 6 to 15 feet, but it is advisable to place shelters at the latter rather than the former height, because it makes the nests less accessible to four-footed enemies.

Robin Shelter No. 1 (Fig. 671) requires a tin pan that measures 8½ inches across the rim. If you cannot find a worn-out pan at home, probably you can get one from a neighbor. The pan may be a trifle larger than this, but you will have to increase the size of the roof board accordingly (A, Fig. 679).

Figure 678 shows a cross-section of the shelter, and Fig. 679 shows a top view. Mark out top board A by the pattern of Fig. 680, saw off the corners as indicated, and plane up the edges. Bore a ⅜-inch hole through the center of five adjacent edges, in which to drive perch-sticks *E* (Fig. 679). Prepare three supports *B* by the pattern of Fig. 680, cut off the lower corners as indicated, and cut a groove from side to side 4 inches below the top, parallel to the top. Cut the sides of the groove with a saw, and split out the wood between with a chisel. The rim of the tin pan is to fit in the grooves. Bore a hole near the lower end of the side supports to run perch-stick *F* through (Fig. 678).

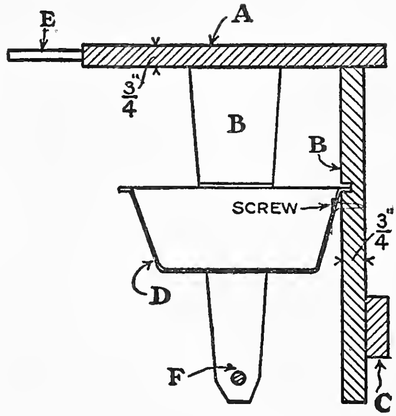


Fig. 678. — Cross-Section of Robin Shelter No. 1, Shown in Fig. 671 (Chapter 36)

Figure 679 indicates the positions for supports *B*; the distance apart to place them will be determined by the diameter of the pan. Block *C* (Fig. 678) should be of the thickness of the projection on the back edge of roof *A*. It blocks out the rear support to make the shelter

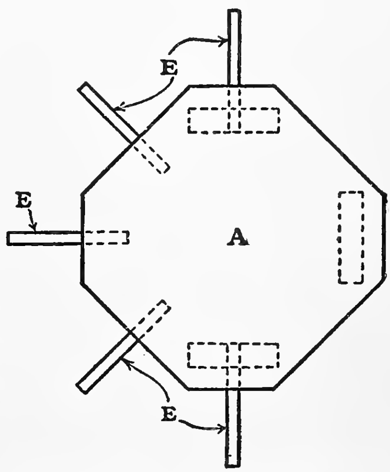


Fig. 679. —Top View of Robin Shelter No. 1, Shown in Fig. 671 (Chapter 36)

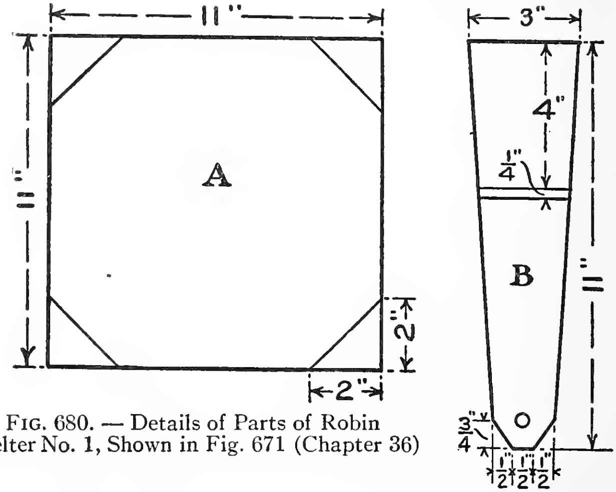


FIG. 680. — Details of Parts of Robin Shelter No. 1, Shown in Fig. 671 (Chapter 36)

fit squarely upon the tree or wall you hang it upon. Cut perch-stick *F* 10 inches long.

Paint the tin pan with two coats of paint, to keep it from rusting. The woodwork can be finished as suggested in Chapter 35. When the painted pan is dry, fasten it to the rear support with a screw driven through a hole pierced just below the rim (Fig. 678). Punch several holes through the pan bottom, for rain-water drains.

