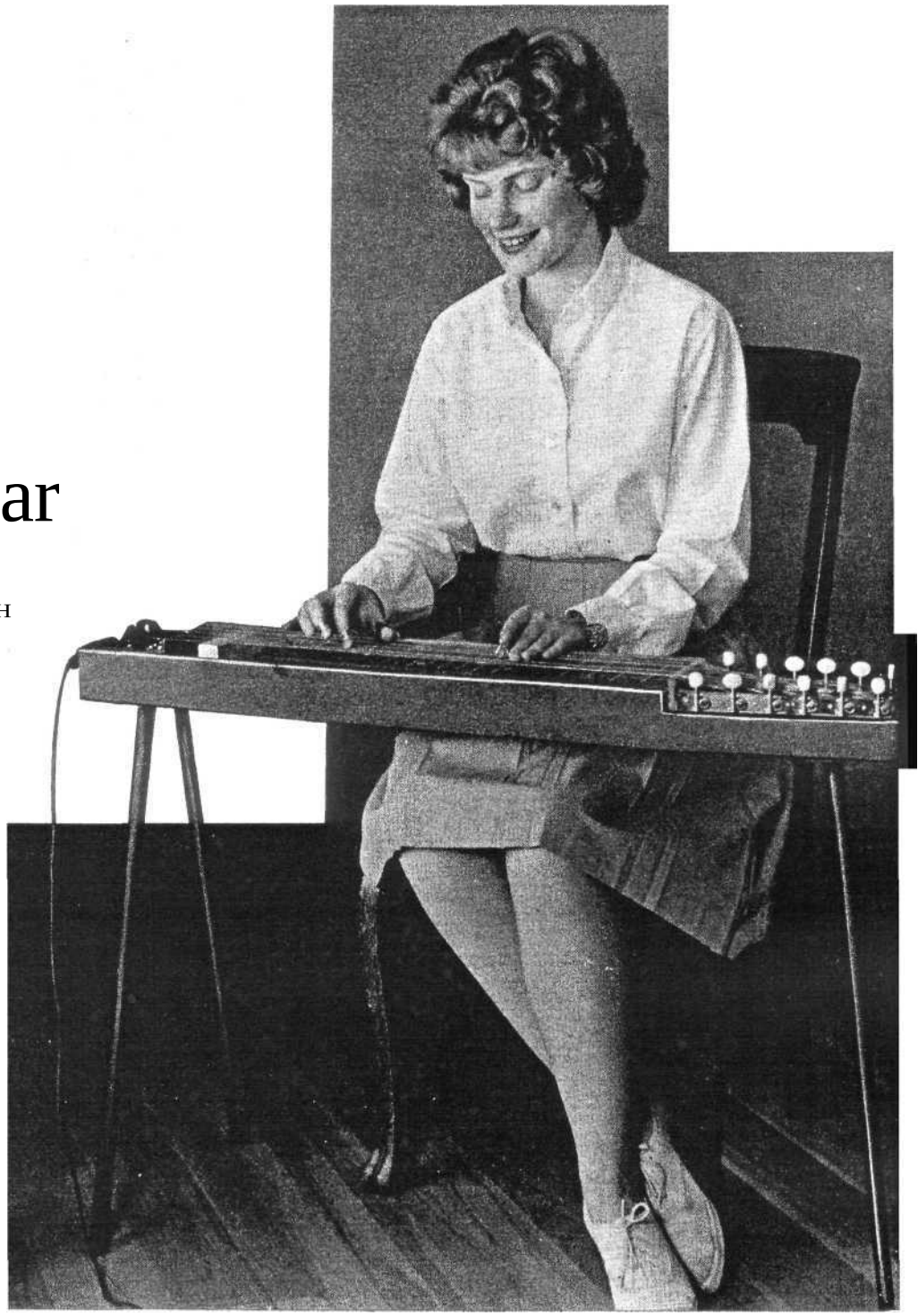
Build a singing steel guitar

By ROY L. CLOUGH



Plug this multichord instrument into any good speaker and you'll make music like you never thought you could

SO MAYBE it's not an authentic Hawaiian guitar. But what is? That amplified vibrato we associate with blood-stirring hulas and plaintive island tunes was really invented in California. At any rate, the sound has become part of American music—you hear it in hootenannies, dance bands and those weird sound effects in science-fiction movies.

That sound is yours for a couple weekends' work. This standing model perches on 24-in. legs,

leaving both hands free for playing. Since the strings are "stopped" with a straight steel bar instead of the fingers, the choice of chords is limited to those that can be covered with the steel—plus a few open-string-and-steel combinations. Early guitars were limited to major chords and a few bobtailed sevenths. Efforts to overcome this resulted in guitars with several banks of strings, or with mechanical tone changers to alter the tuning.

