COMPLETE PROGRESSIVE INSTRUCTIONS for using all the parts in the Chad Valley MOTORIZED Girder & Panel and Bridge & Roadway Building Sets

To make the instructions as clear as possible, this is divided into three sections :

SECTION A ● This starts you off with the simplest to use, the Girder & Panel Sets, which contain only *three basic* building parts. These parts can be used in unlimited combinations to build all the buildings shown in the *Girder & Panel Planning Book*. It is suggested that you build at least one or two buildings before taking up the second section . . .

SECTION B ● Explains the uses of the Bridge & Roadway building parts, enabling you to build any of the bridges and roadway features pictured in the *Bridge & Roadway Planning Book*. You can also combine bridges and buildings into very interesting structures, then go on to the third section . . .

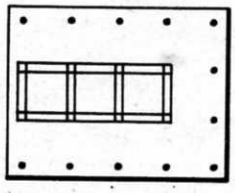
SECTION C ● This shows, by means of diagrams and references to illustrations in the 12-page *Motorizing Project Book*, how to build action into many different kinds of structures.

Section A · Instructions for building with Chad Valley GIRDER & PANEL BUILDING SETS

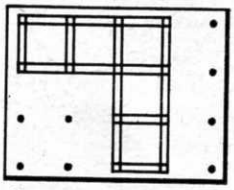
PLEASE READ THIS FIRST: The basic idea of Girder and Panel construction is so easy that any child can build many buildings. But these sets go further than that, allowing full range for his imagination and natural ability. He will soon be designing and building structures of great originality. To provide for this, some special panels are included in the set to fit unusual situations. These are explained in Part II of the instructions. Advanced steps, using modern "cantilever" engineering, are explained in Part III.

PART I • TO START YOUR BUILDING

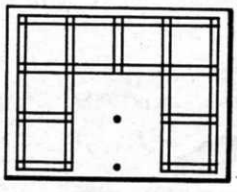
First take the Masonite foundation board from the bottom of the box.



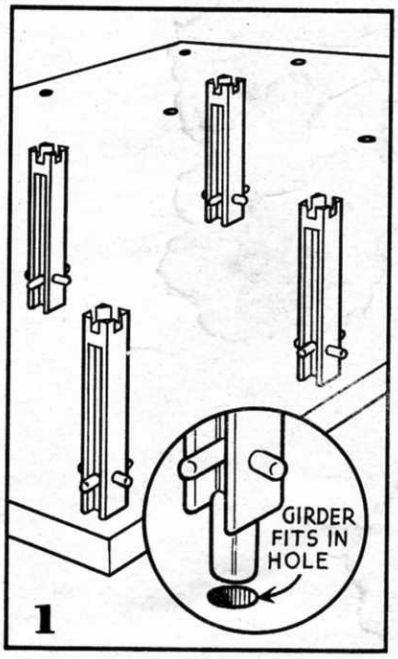
Decide on the shape of the plan for the first floor of your building. Here is a simple plan.



Or you may arrange an "L" shaped first floor.

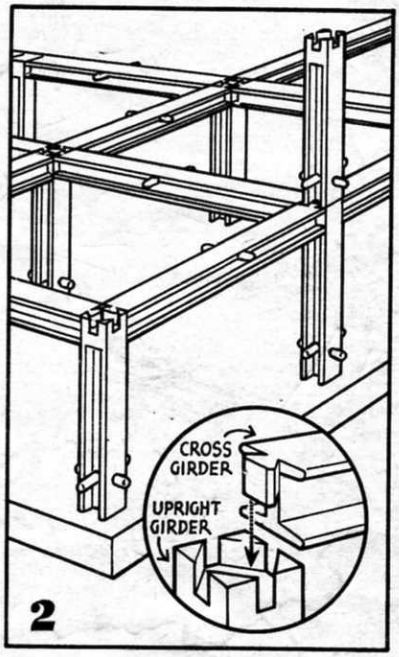


This is a "U" shaped plan like the building in the big picture on the box lid.



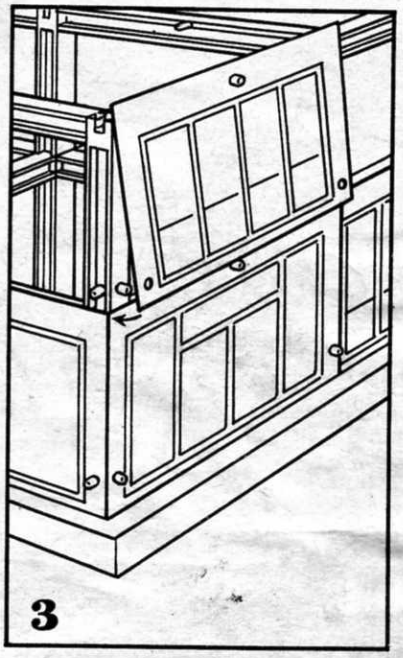
UPRIGHT GIRDERS

Start by standing up the *upright girders* in the holes in the foundation board. Every upright girder has four slots in its top. The cross girders will fit into these slots, so turn the upright girders so that these slots line up in a straight line.



CROSS GIRDERS

Fit the ends of the *cross girders* into the slots of the upright girders, so that the tops are level with each other. When the first story framework is finished, place the second story uprights into the tops of the first story uprights and proceed until the framework is finished.



WALL PANELS

Place the *wall panels* on the framework by snapping the three holes over the rivets on the girders. Start at the first floor and work up, so the upper panels will overlap the lower ones. For best appearance, panels should be chosen carefully and should not be attached in a random fashion.