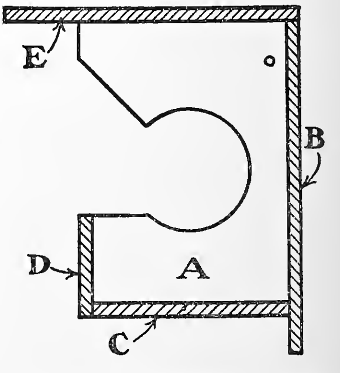


FIG. 681.—Cross-Section of Robin Shelter No. 2, Shown in Fig. 672 (Chapter 36)

Robin Shelter No. 2 (Fig. 672) may be made of grocery-box boards. Material 3/8 inch thick

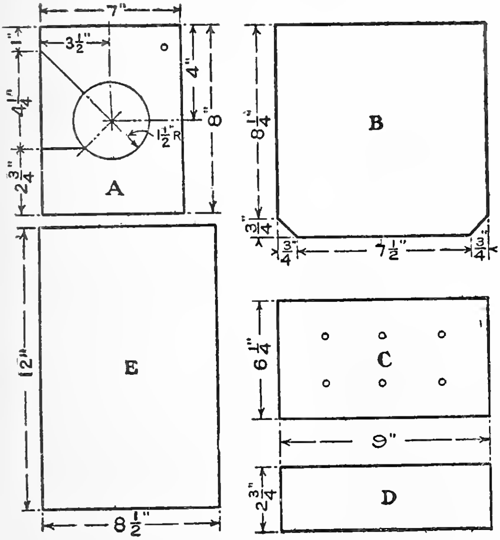


Fig. 682. — Details of Parts for Robin Shelter No. 2, Shown in Fig. 672(Chapter 36)

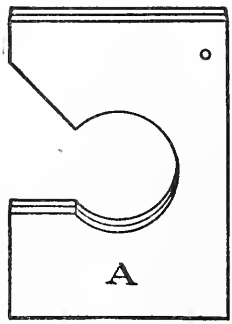
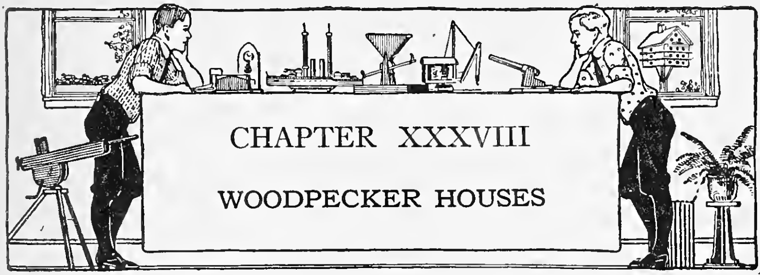


Fig. 683. — How to Cut the Two Side Pieces at One Time

was used in the model shown in the photograph, and the dimensions for the parts required, given in Fig. 682, allow for material of this thickness. The cross-section of Fig. 681 shows how the parts fit together.

Nail together, temporarily, the two boards out of which side pieces *A* are to be cut, lay out the outline upon one board, cut out the two pieces at one time (Fig. 683), and then separate them. A hand bracket-saw (Fig. 18, Chapter 2), or a coping-saw (Fig. 19), is best for cutting the center circular opening. The small hole shown in the upper right-hand corner of the side pieces is provided to run a wire through for hanging up the house. The holes in the bottom board *C* (Fig. 682) are drain holes.

Having cut the parts to the given sizes, and planed them smooth, you will have no difficulty in assembling them, with Figs. 672 and 681 before you to follow.



CHAPTER XXXVIII

WOODPECKER HOUSES

HOUSES for woodpeckers must be made with deep cavities like the hollowed tree-trunks in which they nest. The dimensions will vary for different members of the woodpecker family. Little downy woodpecker requires a cavity 4 inches square at the bottom, extending about 8 inches below the doorway. The doorway must be 1¼ inches in diameter. The hairy woodpecker's house should have a cavity extending 12 to 15 inches below the doorway, measuring 6 inches square at the bottom, and a doorway 1½ inches in diameter. The red-headed woodpecker requires the same size cavity as the hairy woodpecker, but an entrance 2 inches in diameter. The flicker's house should have a cavity extending between 16 and 18 inches below the doorway, and a doorway 2½ inches in diameter. You will find all of the necessary dimensions given in the "List of Dimensions" of Fig. 668, Chapter 35.

The houses in the photographs of Figs. 684 and 685 are designed for flickers. You can reduce the dimensions given, to suit other species of woodpeckers.

Figure 687 shows a detail of the framework of

Woodpecker House No. 1 (Fig. 684). First prepare top and bottom pieces *A* by the pattern in Fig. 688. It will simplify matters to nail two pieces of ⅞-inch board together, mark out the outline upon one board, and cut out the two pieces at one time. A hand bracket-saw or coping saw can be used for sawing out the curved ends, and notching them. Make connecting strips *B* square, of the dimensions given in Fig. 688. Fasten them in the notches in top and bottom pieces *A*, as shown.

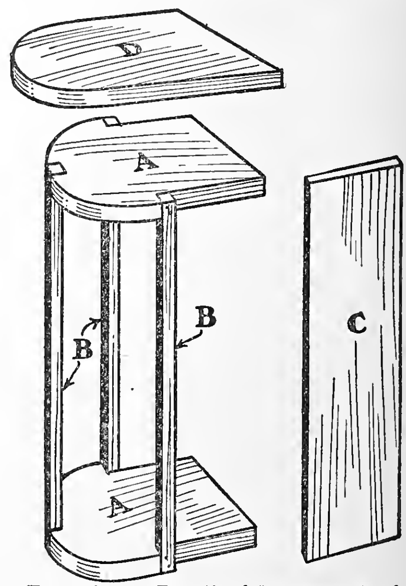


Fig. 687. — Detail of Framework of Woodpecker House No. 1, Shown in Fig. 684

The curved front of the house is inclosed with tin. The sides of five tomato cans, with edges lapped ½ inch, will do. Tack the tin to strips *B* with carpet tacks.

