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Double-Drum Sawdust Stove

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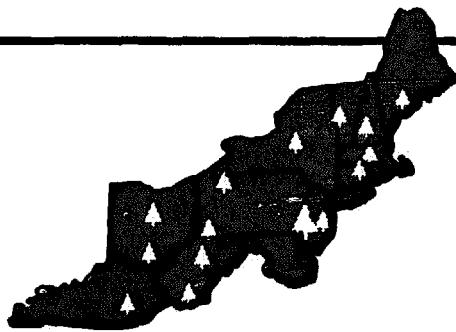
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# USDA FOREST SERVICE RESEARCH NOTE NE-208

1975

## Northeastern Forest Experiment Station



FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 6816 MARKET STREET, UPPER DARBY, PA. 19082

### DOUBLE-DRUM SAWDUST STOVE

ODC 889.811

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**Abstract.**—An inexpensive home-made stove for burning loose sawdust is described. The stove, which is in common use in other parts of the world, can heat a room 20 feet square for 6 to 10 hours without tending.

In the United States, sawdust traditionally has been burned in large furnaces for industrial heating, in smaller furnaces for home heating, and in fireplaces in the form of compressed logs. In other parts of the world, loose sawdust has been burned for years in inexpensive double-drum stoves. These stoves are well suited for heating cabins or workshop areas.

The double-drum sawdust stove has other advantages. It is inexpensive to fabricate; it uses recycled components; it burns inexpensive fuel; and it heats a long time with minimum tending.

After seeing these stoves heating homes in

Chile and reviewing plans<sup>1, 2</sup> for the types used in Afghanistan and England, I fabricated an experimental stove (fig. 1) at the Forest Products Marketing Laboratory in Princeton, West Virginia. Then I learned how to use the stove by firing it with several kinds of fuel having different moisture contents.

<sup>1</sup> The plan is available from Volunteers in Technical Assistance (VITA), 3706 Rhode Island Avenue, Mt. Rainier, Maryland 20822.

<sup>2</sup> Wood Waste as a Fuel. For. Prod. Res. Lab. Res. Leafl. 41. Princes Risborough, England. 11 p. 1956.

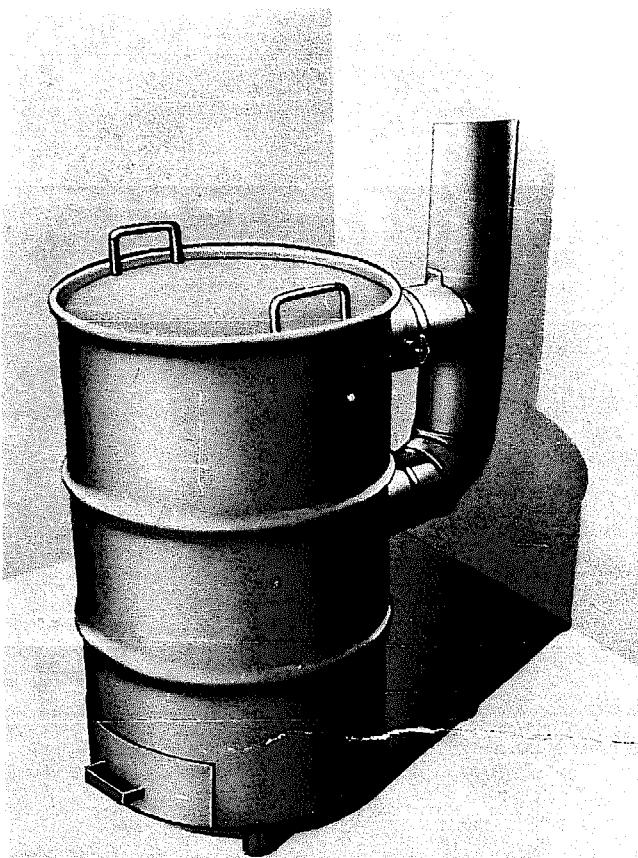


Figure 1.—The double-drum sawdust stove.

