

4-1964

Equipment for Making Nesting Holes for the Alfalfa Leaf-cutting Bee

William P. Nye
Utah State University

George E. Bohart

Follow this and additional works at: https://digitalcommons.usu.edu/piru_pubs



Part of the [Entomology Commons](#)

Recommended Citation

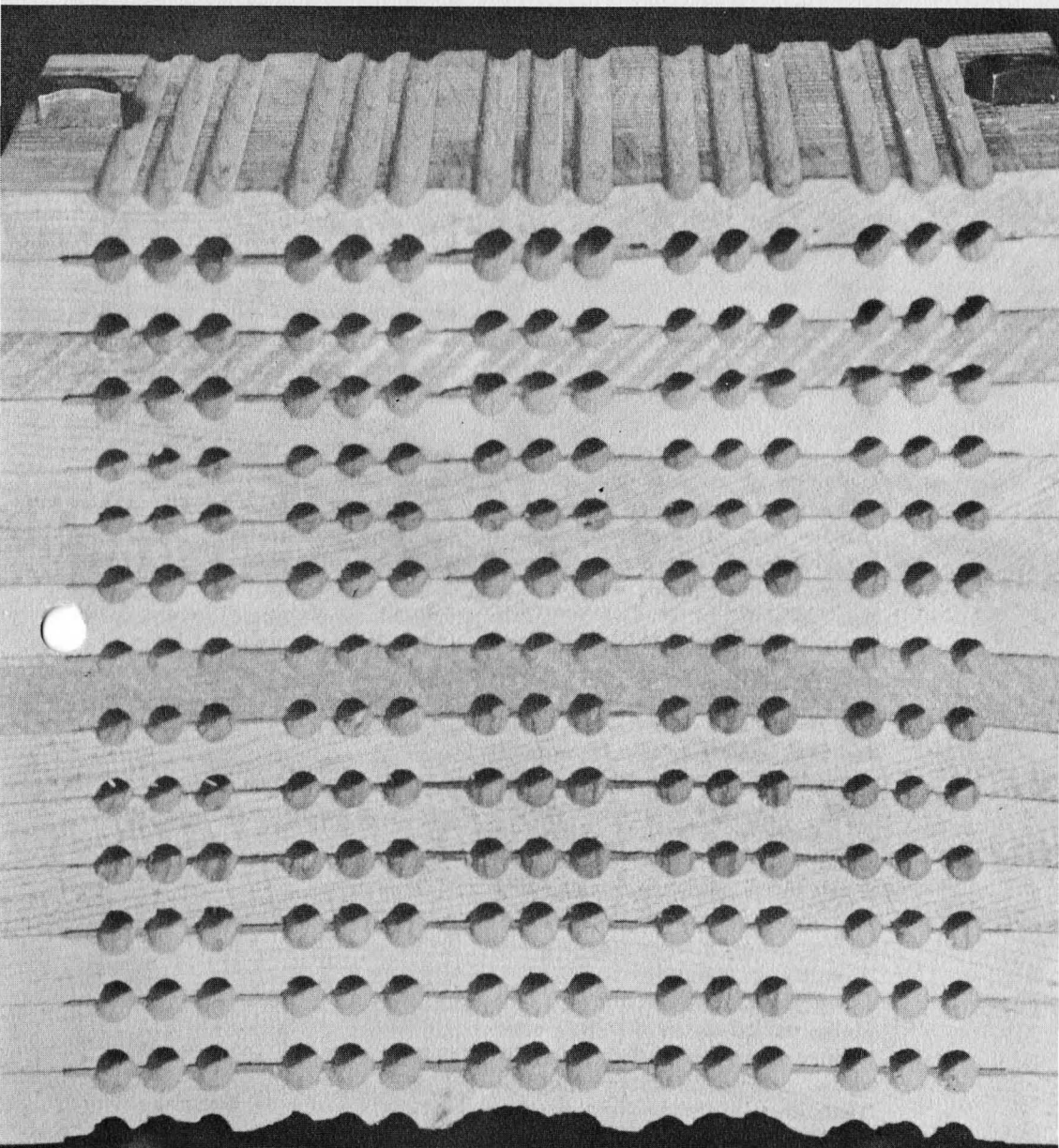
Nye, William P., and George E. Bohart. 1964. Equipment for Making Nesting Holes for the Alfalfa Leaf-cutting Bee. Utah Agr. Extp. Sta. Circ. 145. 7 p.