Prepare side pieces *C* (Fig. 687) after the front has been inclosed. In one piece cut the doorway in the position shown in Fig. 688. Cut roof board *D* (Fig. 687) by the pattern in Fig. 688, and nail it to top piece *A* with equal projections at the sides, and a rear projection to cover back board *E*. Prepare back board *E* by the pattern in Fig. 688, and hinge it to the rear edge of roof piece *D* with a pair of hinges.

Figures 689 and 690 show details of the perches. Sticks

Fig. 686.—Bluebird House.

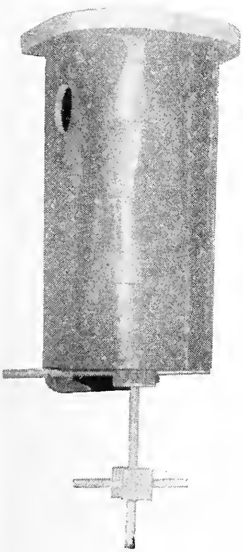


Fig. 684.—Woodpecker House No. 1.

No. 685.—Woodpecker House No. 2.

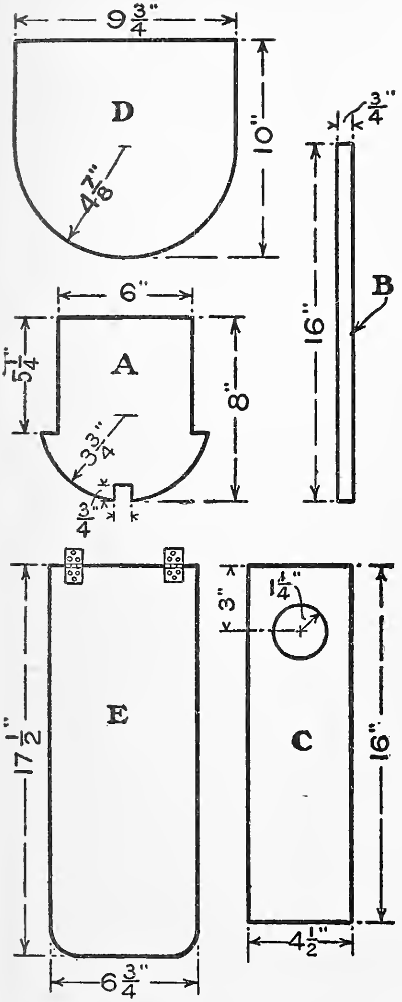


Fig. 688. — Detail of Parts for the Woodpecker House No. 1, Shown in Fig. 684

Fig. 690

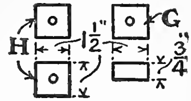
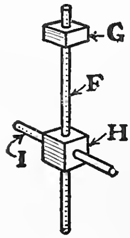


Fig. 689



Figs. 689 and 690
Details of Perch

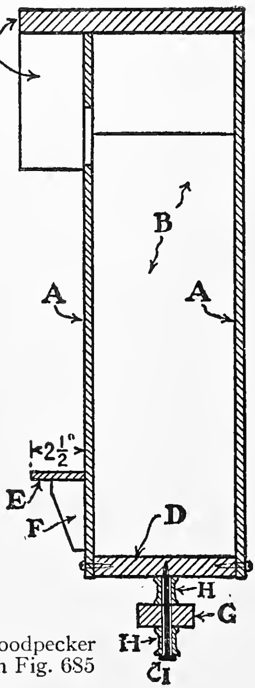


Fig. 691. — Cross-Section of Woodpecker House No. 2, Shown in Fig. 685

F and *I* are ⅜-inch dowel-sticks. Cut blocks *G* and *H* of the dimensions given in Fig. 690. Bore a hole in bottom piece *A* to receive stick *F*, and nail through *G* into *A*.

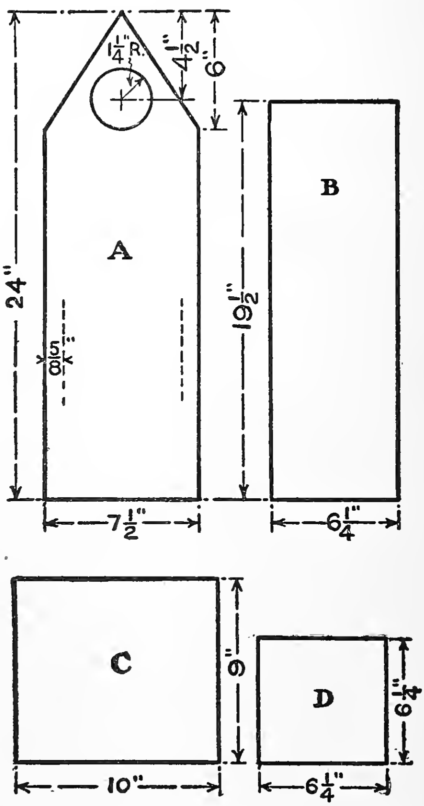
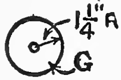
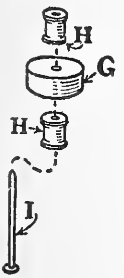


FIG. 692.—Detail of Parts of Woodpecker House No. 2, Shown in Fig. 685.