SIGNS • Signs are attached by snapping the single hole over one of the girder rivets. Generally, the signs are put on the center rivet on the cross girder above an entrance or show window. These signs should be put on before the panels of the upper story are attached. Any signs, however, may be put on any other rivet, if desired.

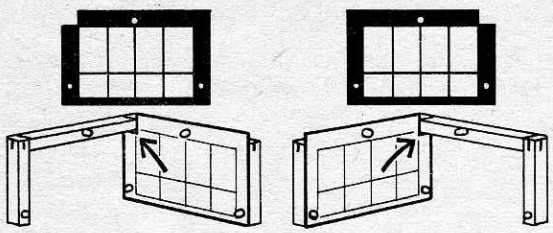
ROOF PANELS • After walls are completed, the roof panels are fitted into the squares formed by the girders of the top story. Again, the type of panel (skylight or plain) should be chosen carefully for best appearance.

FLAGS and PENNANTS • Insert flag into flagpole by placing the notch in the flag under the top hook of the flagpole and wedge the flag between the two hooks. Then place the flagpole into the square hole in top of an upright girder, making sure that the oval sides on the base of the flagpole are directly against the walls of the hole.

Continued on page 2 . . .

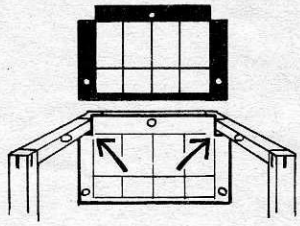
PART II • SPECIAL PANEL SHAPES FOR "INSIDE CORNER" SITUATIONS

When your building has an "inside corner" where two walls meet at a right angle, the regular wall panels will not fit because a cross girder or panel is in the way. To fit in such places, your set contains some specially notched and trimmed panels like these:



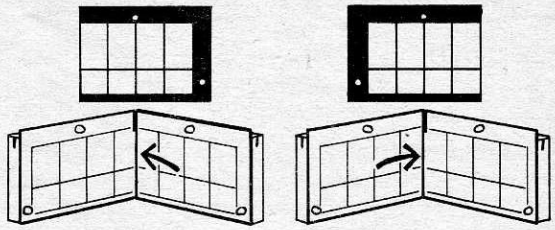
NOTCHED LEFT CORNER **NOTCHED RIGHT CORNER**

Inside a corner formed by two cross girders at a right angle, the notch in the panel will fit around the girder where shown by the arrows.



NOTCHED BOTH CORNERS

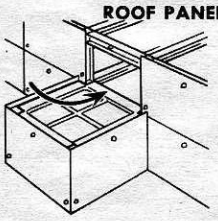
This is used where the cross girder is met at both ends by other cross girders, making two right angles.



TRIMMED LEFT SIDE **TRIMMED RIGHT SIDE**

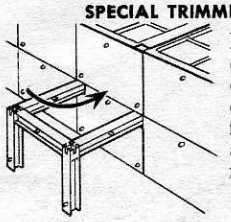
Where a notched corner panel is used, a trimmed panel like this is needed on the other wall to fit into the corner at a right angle.

ROOF PANELS BORDERED BY WALLS



Roof panels are put on after the wall panels *except* where there are roofs on lower wings of the building next to higher walls. In such cases it is easier to put on the roof panels first, as the wall panels next to them will overlap the roof panels on one side.

SPECIAL TRIMMED ROOF PANELS



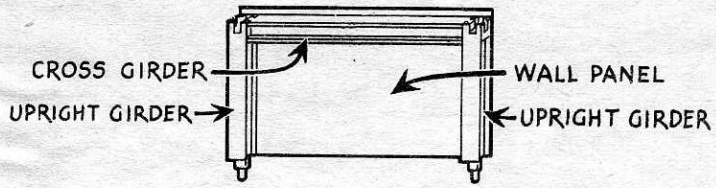
Roof panels in the set with one edge cut off are for use over areas such as auto entrances, where the first floor wall panel will keep a regular roof panel from resting on the cross girder.

MARQUEES

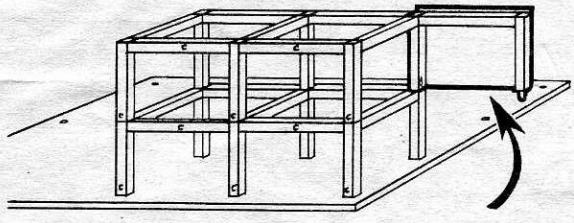
There are two ways to put on a marquee. (1) With edges turned *up*, it can be put on *after* the second story wall panel is in place, by sliding the slotted edge up behind the bottom of the wall panel. (2) In places where there is no second story, the edges of the marquee are turned down, and the slotted edge is slipped behind the top of the first story panel.

PART III • CANTILEVER CONSTRUCTION MADE EASY

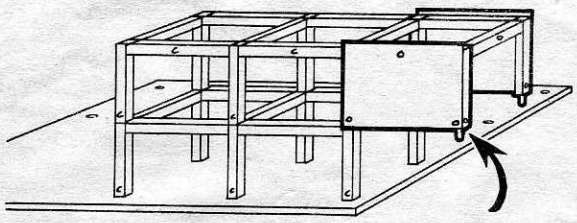
The principle of Girder and Panel *cantilever* construction is the triangular bracing of the structure, as used by engineers in designing bridges and towers. The bracing is provided by the Panels, the rigidity is provided by the Girders. Here is an example of a simple unit:



The wall panel, two upright girders and the cross girder form a single *unit*, held together by the rivets through the three holes in the panel. There is no cross girder at the bottom of the panel.