In both cases, provision had to be made for "damping" unused strings, to prevent them from vibrating sympathetically and producing unwanted dissonances. This involved some sort of mechanical or electrical switching method to take the unused strings out of play. Then, if you suddenly wanted to include the dead strings while playing, you had to switch them back on. This meant kicking a foot or hand lever.

Our model avoids all this by using just one bank of 12 strings, hardly wider than a simple guitar. Thus, all damping can be performed as in classical steel technique—with the edge of the hand. Strings are arranged in three groups: The first five form the melody or major chords; the next four, a diminished seventh; and the last three—farthest from the player—make up the less-frequently-used minor chords. The result is a close-knit fingering arrangement which makes playing much easier and simplifies construction.

build the body first

Laminate the body from three pieces of exterior plywood or any %-in. kiln-dried stock. Cut out the recesses for volume and tone controls and phone jack.

The headstock should be hardwood, preferably maple. After it's cut, you'll have to make up a taper block to hold it in position on the drill press while you bore clean, accurate holes for the shafts of the machine heads which are used for tuning the strings. When you've done the other drilling and slotting, check all parts for clearance and glue and screw the head in place, with a scrap of 1/4-in. Plexiglas between it and the top lamination, so you'll be able to slip in the nut later on. Finish and paint the guitar body now.

Paint the hardboard fingerboard flat black and line off the fret positions with white ceiling-coater type paint in a draftsman's ruling pen. Follow the spacing chart carefully—these positions govern the pitch of the notes. Glue the fret board in place.

The bridge must be iron angle—not brass or aluminum—because of the heavy load on it when the strings are taut. The nut, on the other hand, can be Plexiglas. The grooves in the beveled top edge are just deep enough, for now, to catch the strings. Push the nut into the slot between top lamination and headstock, using a paper shim for a tight fit, if necessary.

The pickup core consists of two identically-drilled pieces of 3/32-in. plastic sheet (styrene or acrylic). Cement in the 12 alnico cylinder magnets with poles facing the same way, then take one turn of electrical insulating tape around the magnets before winding on 1200 ohms' worth of No. 40 Nylclad magnet wire. A 1/4-lb. spool should do it, but you determine the amount with an ohmmeter, since the frequency response changes if you wind on too little or too much. For the winding, pin the assembly to a block of wood chucked in a lathe.

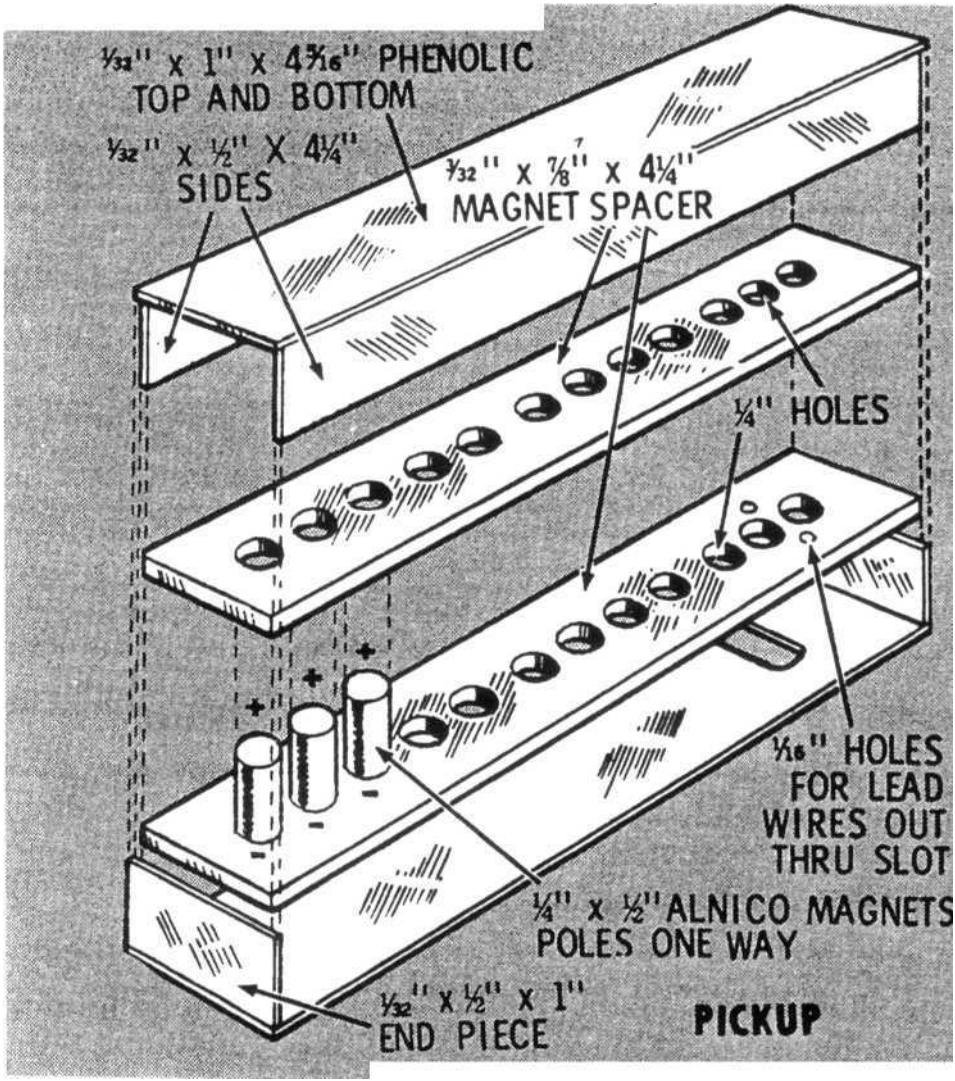
Use short lengths of stranded hookup wire for leads. Cement the wire's insulation into the pickup body so the leads won't pull out. Close in the pickup with thin phenolic covers and wrap the whole unit in aluminum foil, rubber-cemented in place; leave a tab of foil to twist up in the wire that comes from the outside windings of the pickup. Cement the foil-covered pickup into a recess which you can now mark and cut to fit it—making it deep enough to provide the proper clearance between the top of the pickup and the strings. You can check this by laying a straight-edge across the bridge and nut.