Woodpecker House No. 2 (Fig. 685) is shown in cross-section in Fig. 691, with all parts lettered in a manner corresponding to that used on the patterns in Fig. 692. Front and back boards *A* may be made of ⅜-inch stuff, sides *B*, roof boards *C*, floor *D*, and blocks *F* and *G*, should be cut out of ⅝-inch stuff. Cut the main parts before starting to assemble. First, nail the four sides together, then add the roof. Roof boards *C* must be mitered, or one piece must be lapped over the other, at the ridge. Cover the joint with a strip of tin. Fasten floor *D* between the sides with screws, so it may be removed at house-cleaning time.

Fig. 695





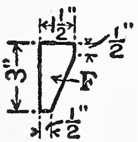
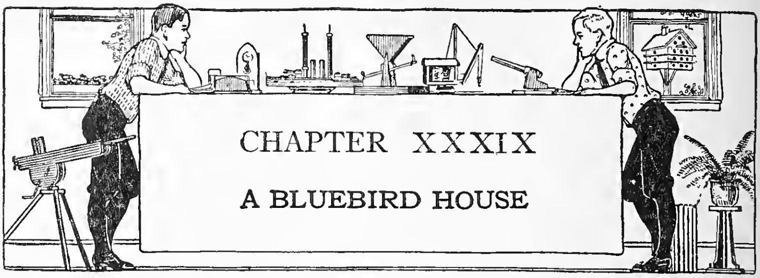


Fig. 694 Fig. 693

Fig. 693.— Detail of Bracket for Woodpecker House No. 2
Fig. 694 and 695. — Details of Knob for Base

There are six brackets *F* to support boards *E* (Fig. 691). The positions for them are shown in Fig. 685 and a pattern is shown in Fig. 693. The knob on the under side of the base, made up of spools *H* and the block *G* (Figs. 694 and 695,) is held by nail *I* driven through the center into base *D* (Fig. 691). Miter shelf boards *E* at the corners. Add screw-eyes for hangers, then the house will be ready for finishing with stain or paint.



CHAPTER XXXIX

A BLUEBIRD HOUSE

BLUEBIRDS require houses a little larger than the wrens, with larger doorways. The floor space should be at least 5 inches square, the doorway 1 ½ inches in diameter. The height to place the house above the ground is from 5 to 10 feet. Comply with these requirements, see that the house is not disturbed by cats and other unwelcome intruders, and it is almost certain that Mr. and Mrs. Bluebird will be perfectly contented with their new quarters, and, with good fortune, will raise their customary two broods.

Bluebird houses can either be hung from a tree limb, or be supported upon a pole. Figure 686 (Chapter 38) shows a hanging bluebird house, and Fig. 696 shows the same house mounted upon an iron-pipe support. If you hang the house, fasten it close up to a tree limb so that it will not swing much, for a swinging house does not strike the fancy of the average pair of bluebirds. The house mounted upon a pole seems to be preferred.

The two-compartment bluebird house shown in the illustrations makes an attractive little structure for the garden or lawn, and it is simple to build.

In the cross-section of Fig. 697, which is a cross-section of **The Hanging-House,** each piece is lettered, and in Fig. 698 you will find patterns of all the parts, similarly lettered. Walls *A* and center partition *E* should be cut out of material ⅞ inch thick, the other pieces may be cut out of box boards ⅜ inch thick. Prepare walls *A* first. If you will draw a center-line, then upon one side of this line draw one-half of the piece, you can take a piece of thin paper,

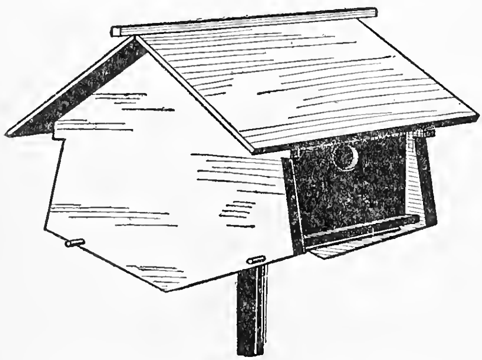


Fig. 696. — Bluebird House Supported on Iron Pipe

make a tracing of the half, and transfer it to the other side of the center-line to complete the piece. By doing this you will find it easy to get both sides alike. Fasten together two pieces of board with several nails driven part way in, draw the outline of the wall upon one board, and saw out the two pieces at one time. Both pieces will then be alike.