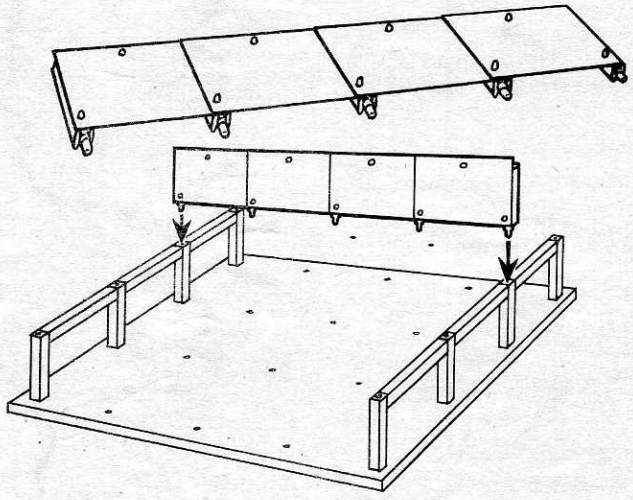
When you put this unit in place on a framework, like this, it will stay there even though there is no upright girder below the outer edge for it to rest on. It is self supporting.



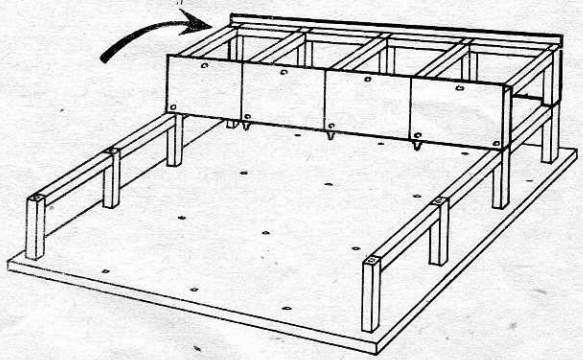
Now put another such unit on the next upright of the framework. Join the outer ends with a cross girder, put a wall panel across the open end, and you have built a complete cantilevered room. Easy, isn't it?

You can build another story above the cantilever. By putting two or more units together as shown in the column at the right, you can make the cantilevered part of the building wider, or extend it out farther.

For long cantilever spans, like on the Airplane Hangars illustrated in the Planning Book with the No. 2 and No. 3 Sets, the row of units is put together flat on the floor, like this:



The entire assembly is then lifted up and both ends are placed on the upright girders of the framework already built on the foundation.



Another cantilver assembly is then placed parallel to the first. Place it with the panelled side facing away from the first assembly, so you can join them across the top with cross girders. A third and fourth assembly may be added and joined together in the same way.

This same "assemble and raise" method is also used for building long spans for bridges and trestles.

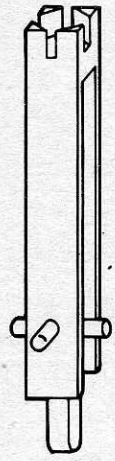
In some cantilevered buildings, you will have to use notched panels on the story below the cantilevered room.

Section B · Instructions for building with Chad Valley BRIDGE & ROADWAY BUILDING SETS

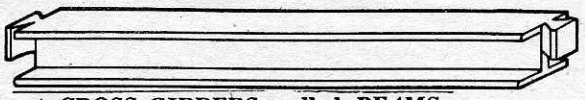
You can design and build bridges, roadways, trestles with these interchangeable construction parts.

HERE ARE ALL THE PARTS AND HOW THEY ARE USED

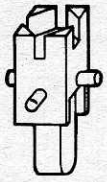
GIRDERS



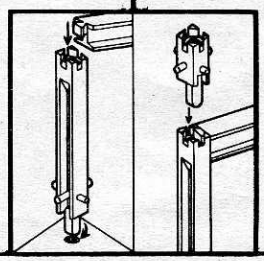
◀ **UPRIGHT GIRDERS, called *COLUMNS.*** These are the supporting members. They are always used in an upright position as shown.



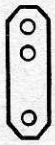
▲ **CROSS GIRDERS, called *BEAMS.*** The beams are joined to the columns along the sides of the bridge, also *across* the bridge to support the roadway and stiffen the structure.



◀ **STUB GIRDERS, called *STUBS.*** These short stubs are used as fasteners at the top and bottom ends of columns, also to fasten roadways and ramps to the foundation boards.

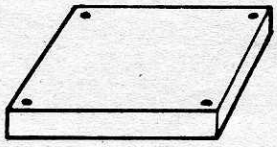


BRACES



▲ ***CROSS BRACES*—These braces give strength to the entire structure, as explained later on this page. The two holes in one end of each brace are spaced so that the brace will fit either from column-to-column, stub-to-stub, or column-to-stub as required.**

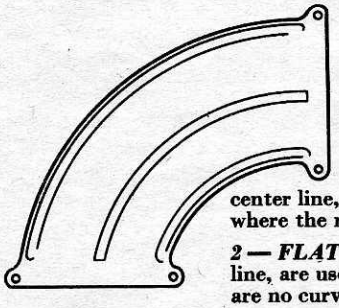
◀ ***TIE BRACES* are used for securing Stubs to the bottoms of columns. (The Tie Braces come in strips. To separate them, bend the strips at the narrow places and the Tie Braces will snap apart.)**



◀FOOTINGS

These Masonite boards serve as bases for bridge piers and ramps. Columns and stubs fit upright into the holes in the footings.