the control panel

The control panel and end plate can be cut from 1/8-in. hardboard—or more elegant opaque plastic, if you've some on hand. The plates are similar, except that there's only one 3/8-in. hole in the end one.

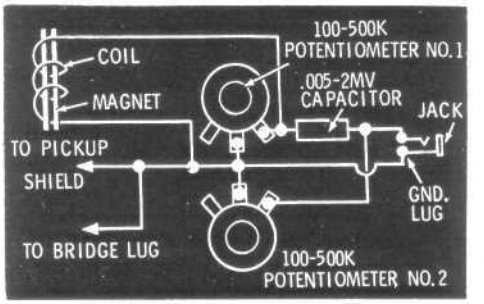
When you install the machine heads (available from any musical supply house) in the headstock, note the position of the worm drive. Measure off the bridge location from the nut, as shown; this is a critical dimension for pitch—it shouldn't be over 22-3/4 in or under 22-11/16 in Note there's a grounding lug under one of the screws; feed a bit of hook-up wire from it to the outside braid of the pickup cable. Wire up the control pots and the phone jack as shown in the schematic and screw their plates in place. The guitar plays through any standard amplifier and speaker system. In stringing and tuning it follow the diagram just below the wiring schematic, bearing in mind that in each group the lightest-weight string is located farthest from the player.

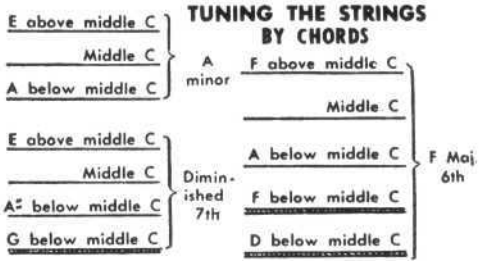
After tuning, pull lightly on all strings, to take