Before separating the cut-out pieces, plane up their edges. With walls *A* prepared, cut out center partition *B*, walls *C*, roof moulding *D*, roof boards *E*, ridge-piece *F*, and floor *G*.

The Doorways. If you haven't an expansive-bit that can be adjusted to cut holes 1½ inches in diameter, for the doorways, bore several small holes in walls *C*, and cut out the wood between them to make 1½-inch openings.

The tops of walls *C* must be bevelled to correspond with the pitch of the roof, as must also the tops of moulding strips *D*. Ridge-piece *F* must be grooved to fit over the roof ridge, as indicated in Figs. 697 and 698.

In Assembling the House, first fasten partition *B* between walls *A*, then nail moulding strips *D* to walls *C*, and fasten walls *C* between walls *A*, close up against strips *D*. Care must be taken to get walls *A* exactly opposite, else the entire structure will be lopsided. Next, fasten roof boards *E* in place, being careful to get the end projections equal. With the roof nailed on, fasten ridge-piece *F* to it.

The Floor is Made Removable so that the compartments will be accessible for the annual house-cleaning. The floor board (*G*, Fig. 697) slides in between walls *A*, above perch-sticks *H*, and is held in position by nine wooden wedges (*K*, Fig. 697) wedged in between it and the perch-sticks. Bore ¼-inch holes through walls *A*, about ¾ inch below the floor, to receive

The Perch-Sticks *H*. Dowel-sticks may be used. The bottom perch-stick *H* runs through a pair of blocks *I* cut to the dimensions shown in Fig. 698 and hangers *J* (Fig. 698) run into holes bored through the corners of blocks *I*, and into holes bored in the center of the bottom edge of walls *A* (Fig. 697). Fasten the pieces with brads.

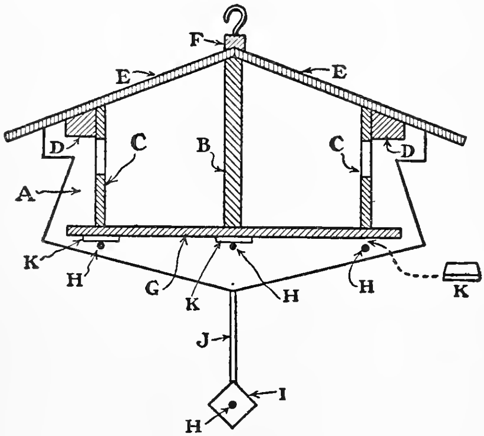


FIG. 697. — Cross-Section of Hanging Bluebird House Shown in Fig. 686. (Chapter 38)

The Bluebird House on a Pole, shown in Fig. 696, is built in the same way as the hanging-house, up to the point of attaching the perch-sticks. The center perch-stick *H* (Fig. 697) is omitted, also the perch-stick suspended beneath it. These must be left off to make room for

The Iron-Pipe Support (Fig. 699). Get a piece of 1-inch or 1¼-inch iron pipe 10 or 12 feet in length, and have a