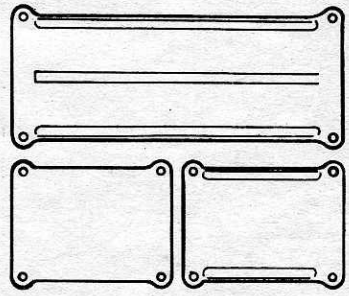
ROADWAYS AND RAMPS



CURVED ROADWAYS. **The No. 5 Bridge and Turnpike Set contains *two different kinds of curved roadways:***

1—CURVED RAMPS, **marked by a solid yellow center line, are used at the ends of bridges where the roadway goes down hill.**

2—FLAT CURVES, **with dotted yellow line, are used only for level curves. (There are no curved roadways in the No. 4 Set.)**

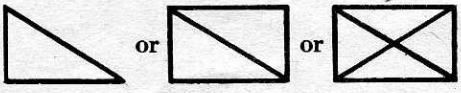


◀ ***STRAIGHT ROADWAYS.*** **The long straight pieces are used as straight ramps at the ends of bridges (*not* to be used as roadway *on* the bridge).**

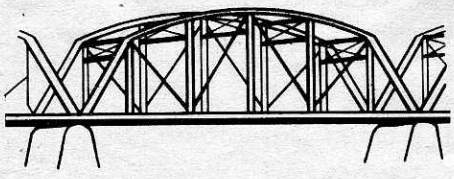
◀ **These shorter pieces are used as roadway on the bridge. Each section is as long as one bridge beam. There are two kinds: *with* and *without curbs.* Those without curbs are used where roads cross.**

What makes a bridge STAY UP?

Except for suspension bridges, which are hung from cables, all steel bridges are made up of *girders and braces* arranged to form *triangles* like this:

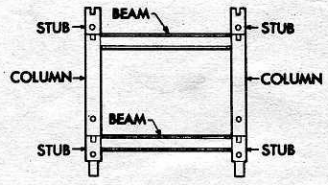


Look at any steel bridge and you will see that, whatever the size or shape of the bridge, the steel members cross and criss-cross to form triangles. These triangles brace the steel girders to make the bridge strong and rigid.

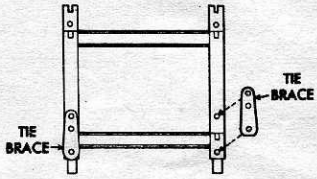


A STEEL TRUSS BRIDGE

To see how this triangular cross bracing is used in building bridges, and to learn how all the different parts fit together, first build a single unit like this:



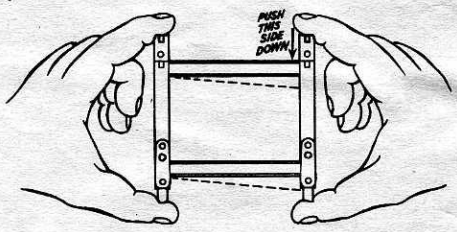
To hold the Stubs securely on the bottoms of the Columns, fasten them with two Tie Braces, like this:



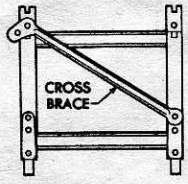
Snap the bottom hole in the Tie Brace over the rivet on the Stub and snap the top hole over the rivet on the Column.

(The middle hole in the Tie Brace is used only to fasten two Stub Girders together.)

Pick up this assembled unit and hold it in your hands like this:



You will see that the unit is wobbly when you push down with your right hand, because it is not cross-braced. The next thing to do is to add a Cross Brace to form triangles, as below:

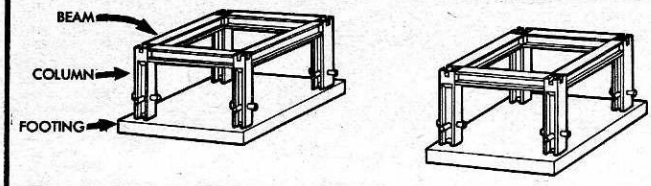


Snap the hole in the narrow end of the Cross Brace over the rivet on the Column, then swing the Cross Brace until one of the holes in the wide end comes over the rivet on the Stub. Snap it on.

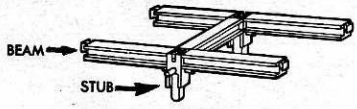
Now hold the unit in your hands as you did above and try to push the right side down. You can see how strong and rigid it is.

You are now ready to build a bridge— **see page 4 . . .**

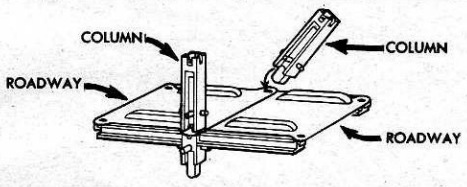
LET'S BUILD A SIMPLE BRIDGE



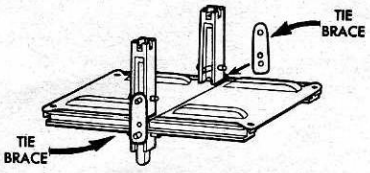
First build the end piers on two Footings. Place a Column in each hole and place Beams across the tops of the Columns to form a square.



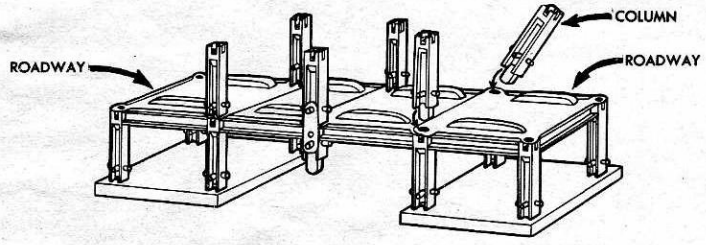
Begin to assemble the center span of the bridge on the floor by putting 5 Beams and 2 Stubs together like this.



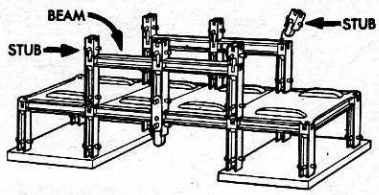
Place 2 short Roadway pieces so two holes on each come over the Stubs. Put on two Columns, pushing the tips of the Columns through the holes.