## Fabrication

The experimental double-drum stove was made from a 55-gallon steel drum and a 30-gallon drum, plus about \$25 worth of other materials, including stovepipe. Tools needed for fabrication are tin snips, hammer and anvil, pop rivet tool, drill and bit, metal-cutting saber saw, and equipment for brazing with bronze.

The stove (fig. 2) consists of two drums, one inside the other. A false floor inside the outer barrel supports the inner barrel. A drawer opening below the false floor provides draft, and the drawer catches dropping ashes, which are then easily removed. Three-inch holes in the center of the false floor and the inner barrel bottom let air pass up to the fuel and let ashes fall into the drawer.

A tightly fitting lid covers the outer barrel. Under this lid are about 3 inches of clearance

to the top of the inner barrel. Two 6-inch diameter stovepipes exit from the outer barrel, allowing smoke to exhaust. The outer barrel is supported by three legs to keep excess heat from the floor and prevent rocking.

The false floor and drawer were fashioned from 20-gage sheet metal. Drawer tabs and curved front were fastened with pop rivets. The false floor rests on two parallel  $\frac{1}{2}$ -inch steel rods, which were run through holes on opposite sides of the outer barrel, and were brazed to it.

Two handles of the lid and one on the drawer were made of  $\frac{1}{2}$ -inch steel rod, bent to shape, and attached by brazing.

The two joints of stovepipe were brazed to the outer barrel, one near the top of the stove and the other directly beneath it. These two horizontal pipes join into a common vertical pipe. The upper horizontal pipe is fitted

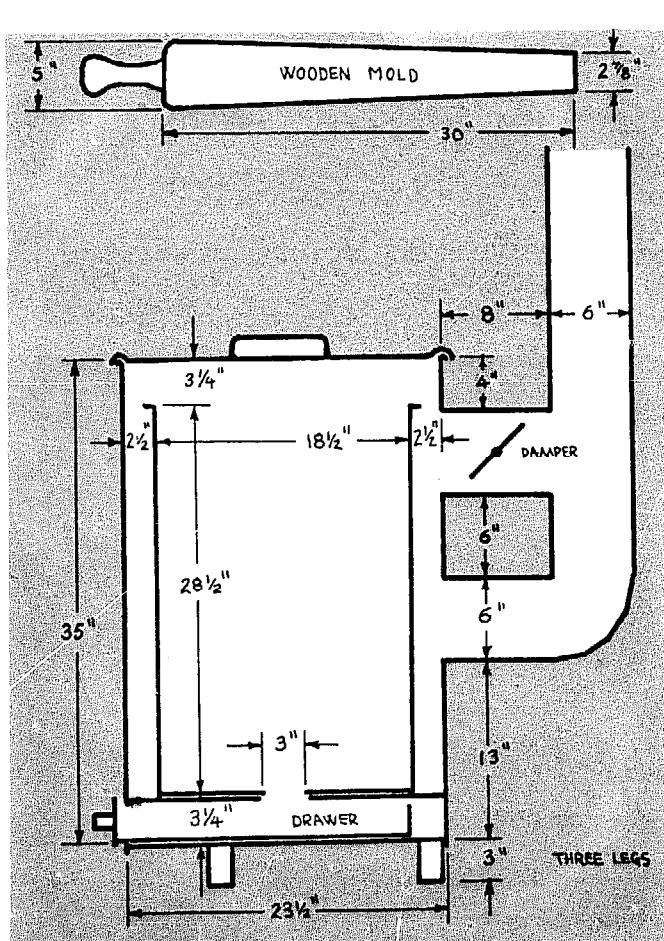


Figure 2.—Design of the experimental double-drum stove.

with a damper. The vertical pipe is fitted with elbows, straight lengths, wall or ceiling thimble, and a vent cap to suit the individual installation.

Smaller or larger stoves can be fabricated with heavy-gage sheet metal (about 14 gage). The relative sizes of the components should be roughly proportional to the dimensions of our experimental stove.