This Bulletin is brought to you for free and open access by the Pollinating Insects Research Unit at DigitalCommons@USU. It has been accepted for inclusion in All PIRU Publications by an authorized administrator of DigitalCommons@USU. For more information, please contact [digitalcommons@usu.edu](https://digitalcommons.usu.edu).



Equipment for making

NESTING HOLES FOR THE ALFALFA LEAF-CUTTING BEE



William P. Nye and George E. Bohart

EQUIPMENT FOR MAKING NESTING HOLES FOR THE ALFALFA LEAF-CUTTING BEE

(*Megachile rotundata* Fabricius)

William P. Nye and George E. Bohart

Studies by Bohart (1962) and others have shown that holes in wood are usually more attractive to the alfalfa leaf-cutting bee than paper straws or flutes in corrugated cardboard. Nesting units made of wood are also more permanent than ones made of paper and less subject to rapid temperature and humidity fluctuations. Other materials such as plaster-of-paris and metal appear to be less attractive than wood. The most suitable diameter for the nesting holes in wood is close to 3/16 inch. Holes deeper than 5 inches are usually not completely used and shallower holes are less economical in terms of number needed and space occupied.

Holes drilled in wood

Seed growers providing nesting holes for leaf-cutting bees usually drill their own with a drill press, using a standard high speed bit designed for metal. Holes drilled in wood with this type of bit have rough walls with fibers extending into them, especially if the lumber is green or after it has been exposed to a moist atmosphere. Projecting fibers greatly reduce use by bees. Holes drilled in well-cured, close-grained fir with a high-speed wood-

drilling bit may remain relatively clean, but the bit must be kept sharp. A seed grower in Oregon has developed a pneumatic gang drill with 62 single-flute bits with which he makes nesting holes on a commercial basis. This appears to be an excellent piece of equipment but is beyond the means of the seed grower interested only in making holes for himself and, perhaps, his neighbors.

A major difficulty with drilled wood blocks is the impossibility of disassembling them to inspect the nests and clean the holes. Since the bees do not reuse holes from which there has been no emergence, it becomes necessary eventually to re-drill many of them. To distinguish old nests that need re-drilling from new ones, it is necessary to mark all nests in the spring before placing them in the field.

Use of grooving equipment to make holes in wood

Available equipment can be modified to make multiple semicircular or U-shaped grooves in boards. Boards with semicircular grooves can be matched in series to make circular tunnels (fig. 1) and those with U-shaped grooves can be stacked back-to-groove to

The authors are entomologists in the Entomology Research Division, Agricultural Research Service, U. S. Department of Agriculture and stationed on the Utah State University campus.

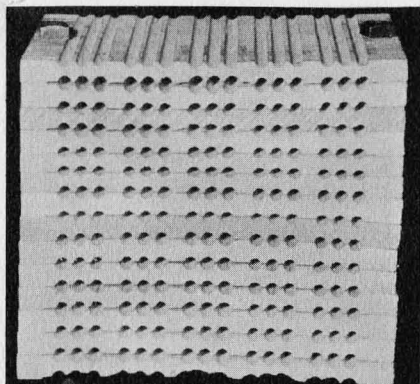


Fig 1. Boards with semicircular grooves matched in series to make circular tunnels

make tunnels that are flat on one side (fig. 2).

The following advantages of grooving rather than drilling are readily apparent: (1) The grooves can be cut with the grain and thus present no problem with rough or fibrous walls. (2) Multiple units can be assembled to cut a large number of grooves at once. (3) Equipment for making grooves can be built from commercially available parts by anyone with some machining experience and access to a shop. The only parts we could not obtain (and consequently had to machine) were the rollers and the shaft with left hand threaded nut. (4) A multiple cutter is much less expensive to build than a gang drill and, since grooving places little strain on the cutters, maintenance is low. (5) The nesting units can be readily disassembled and the nests pushed out and stored in separate containers for later emergence. Thus, clean, empty units can be placed in the field whenever advisable.