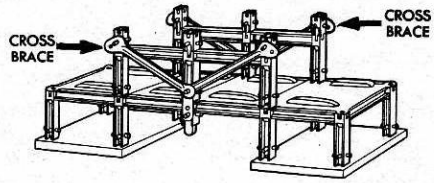
Put on a Tie Brace to fasten the Stub to the Column on each side. This will hold the assembly together so that the span can now be lifted into the piers.



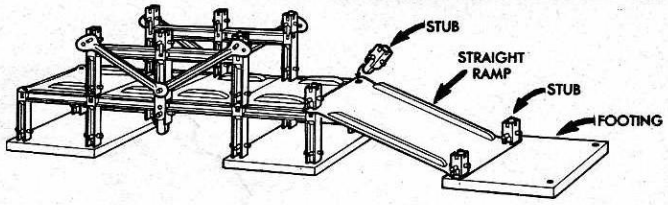
Fit the Beam ends of the span on the Columns of the piers. Now place a short Roadway piece on top of each pier and put on 4 more Columns as shown.



Place 2 Beams on each side to join the tops of the 3 Columns, and insert a Stub into the top of each Column.

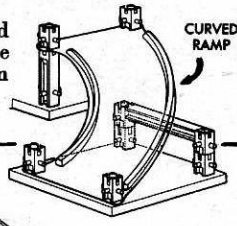


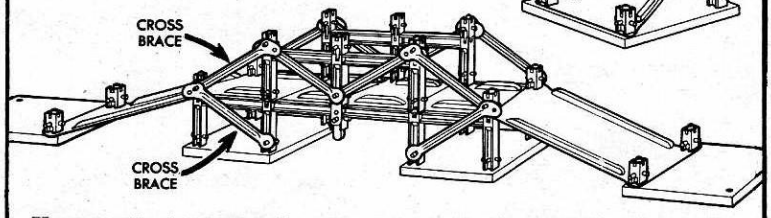
Now we are ready for the Cross Braces that will make the bridge strong. Attach Cross Braces on each side from the center Column to the Stubs on top of the end Columns.



Attach one end of a Straight Ramp to the end of the bridge with Stubs. The other end of the Ramp is fastened to a Footing with two more Stubs.

If a Curved Ramp is used, build a support for the Ramp on the Footing with 4 Stubs and a Beam like this . . .

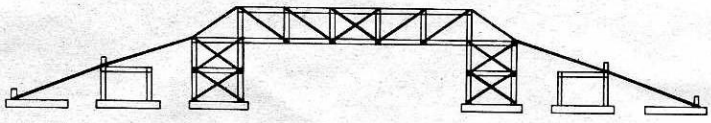




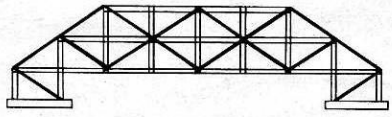
You now further strengthen the entire bridge by installing four additional Cross Braces on each side.

JUST FOLLOW THESE SAME STEPS TO CONSTRUCT MANY DIFFERENT BRIDGES.

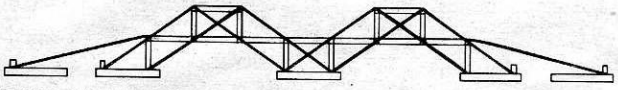
HERE ARE FOUR DIFFERENT BRIDGES BUILT IN THE SAME WAY



HIGHWAY BRIDGE • This bridge is like the simple bridge above except that it is longer and the piers are higher. Note the extra cross bracing on the piers, as well as on the center section of the span.



RAILROAD BRIDGE • Again, this is the same basic bridge but the sides are 2-columns high and they are joined across the top with beams for additional rigidity.



DOUBLE SPAN • For long bridges, an additional pier in the middle is often more desirable than building a large, complicated single span. Compare this with the Causeway Bridge on the lid of the box.

INVERTED TRUSS • All these bridges are of the type known as "truss" bridges. In this one the truss is upside down, making a level trestle for railroad tracks on top.

Try these and some of the more complicated structures in the Bridge & Turnpike Planning Book. You can then go on to the next step and learn to motorize them.

Section C · INSTRUCTIONS for using the MOTORIZED PARTS in Sets 8, 9 and 10

After learning to use the Girder & Panel and Bridge & Roadway parts you are ready to build action into your structures with these motorised parts, which are all explained here very simply.

1—The POWER UNIT (Battery Box and Switch Panel)

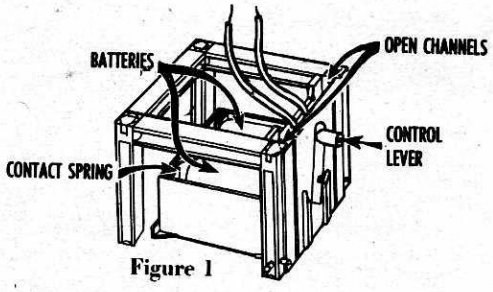


Figure 1

First insert the batteries (2 flashlight batteries, size "C"), depressing the contact spring in the rear of the box. Place the batteries so that one points toward the front, the other toward the rear.

The Power Unit is often the first of the motorizing parts to be placed in the structure being built, because it is usually desirable—for realism and also because of the weight of the batteries—to have the controls near "ground level." Also, this unit must be built into your structure as you proceed for it is difficult to add or insert it later on.

The Power Unit has an open channel at each front corner to fit between two outside columns as shown in Fig. 1. Beams are then placed on the columns over the sides and back, but *do not put a beam over the front* where the wires come out. The lever on the Switch Panel controls the forward, stop, and reverse action of the motor.