### Installation

The stove should be placed at least 24 inches away from any combustible wall or floor material.<sup>3</sup> It should be set on a fireproof floor pad that extends at least 18 inches in front of the drawer opening. A wall thimble or triple wall pipe should be used where the

pipe goes through the wall or ceiling and roof. The flue pipe should not have long horizontal sections, as they favor condensation of flue gas. The condensates leak at the joints and cause pipe corrosion.

### Fuels

In addition to sawdust, bark residue from sawmills and planer shavings from planing mills can be burned in the stove. The limiting factor for fuels is their moisture content. Though fuel having more than 100 percent moisture content (oven-dry basis)<sup>4</sup> will burn, most of the heat is used in evaporating fuel moisture. Fuel below 60 percent moisture content works well. Fresh sawdust, shavings, and bark typically have moisture contents

<sup>3</sup> Using Coal and Wood Stoves Safely. National Fire Protection Association NFPA HS-8. 12 p. Boston. 1974.

<sup>4</sup> The water in the material weighs as much as the dry material itself.



Figure 3.—The stove filled and ready for firing (lid removed). Notice the hollow center in the fuel charge.

ranging from 50 to 110 percent. The best source of fuel is sawdust or shavings from dried lumber.

Fuel can be stored in a bin or in plastic garbage bags. If a bin is used, the inner barrel is either removed and taken to the bin for filling, or a large bucket is used to transfer the fuel from bin to stove.

### How to Use the Stove

A round wooden mold, 3 feet long, tapering from 5 inches to 2 $\frac{1}{8}$  inches, is used to shape the fuel charge.

To fill the stove, place the small end of the wooden mold in the hole at the bottom of the inner barrel. Then tamp sawdust or bark around it until the inner barrel is full. Wet fuel should not be tamped as much as dry fuel. Carefully remove the mold, leaving a vertical hole in the center of the fuel charge (fig. 3).

Before lighting the fire, open the drawer and damper. Then crumple waste paper,

drop it down the hole in the fuel, and place the lid on the outer barrel. Place additional crumpled paper in the drawer and light it; move the drawer in so the flames will ignite the paper in the hole.

Once the fuel is burning, adjust the drawer and damper to obtain the desirable rate of burning and output of heat. Closing the damper forces hot air to circulate lower in the stove before leaving through the bottom stovepipe. Thus more heat is transferred to the room and less is lost through the pipe.