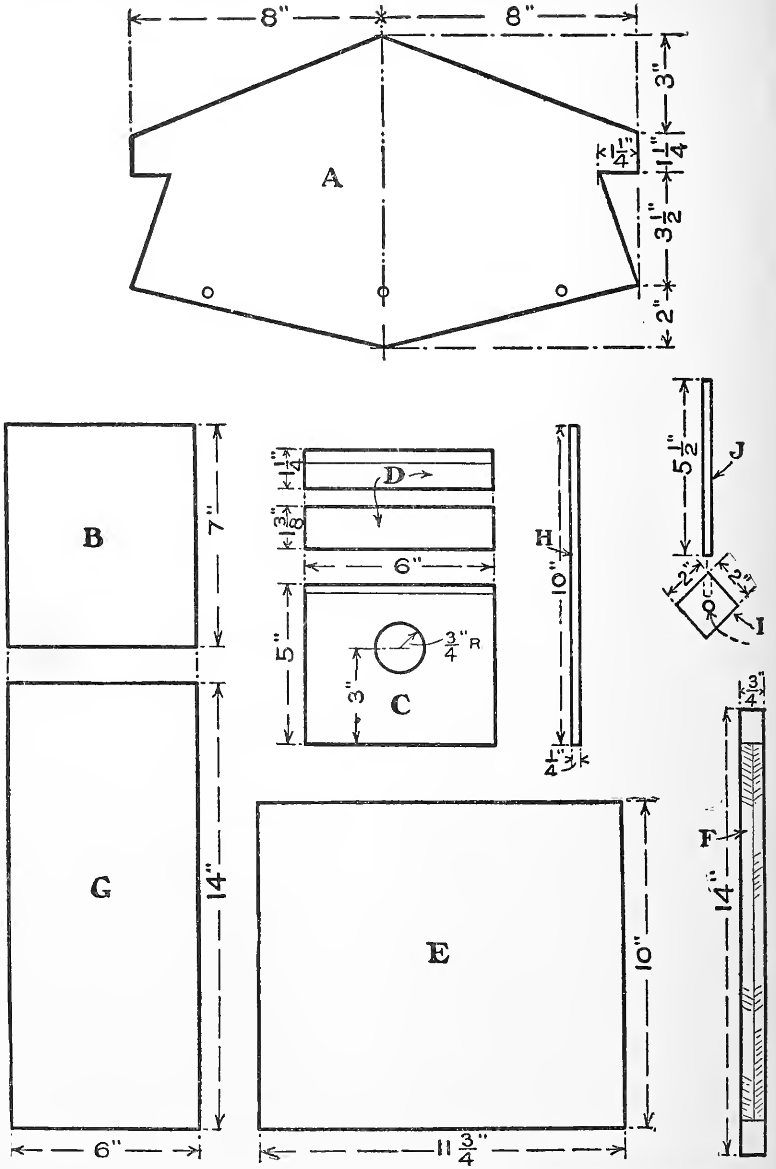


FIG. 698.— Details of Parts for Bluebird House Shown in Fig. 686 (Chapter 38).

plumber thread one end of it (*M*, Fig. 700). Also get a threaded *floor-flange* (*N*, Fig. 700) to fit the pipe. Cut a piece of ⅞-inch board to fit against the under side of the floor of the house (*L*, Fig. 699), and fasten it to the floor, then screw the floor-flange to the board, in the right place to make it come exactly under the center of the house; and screw the end of the pipe into the flange (Fig. 701).

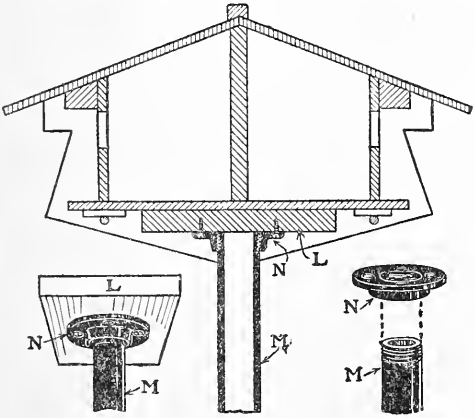


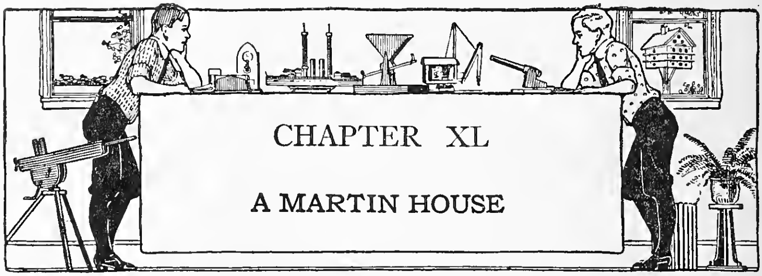
FIG. 701 FIG. 699. FIG. 700

FIG. 699. — Cross-Section of Bluebird House Supported on Iron Pipe

FIGS. 700 and 701. — Details of Iron Pipe Support

In a clay soil the pipe support will stand erect if driven several feet into it, but in a sandy soil it will be necessary to run some wire stays from the top of the pipe down to stakes driven into the ground several feet away from the base of the pipe.

A Permanent Way of Erecting the Pipe, is to set it in a hole and then to fill the hole with concrete.



CHAPTER XL

A MARTIN HOUSE

Martins are very sociable birds, and prefer to nest in colonies. They are not content with one or two compartment houses if larger houses are obtainable. A thirty-room house like that shown in Fig. 702 is none too large. This house has been designed so as to be of the simplest possible construction. The floors and roof are built in sections (Fig. 703), so the house can be erected easily, and so it may be taken apart for cleaning.

Building Material. In building a house of the proportions of the martin house, where there are so many small parts exposed to the weather, it is worth while to buy good lumber. The best wood for the work is cypress, and the best thickness to use is $5/8$-inch stuff. Thicker stock will do, but it will make a heavier house, and that means more to lift when erecting it.

The author's martin house, from which the drawings have been made, measures 24 inches wide, 30 inches long, and 35 inches high. First, build

The First Story Frame out of boards 4 inches wide (*A* and *B*, Fig. 703), then the second story frame out of 8-inch boards (*C* and *D*, Fig. 703), and then the third story frame out of 8-inch boards (*E* and *F*, Fig. 703). Cut boards *A*, *C*, and *E* 29 inches long, and boards *B*, *D*, and *F* 24 inches long.

Cut the Doorways before nailing the frames together.