2—The MOTOR UNIT

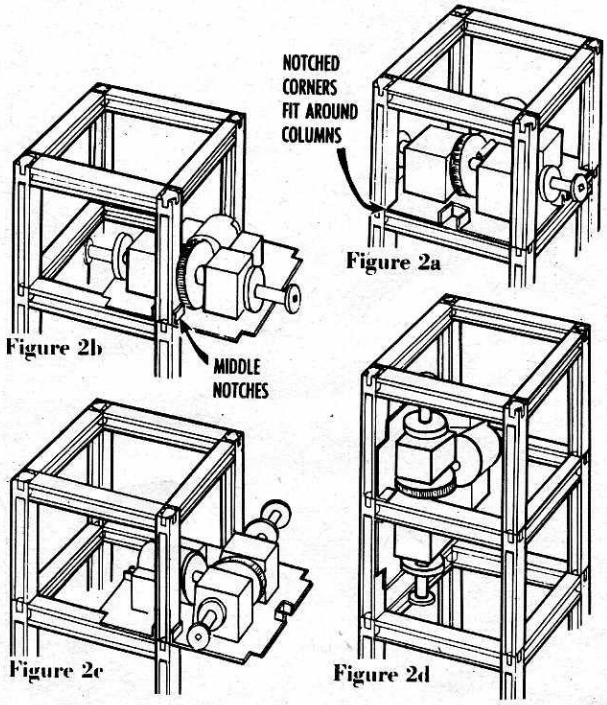


Figure 2a
Figure 2b
Figure 2c
Figure 2d

The Motor Unit may be placed in the structure in several ways. Most often it is placed as in Fig. 2a, with the four notched corners fitting around columns or stubs. The unit may be also placed with the two middle notches holding it onto two columns as in Fig. 2b, or turned as in Fig. 2c. The unit may also be mounted vertically as in Fig. 2d; for a good example of this see the detail photo of the Hook Conveyor on page 6 of the Motorized Project Book.

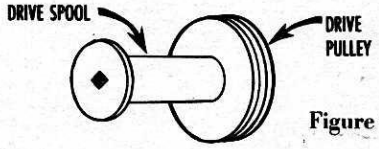


Figure 2e

DRIVE PULLEY AND SPOOL • This part has a square hole to fit onto the square shaft of the motor unit; you can put it on either end, depending on how it is to be used. The smaller part (the Spool) is used for *winding up* the cable when lifting an elevator, crane or drawbridge; reversing the motor will unwind the cable to lower the load. The larger end (the Drive Pulley) is used for running the cable in a continuous motion in either direction, as for a conveyor or rotating part of a structure. The small rubber bands in the set may be placed around the drive pulley, in the groove, to keep the cable from slipping. (A rubber band may also be used to hold the end of the cable onto the spool, and also to prevent slippage in a belt conveyor.)

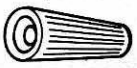


Figure 2f

ELECTRICAL CONNECTIONS • After the Power Unit and the Motor Unit are installed in the structure, the wires must be connected. "Wire nuts" are supplied for this purpose. Insert the end of one wire from the switch and one wire from the motor into a wire nut and twist it clockwise until tight. Do the same with the other two wires. Be sure there is enough slack in the wires to allow them to move back and forth without tension when you work the switch lever.

3—The ELEVATOR CAB

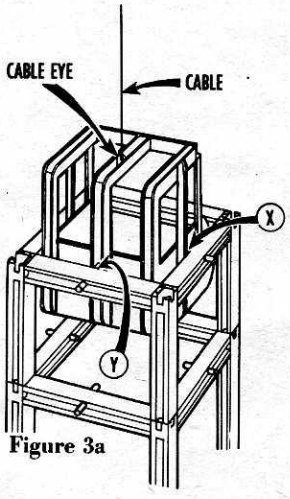


Figure 3a

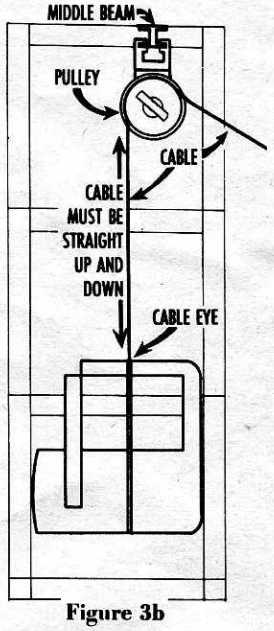


Figure 3b

The Elevator Cab is fastened onto the cable by simply tying the cable through the eye in the center beam atop the cab.

When placing the cab in the building, note that the "guides" on the sides of the cab are to the rear of the rivets on the beams at the sides of the elevator shaft (see arrow "X") and that the rivets on the beams behind the cab slide in the groove at the rear of the cab (arrow "Y").

In installing an elevator it is necessary that the cable run *straight up* from the cab to the pulley, otherwise the cab may tilt and become jammed; this is shown in Fig. 3b.

4—The MIDDLE BEAMS

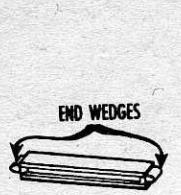


Figure 4a

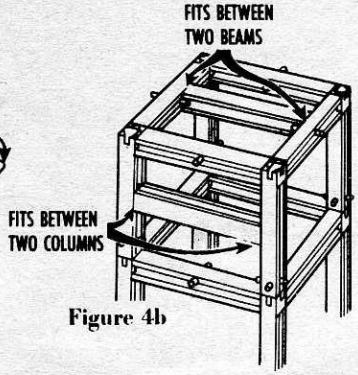


Figure 4b

The purpose of the middle beams is to enable the builder to attach pulleys at any point in the structure, rather than being restricted to fastening them to the regular structural columns and beams. A middle beam is placed into the structure by wedging the ends into the space between the flanged sides of columns or beams as in Fig. 4b. By sliding the middle beam either way between the structural beams, the pulley can be correctly positioned over the elevator cab (Fig. 3b).