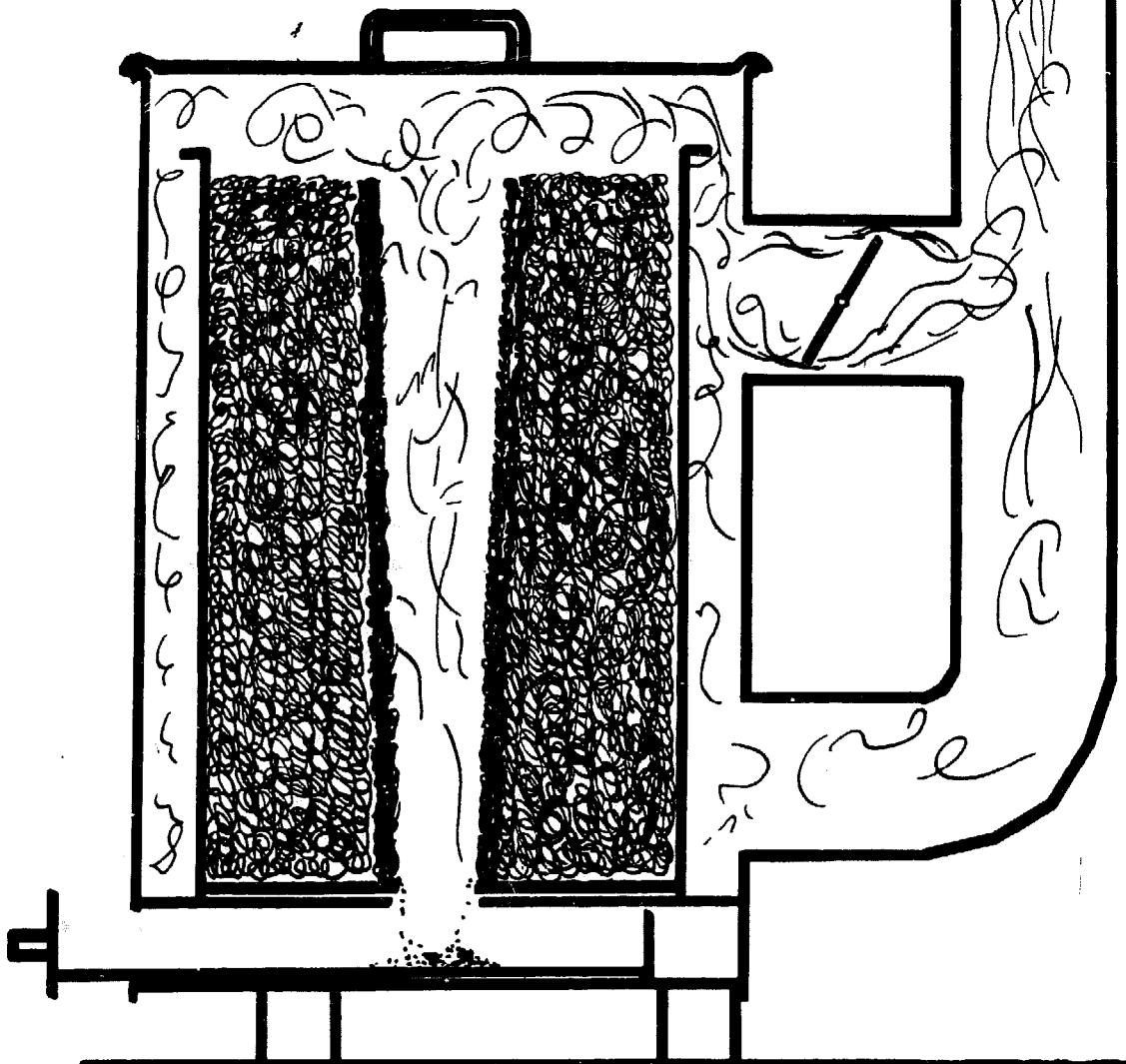
**CAUTION:** Do not open the lid while the fuel is burning. Oxygen thus mixed with flammable gases can cause a flare-up.

With dry sawdust and a good draft, one charge of this stove can heat a room 20 feet square for 6 to 8 hours with no tending. Wetter fuel heats less but lasts longer. During the first 2 hours of burning, there is enough heat at the center of the lid to boil water or cook with. As burning progresses, the heat on the lid is distributed more toward the rim.

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# SAWDUST STOVE

*A Natural for Heating Cabins  
and Cutting Fuel Costs*



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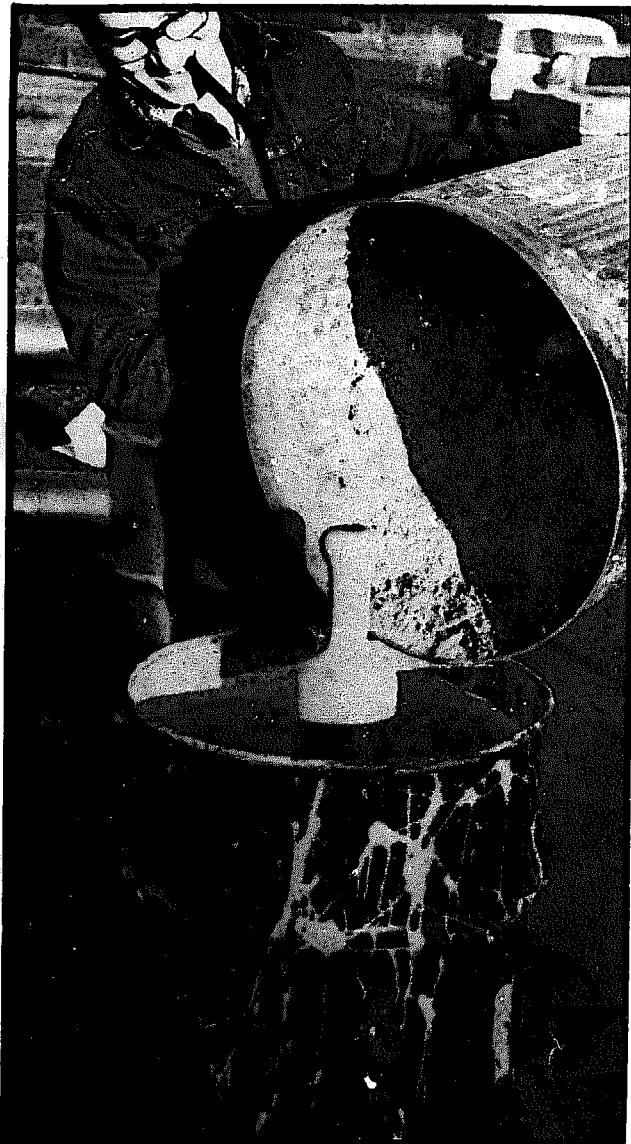