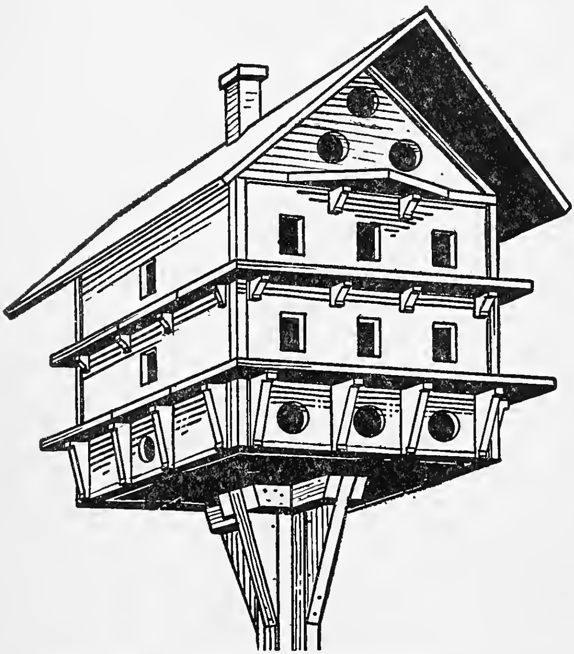


Fig. 702. — A Thirty-Room Martin House

Mark off the positions for the partitions, which must divide the frame into nine compartments of equal size (Fig. 703), and then locate the doorways opposite the centers of the compartments. There will be one round doorway in boards *A*, and three in boards *B*, 2½ inches in diameter. Unless you own an expansive-bit which can be set to bore holes $2\frac{1}{2}$ inches in diameter, describe the circles with a pencil-compass, bore several holes inside of each circle, and cut out the wood between the circles, and trim up the edges, with a chisel.

There is one square doorway in boards *C* and *E*, and three in boards *D* and *F*, of the second and third story frames, each 2 inches wide and 3 inches high. After marking them out with a pencil, bore a hole at each corner, and cut from one hole to another with a small saw. Trim up the edges of the openings with a chisel.

After cutting the doorways,

Nail Together the Frame Boards, then cut and fasten the partitions in place in the positions shown in Fig. 703. You can cut two partitions of a length equal to the inside length of the frame (*G*), and six shorter partitions to fit between them (*H*); or you can cut two partitions of a length equal to the inside length of the frames, and two of a length equal to the inside width of the frames, and *halve* them together. They will be halved in the same way that the pigeon-holes of the writing-desk shown in Chapter 8 are put together (Figs. 187 and 188).

Prepare Floor Boards *I* to fit the first-story frame (Fig. 703), floor boards *J* to form a 3-inch projection upon all sides of the second-story frame, floor boards *K* to form a 2-inch projection upon all sides of the third-story frame, and floor boards *L* to fit the third-story frame.

A hole must be sawed through the exact center of floors *I*, *J*, and *K* to admit the post support *V* (Fig. 708), which

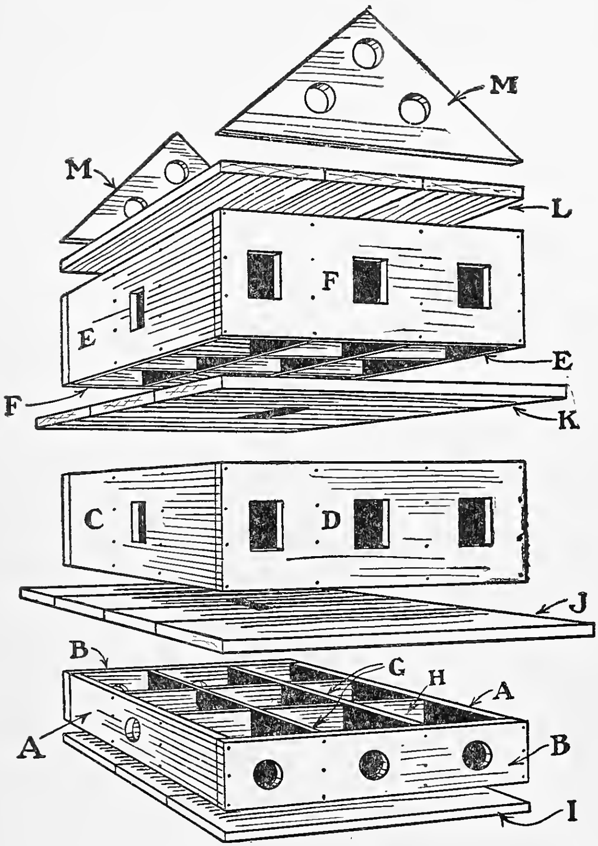


FIG. 703. — Build the Martin House in Sections as above
(For Dimensions of Parts See Text)

extends through the first, second and third stories. Nail floor boards *I*, *J*, and *K* to the under side of the first, second, and third-story frames. These sections need not be fastened to one another, because the center post support will tie them together when they are slipped over it.

Cut the Gable-Ends *M* and partition *N* (Figs. 703 and 704) out of 12-inch boards, making the angle at the peak 90 degrees. Bore three 2½-inch doorways through ends *M*, in the positions shown. Nail floor boards *L* to the bottoms of gable-ends *M* and partition *N*, then cut partitions *O* (Fig. 704) 4 inches wide, to fit between ends *M* and partition *N*, and fasten floor *P* on top.