5—The PULLEYS

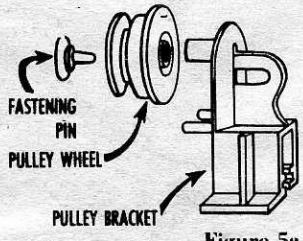


Figure 5a

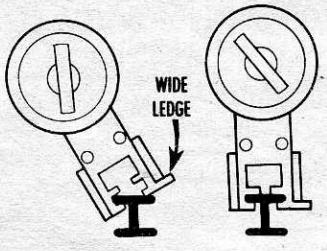


Figure 5b

The pulleys are made up of three parts—the pulley *bracket*, the pulley *wheel*, and the *fastening pin*—which you will assemble as shown in Fig. 5a.

Pulleys are installed in the structure wherever required by snapping the grooves in the base of the bracket onto the flange of any beam or column as in Fig. 5b. (The wide ledge on one side of the bracket base is to aid in removing the pulley—just push up on this ledge to snap the bracket off the beam.)

USED AS WHEELS • By fastening the pulley assemblies upside-down to the bottom beams (as on the Crane on the box lid) they become wheels that roll on rails. The two projections on the bracket straddle the bottom of the stub girder, providing extra rigidity.

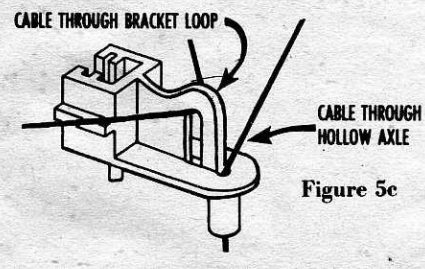


Figure 5c

USE OF BRACKET WITHOUT PULLEY WHEEL • In many instances you will use just the brackets as guides for the cable where a pulley is not needed. The cable may be put through the loop on the back of the bracket or it may be passed through the hollow axle as in Fig. 5c. Brackets are sometimes used for fastening the ends of cables. You will see several examples of these uses in the detail picture of the Draw Bridge on page 8 of the Motorizing Project Book.

6—The SWIVEL

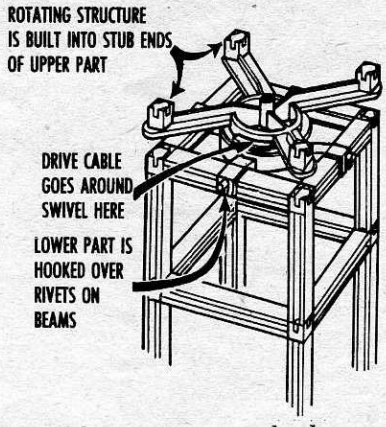


Figure 6

The Swivel has two parts: the *lower* part is attached to the main structure by placing the hook ends of the four arms over the centers of four beams; the *upper* part has stub-like ends on its four arms into which the rotating part of the structure is built. For a good view of a swivel installation see the detail photo of the airplane swing on page 7 of the project book.

The flanged circular section of the upper part of the swivel acts as a larger pulley around which the cable passes to turn the swivel when it is motor driven (see picture of radar on page 5).

7—The HINGES

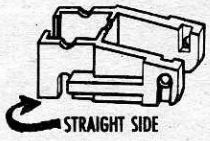


Figure 7

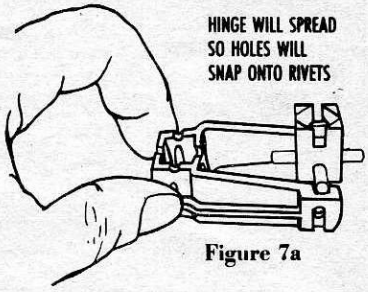


Figure 7a

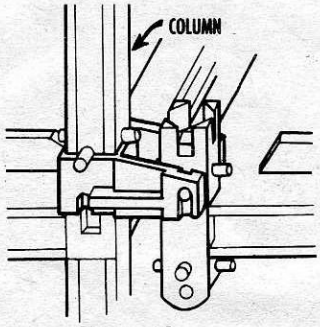


Figure 7b

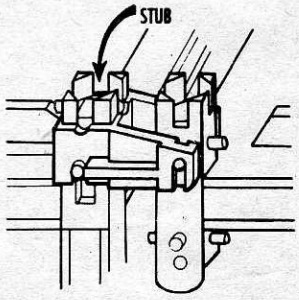


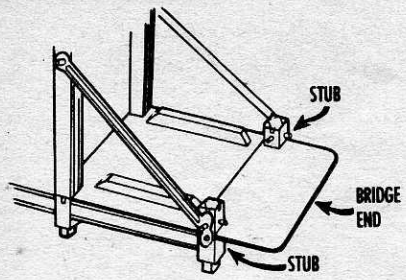
Figure 7c

Hinges are used on draw bridges, boom cranes, and for various flexible joints. The hinges are always used with the straight side down as in Fig. 7.

The hinge is first attached to the *movable* part of the structure; this part should be completed, with all cross braces and tie braces in place, before attaching it to the main part of the structure. The holes in the small end of the hinge are snapped over the rivets on the end stub girder as shown in Fig. 7a.