**W**ith today's Energy Crisis on everyone's mind, new sources of fuel for heating, and ways to cut heating costs, are becoming increasingly important.

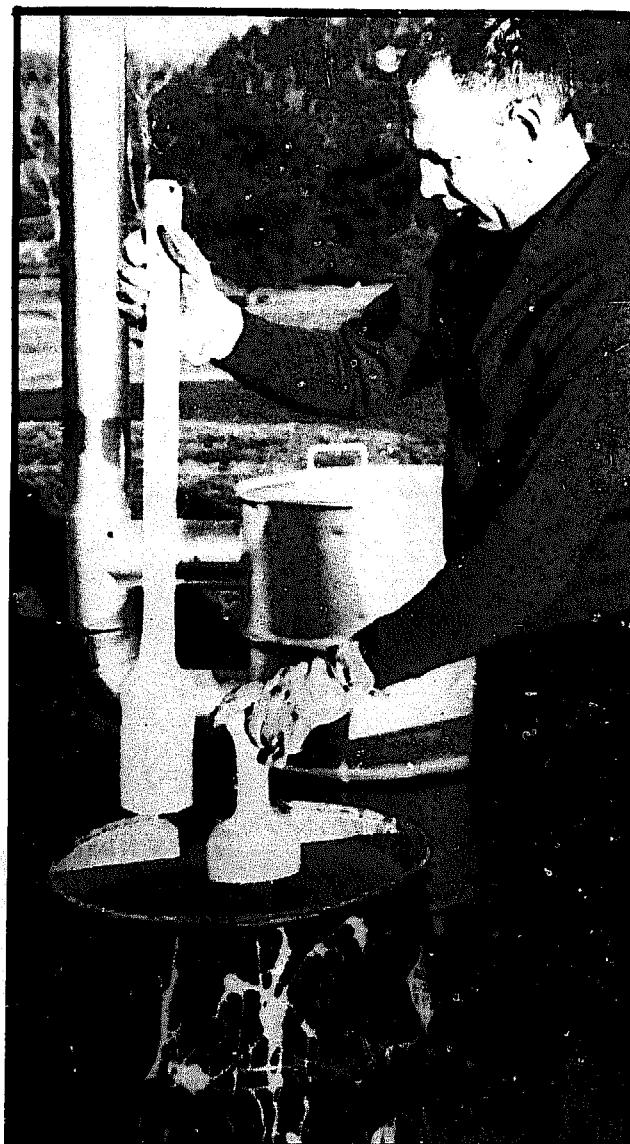
For the energy-conscious and economy-minded, sawdust can be one excellent source of heating fuel. One Forest Service employee urges the use of a stove and sawdust-fuel system that can provide enough energy to heat a cabin or workshop adequately.

The sawdust-burning stove is not a new idea. It is used to heat dwellings in many underdeveloped parts of the world, including Asia and South America.