Types of grooving equipment

Two basic types of grooving equipment have been made for leaf-cutting bee nesting holes. The first type was constructed in our shop with relatively inexpensive items

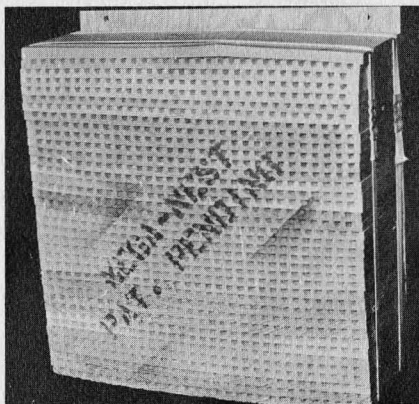


Fig. 2. Boards with U-shaped grooves stacked back-to-groove

(total cost between \$350.00 and \$400.00). This equipment consists essentially of a series of cutter heads mounted similar to circular saw blades on an arbor. The second type consists of a jointer or planer with the blades ground to cut a series of grooves 3/16 inch wide and deep. The planer should be able to make cuts at least 1/4 inch deep. A machine modified from a 12 inch planer to cut 30 grooves at a time was designed and assembled by an alfalfa seed grower in Fillmore, Utah, for a cost of about \$1,000.00. Jointer equipment would be less expensive but the number of grooves that could be cut at one time would be more limited (15 grooves for a 6 inch jointer).

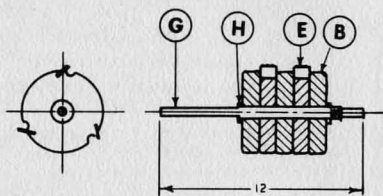
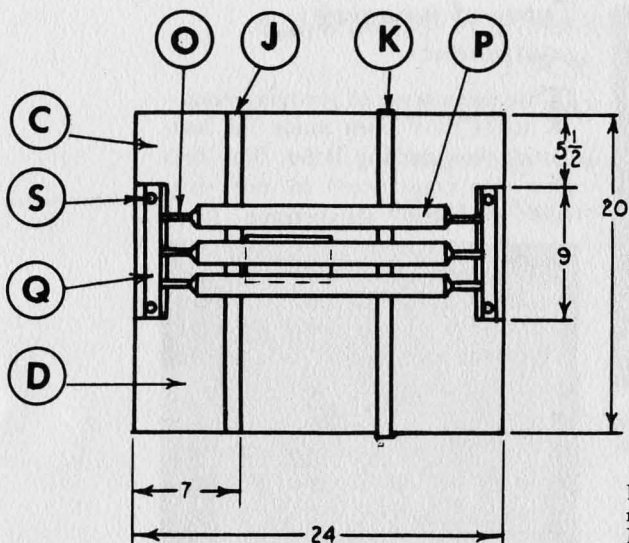
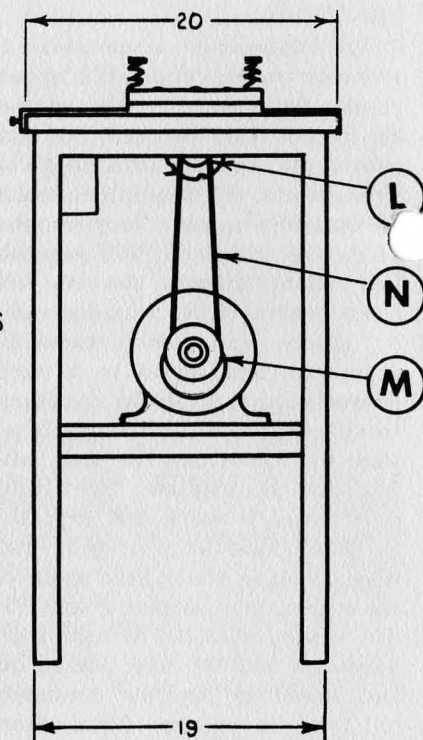
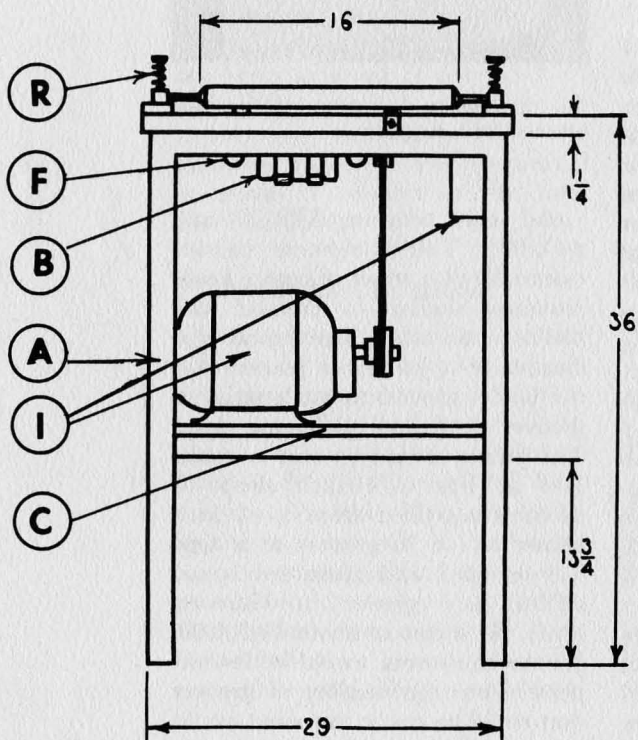