The other end of the hinge is attached to the main structure with either a column (Fig. 7b) or a stub (Fig. 7c). If a *column* is used, it is pushed down through the hinge from above, but if a *stub* is used the hinge must be pushed down onto the stub. These drawings show how the slots in the hinge are designed to fit around the rivets on either the stub or the column.

8—The BRIDGE ENDS



Bridge ends, which are short sections of roadway, are used to close the gaps between movable and stationary parts of lift bridges and of swing bridges, and between the two halves of double draw bridges. They are held in place by columns or stubs in the same manner as roadway sections.

9—The SAFETY GATES

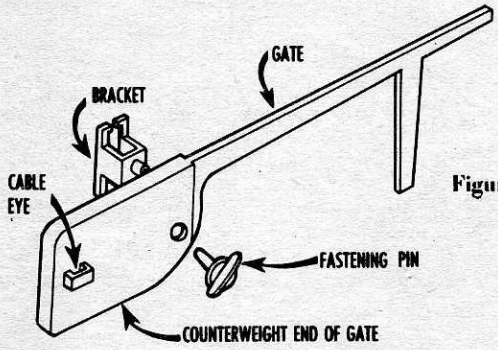


Figure 9

A safety gate assembly consists of three parts—the *bracket*, the *gate*, and the *fastening pin*—as shown here. The gate is counterweighted so it will stay open (that is, in raised position) when it is not held closed by the cable that raises and lowers the bridge. The cable passes through the "cable eye" in the gate's counterweight, and the gate is operated by the tension of the cable as it winds and unwinds. Photos on page 2 of the Motorizing Project Book show a typical gate installation in detail.

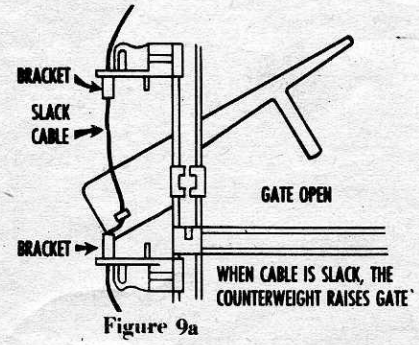


Figure 9a

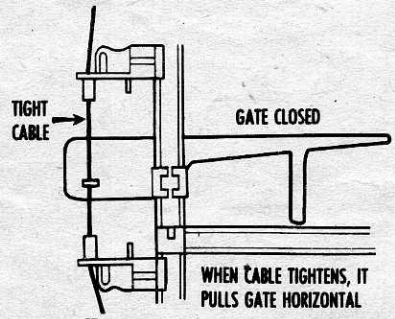


Figure 9b

10—BELT CONVEYOR

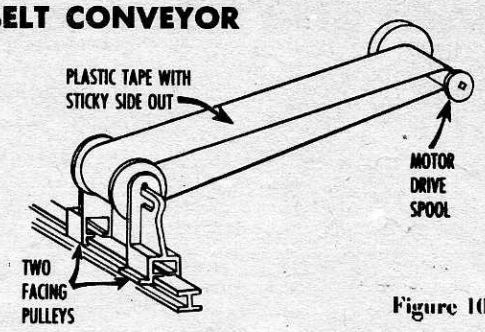


Figure 10

Fig. 10 shows a simple belt conveyor installation. Two facing pulley assemblies *without pins* form a drum around which the belt travels at one end of the conveyor, while at the other end the belt goes around the drive spool on the motor unit.

The belt is made of plastic tape that is sticky on one side. It goes around the drum and spool with the *sticky side out.* In putting on the belt, pull the ends together until the belt is tight, then overlap the ends—they will hold together and the sticky surface will keep small objects from slipping off when it runs. *Caution:* When installing the belt be careful not to lay the sticky side down on the foundation board or footings as it will adhere to the paint; you can lay wall panels on the footings until after the belt is in place. Should you need additional conveyor belts you may use regular ¾-inch wide cellophane tape.

11—HOOK CONVEYOR

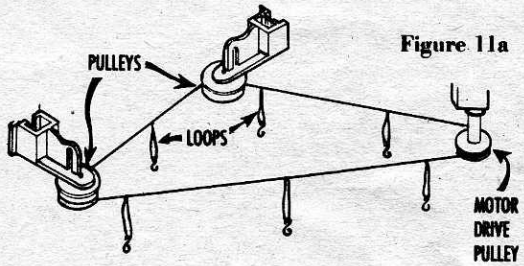


Figure 11a

Hook Conveyors run on pulleys that are mounted horizontally. See detail photo on page 6 of the Motorizing Project Book showing position of pulleys and motor.

Tie a series of equally spaced loops in the cable before attaching it to the pulleys (Fig. 11a). The loops should be at least an inch long so that the hooks will hang far enough below the pulleys to avoid becoming tangled. Snap the small part of the hooks into the loops.

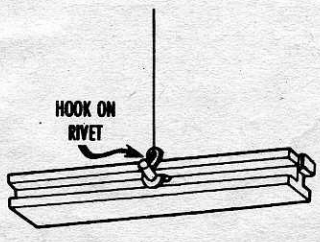


Figure 11b

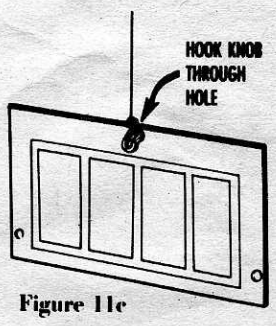


Figure 11c

You can pick up a girder with the hook by pushing one of the girder rivets into the curve of the hook (Fig. 11b). The small knob on the end of the hook is for picking up panels—just put the knob through one of the holes in the panel (Fig. 11c). The knob does not interfere with using the hook for other purposes.

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