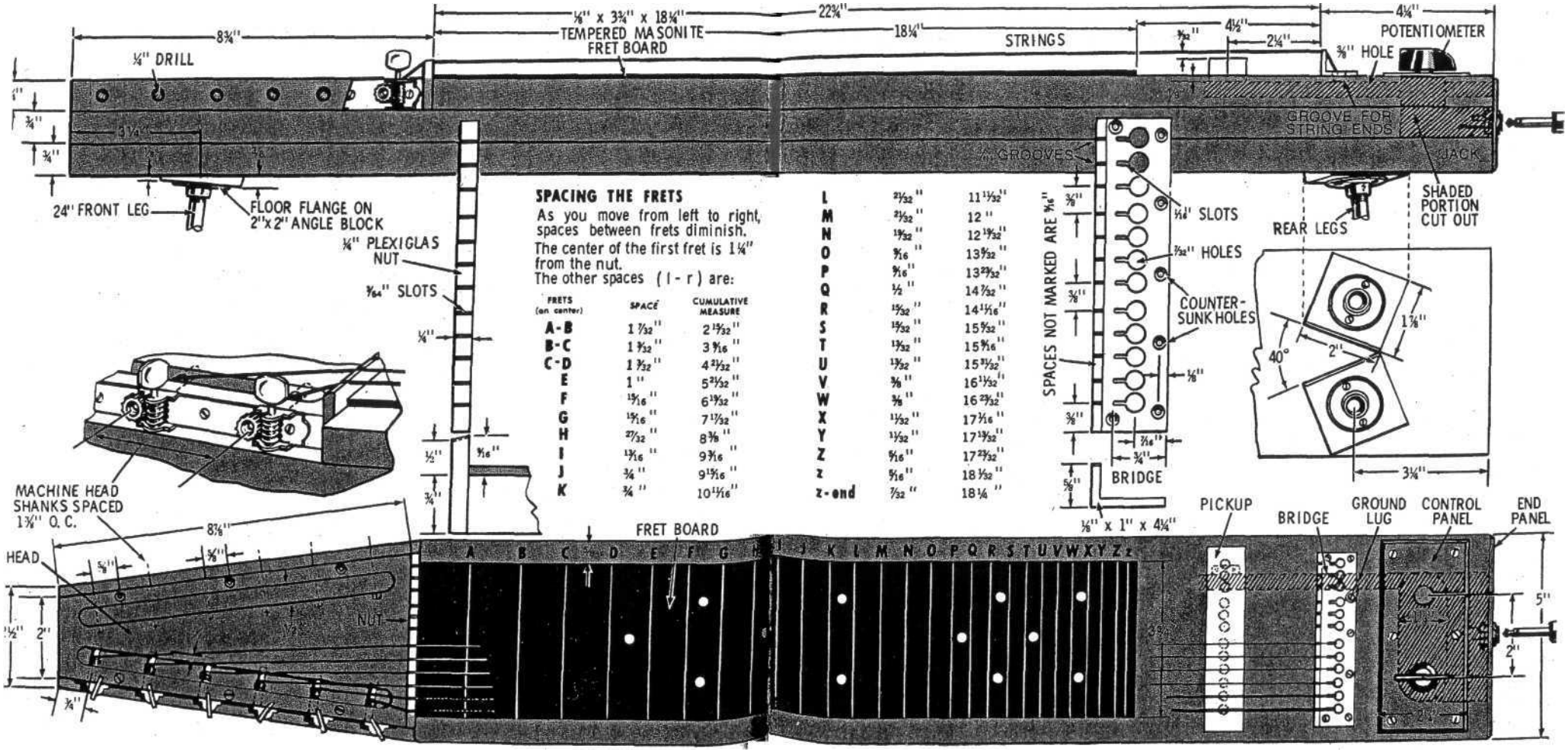

1/32" X 1" X 4 3/16" PHENOLIC
TOP AND BOTTOM
1/32" X 1/2" X 4 1/4"
SIDES
1/32" X 7/8" X 4 1/4"
MAGNET SPACER
1/4" HOLES
1/16" HOLES
FOR LEAD
WIRES OUT
THRU SLOT
1/4" X 1/2" ALNICO MAGNETS
POLES ONE WAY
1/32" X 1/2" X 1"
END PIECE
PICKUP

out the initial stretch, and retune. They'll *stay* tuned, now. Check the level of the strings by laying the steel bar across them. Squeaks mean a high string. Loosen it and file its nut groove a bit deeper—a touch-up operation that's necessary because the diameters of strings vary.

The way the strings are located and tuned puts the major with its seventh and relative minor in a straight line across the fret board. This means no groping around for related chords. They're right under your fingertips—leaving you free to watch the hula your music inspires.







SPACING THE FRETS

As you move from left to right, spaces between frets diminish.
The center of the first fret is 1 1/4" from the nut.
The other spaces (l - r) are:

FRETS (on center)	SPACE	CUMULATIVE MEASURE
A-B	1 1/32"	2 15/32"
B-C	1 3/32"	3 9/16"
C-D	1 3/32"	4 21/32"
E	1"	5 21/32"
F	15/16"	6 13/32"
G	15/16"	7 1/32"
H	27/32"	8 3/8"
I	13/16"	9 3/16"
J	3/4"	9 15/16"
K	3/4"	10 11/16"
L	2 1/32"	11 11/32"
M	2 1/32"	12"
N	1 29/32"	12 29/32"
O	29/32"	13 25/32"
P	29/32"	13 29/32"
Q	1/2"	14 7/32"
R	15/32"	14 11/16"
S	15/32"	15 5/32"
T	13/32"	15 9/16"
U	13/32"	15 21/32"
V	3/8"	16 11/32"
W	3/8"	16 23/32"
X	11/32"	17 7/16"
Y	11/32"	17 13/32"
Z	5/16"	17 23/32"
z	5/16"	18 1/32"
z-end	7/32"	18 1/4"