Fig. 5. Drawing of cutter heads and shaft for equipment

Fig. 3. Drawing of equipment using molding cutter heads and knife sets
Letters correspond to those used in parts list



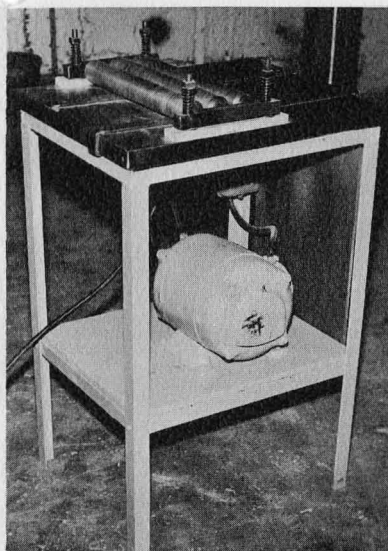


Fig. 4. Same equipment photographed

Detailed description of equipment using molding cutter heads

Our original model of the first basic type mentioned in the paragraph above made use of three cutter knives mounted in each cutter head and ground to cut $3/16$ inch wide and $3/32$ inch deep semi-circular grooves approximately $1/16$ inch apart (fig. 5 and 6).¹ Shortly after the first model was built, these knife sets were no longer available and it became necessary to purchase blanks which could be ground by a machinist to cut three evenly spaced U-shaped grooves $3/16$ inch wide and equally deep. Knife sets ground

to these specifications cut U-shaped grooves that don't require matching on adjacent boards (fig. 2).

Following is a list of parts for constructing a cutter with 5 cutter heads designed to cut 15 grooves at a time.

A — Angle iron, $1\frac{1}{2}$ inches, to make legs and framework for table top and motor mount.

B — 5 cutter heads, heavy duty, solid steel molding, with $\frac{5}{8}$ inch arbor hole. (Cutter heads with 1 inch arbor hole are also available).

C — 3 $\frac{5}{8}$ inch plywood — two pieces for table top and one for motor shelf.

D — 1 $1/16$ inch stainless steel sheet metal piece to cover plywood top.

E — 5 cutter knife sets, heavy duty molding, blanks (to be ground by machinist to cut three U-shaped grooves each $3/16$ inch wide and equally deep¹).

F — 2 ball bearing pillow blocks, solid housing, self-aligning.

G — 1 shaft, steel, 12 inches long, $\frac{5}{8}$ inch in diameter.

H — 1 safety collar.

I — 1 motor, heavy duty, totally enclosed, 60 cycle, 1 to $1\frac{1}{2}$ horsepower, 230 volts, single phase or 230 volts, 60 cycle, three phase with starter switch, 1725 revolutions per minute.

J — 1 bar, table length and $\frac{1}{4}$ inch by 1 inch (used as fixed rip fence).

K — 1 bar, $3\frac{1}{2}$ inches longer than table and $\frac{1}{4}$ inch by 1 inch (used as adjustable fence).

L — 1 V-pulley, $1\frac{3}{4}$ inch; $\frac{5}{8}$ inch bore for cutter head.

¹Delta Industrial Machines, Rockwell Manufacturing Company, 400 North, Lexington Avenue, Pittsburgh, Pennsylvania.

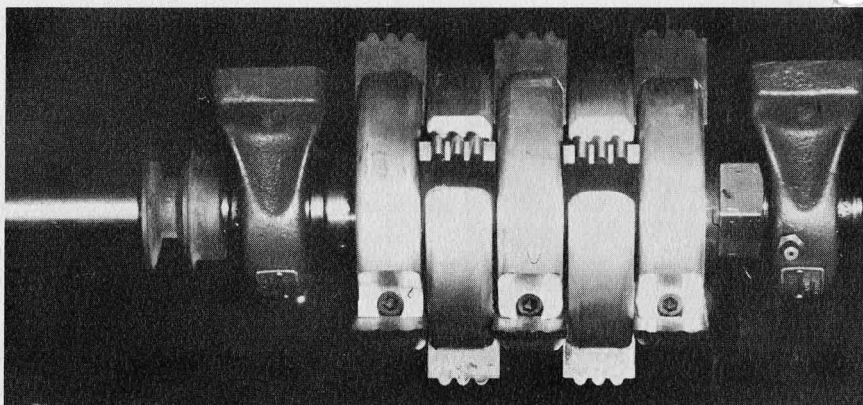


Fig. 6. Photograph of cutter heads

M — 1 V-pulley, $3\frac{1}{2}$ inch for motor.