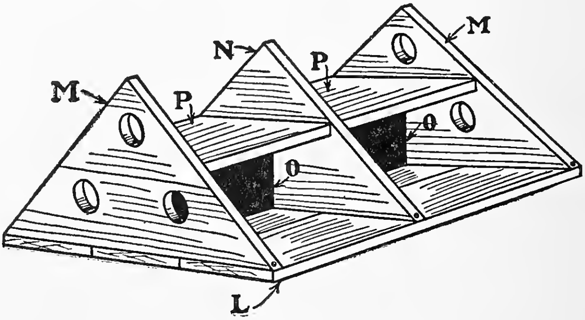


FIG. 704. — Detail of Top Section

Cut the Roof Boards long enough to project 6 inches over the gable-ends and side walls, fasten them together in two sections with battens, and fasten them to the tops of the gable-ends.

Cut two triangular pieces like *S* (Fig. 705), and nail one to the center of each end of floor *L*. Prepare a pair of

Brackets of the shape of *U* (Fig. 706) to fit under each of the pieces *S*, and sixteen of the same size to fit under the third-story ledge, four on each side of the house. Cut sixteen brackets of the shape of bracket *T* (Fig. 705), and fasten these below the second-story ledge, four on each side of the house. Cut

The Chimney blocks *Q* and *R* of the shape shown in Fig. 707, nail them together, and fasten to the center of the peak of the roof.

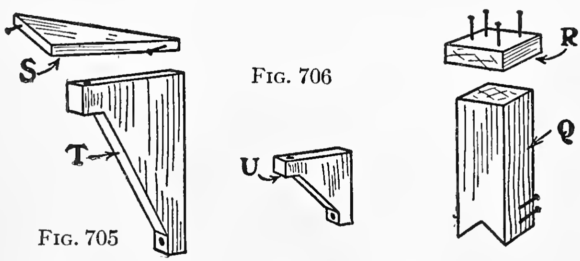


Fig. 707

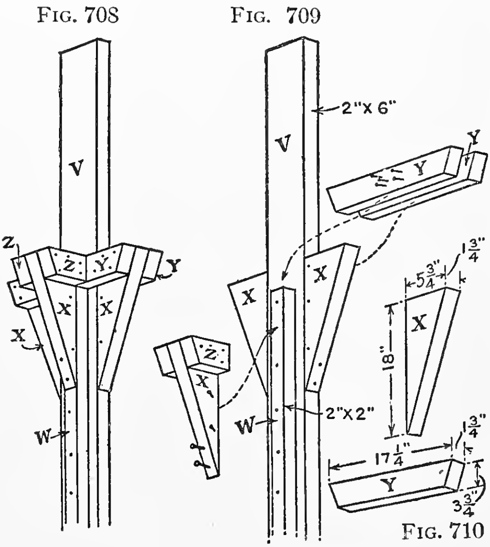
Fig. 706

Fig. 705

Figs. 705 and 706. — Details of Shelf Brackets
Fig. 707. — Chimney

The Bird-House Support is built up as shown in Figs. 708 to 710. Center post *V* is a 2-by-6, pieces *W* are 2-by-2s (Fig. 709), brackets *X* are cut out of a 2-by-6 (Fig. 710), and the shoulder blocks *Y* and *Z* are cut out of a piece of 2-by-4. You will see by Fig. 709 that one of the triangular brackets *X* is spiked to each of the edges of the 2-by-6 *V*, so the tops are on the same level. Shoulder cross-pieces *Y* are then spiked to upright *V*, and to brackets *X*, even with the tops of brackets *X*. Two-by-two *W* is spiked to each side of 2-by-6 *V*, with the top butting against the under side of shoulder crosspiece *Y*. Another bracket

X is then spiked to each of the pieces *W*, with its top even with the tops of the other brackets. Shoulder blocks *Z* are cut to fit against brackets *X* and crosspieces *Y*. Center member *V* of the support should project far enough above the bracket, so the first-, second-, and third-story frames will slip over it, and the top floor will rest upon it.



Figs. 708 to 710. — Details of Post Support for Martin House

A Concrete Base. Because a martin house must have a height of from 15 to 20 feet above the ground, the base of the support must be made very solid to prevent its blowing over in a heavy wind-storm. The best method is to dig a hole about 30 inches deep, 20 inches wide, and 20 inches long, stand the support in the center, and fill in around it with concrete.. Mix up the concrete in the way described for making the mixture for the concrete lawn-roller (Chapter 34).

To Set Up the Martin House, after the support has been erected, will require two persons. Build a temporary scaffolding around the support, to stand upon, and raise and set in place one section of the house at a time. Figures 711 to 714 in the *Frontispiece* to Part 4, opposite page 293, show how the author rigged up a ladder scaffolding for setting up his martin house; also how the sections were assembled.

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