Sawdust is a readily available fuel throughout the United States. Mountains of it are produced and generally discarded by sawmills each day. As a heating fuel



*Filling the inner barrel with sawdust. Note the wooden insert in the center.*



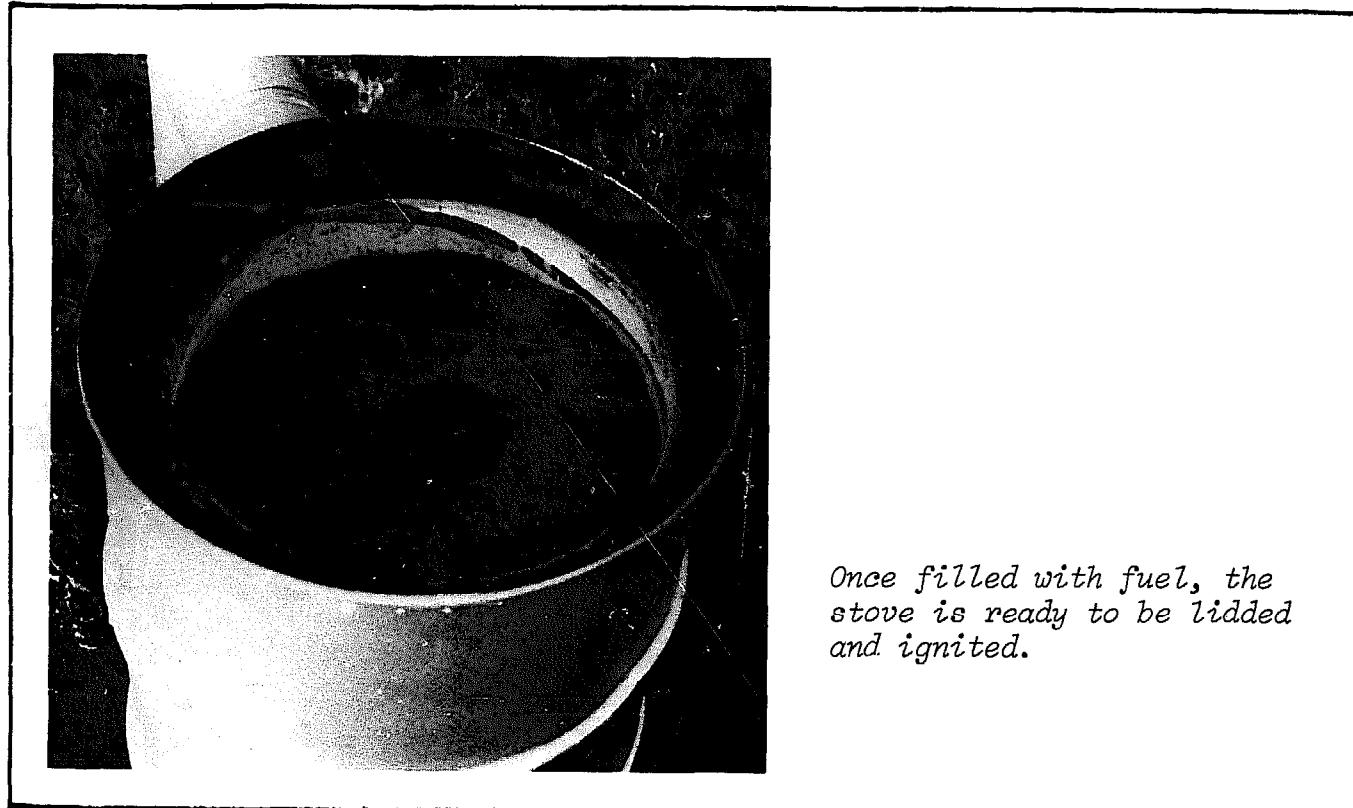
*To pack sawdust in the barrel tightly enough, it should be tamped down.*

it would be quite inexpensive to obtain. Bark, another residue at many sawmills, can be used as an alternate fuel. For most efficient heating, the moisture content of both these materials should be below 60%.

The stove that has been tested by Forest Service Market Analyst Jeffrey L. Wartluft of the Forest Products Marketing Laboratory in Princeton, W. Va., is likewise inexpensive to construct. The test stove was made with about \$25 worth of materials and simple tinsmith's tools. In this stove, one charge of sawdust can

burn unattended for 6 to 10 hours, depending on the moisture content of the sawdust and on draft conditions. The drier the sawdust, the greater the heat given off. At best, it can generate enough heat for a 20 X 20 foot room.