N — 1 V-belt.

O — 3 pieces $\frac{1}{2}$ inch shaft, steel (used as shafts for roller).

P — 3 rollers, steel, $1\frac{1}{2}$ to 2 inches in diameter and about 16 inches long (see text).

Q — 2 1-inch-square steel bars for attaching rollers to table top).

R — 4 2-inch coil springs of type used in mower wheel dogs (to maintain pressure of rollers against lumber).

S — 4 bolts and nuts, $\frac{1}{2}$ inch by 6 inches (for mounting rollers to table top).

The general layout of the equipment is illustrated in figs. 3 and 4. The top is 20 by 24 inches and 36 inches high. The steel rollers can be machined from a $1\frac{1}{2}$ inch water pipe. Each roller has a piece of steel bar $\frac{1}{2}$ inch long by $1\frac{1}{2}$ inches in diameter welded in each end and drilled with a $\frac{1}{2}$ inch bit to accommodate the steel shaft. The rollers keep the lumber pressed against the cutters and protect the operator. The desired roller pressure is maintained

by tightening a nut against the springs mounted on the blocks that hold the rollers. The steel bar used as an adjustable fence should be crimped around the ends of the table and provided with a set screw at one end to tighten it at the proper distance from the fixed fence. The shaft, which is mounted immediately under the table, is provided with nut, pillow blocks, collars, cutter heads, and pulleys as shown in figures 5 and 6. We found it necessary to cut a left-hand thread on one end of the shaft and make a left-hand nut to tighten the cutter heads together. The teeth of the cutter knives project above the table surface through an oblong $2\frac{1}{8}$ by $5\frac{1}{4}$ inch slot cut through the plywood table top under the middle of the set of rollers. The plywood top should be protected with a piece of stainless steel sheet metal.

Thickness of the board to be grooved should be from $5/16$ to $6/16$ inch. The most convenient width depends upon the number of cutter heads mounted on the arbor (fig. 5). Pieces of any length can be used, but we recommend that after being grooved they be cut into 5

inch lengths with a fine-toothed circular saw. The sawed ends can be wire brushed to clean off any projecting fibers. The stack of grooved boards should be bolted or strapped together and one end fastened to a piece of wood to close off the inner end of the holes (fig. 2).

Equipment using a single molding cutter head mounted on a bench saw

The grower who has a circular bench saw and wishes to make grooves with a minimum initial investment can mount a single molding cutter head on the saw arbor and have a set of knife blanks ground by a machinist to the specifications given in the parts list above. Although this equipment cuts only three grooves at a time, nesting holes can be made faster than with a single bit drill press if the boards be grooved are more than a foot g.

Mention of a proprietary product in this publication does not constitute a guarantee or warranty of the product by the Utah Agricultural Experiment Station and does not imply its approval

Description of equipment using shaper cutters

A similar machine to the one using a series of molding cutter heads, but which avoids the need for having blank knife sets ground by a machinist, makes use of shaper cutter D-191.² This cutter makes three grooves 3/16 inch wide by 3/32 inch deep. A series of these shaper cutters should be mounted on a shaft. The cutter head is then mounted immediately under the table. Rip fences and spring-mounted rollers can be used as described for the unit with the molding cutter heads and knife sets.

Boards grooved by this equipment, which makes semicircular grooves, must be stacked with the grooves opposing each other to make circular holes (fig. 1). The boards should be accurately cut to a uniform width and length so they can be placed in a close-fitting form at the time they are strapped together.

²Delta Industrial Machines, Rockwell Manufacturing Company.

to the exclusion of other products that may also be suitable.

LITERATURE CITED

- Bohart, G. E. How to manage the alfalfa leaf-cutting bee (*Megachile rotundata* Fabr.) for alfalfa pollination. Utah Agr. Exp. Sta. Cir. 144, 1962. 7 p.