The stove is basically two steel drums - a 55-gallon drum and a 30-gallon drum - set one inside the other. A false floor inside the outer barrel supports the inner barrel above a drawer, which serves as a draft to let air in and also catches ashes for easy removal. In the center of the false floor and in the bottom of the inner barrel are 3-inch holes that permit air to pass up to the fire. A tightly-fitting, removable lid covers the outer barrel, while leaving several inches clearance at the



*Once filled with fuel, the stove is ready to be lidded and ignited.*

top of the inner barrel.

The outer barrel sits up on three legs, which keep heat from the floor and prevent rocking. A stove pipe for exhausting smoke is also attached to the outer barrel.

The drawer and false bottom of the 55-gallon outer drum are made of 20-gauge sheet metal. This false bottom is supported by two 1/2-inch steel rods that run through holes in opposite sides of the outer barrel, where they are brazed. Handles brazed onto the lid and drawer of the outer barrel and to the top of the inner barrel are of the same type rods. And the drawer tabs and curved front are fastened by either pop rivets or brazing.

Two 6-inch horizontal stove pipes lead from the outer barrel to join a single 6-inch vertical pipe. One horizontal pipe leads from the top of the barrel, while the other leads from the area immediately above the false floor. The vertical pipe can be fitted with elbows, straight lengths, and a ventilation cap to suit the individual installation. The damper is located in the upper horizontal pipe.

Stoves of other sizes might be fabricated from heavy gauge sheet metal - about 14 gauge.

In preparing the test stove for operation, a round wooden insert is first placed upright in the center of the smaller barrel. The hole at the bottom of the barrel holds it in place. This insert is made of turned wood. At the top, below its narrow handle, it is five inches in diameter, and it tapers evenly to three inches in diameter at the bottom.

When the insert is in place, sawdust can be packed into the container around the insert. Dry sawdust will require more tamping than wet sawdust. After packing, the wooden insert is removed carefully, leaving an open column in the middle of the sawdust. This open space acts like a chimney when the stove is lit and burning.

In lighting the stove, both damper and drawer should be opened to create a full draft. Crumpled paper is dropped into the open column, then the lid of the outer barrel is put on securely. Next a lighted piece of crumpled paper is inserted into the lower drawer. This will ignite the other paper in the column adjacent to the sawdust fuel and will start the sawdust burning. With dry sawdust, paper from a large grocery bag is adequate to start the stove burning. With wetter material, more paper is needed.

Once the fuel is burning, the drawer and damper can be adjusted to control the speed of burning and, in turn, the amount of heat produced. Closing the damper forces hot air to circulate lower in the barrel and causes more heat to transfer to the room. Any excess heat leaves with the exhaust through the stove pipe.

For safety, the stove should be placed at least 24 inches away from any combustible wall or floor material. A wall thimble or triple wall pipe should be used where the pipe goes through the wall or roof to the outside. Before lighting, the lid must be fixed firmly on the stove. And since the stove burns hot enough to boil water, its surfaces should not be touched by skin or clothing. Adequate ventilation, as with all stoves, is a must to prevent possible accumulation of carbon monoxide.

The sawdust stove has a major limiting factor: the moisture content of the sawdust. The fuel should have a moisture content below 60%. Sawdust and bark fresh from the sawmill can have moisture contents anywhere from 50 to 110%. The best sources of sawdust are at the many plants and retail lumber yards that cut dry wood. While fuels exceeding 100% moisture content on an oven-dry basis will burn, most of their heat is used to drive off moisture and will, therefore, not be available to heat the room.

Sawdust and other wood residues are, indeed, excellent, but generally overlooked, sources of heating fuel. With this relatively simple system, they could be used to meet the needs of certain heating situations and could help to ease the strain on both energy supplies and pocketbooks.



*Lighted paper is inserted into the drawer to ignite the sawdust stove.*