Price $1.95

THE COAL & WOOD BURNERS ALMANAC

A Guide to Solid Fuel Burning along with the Owners Manual for the Model 404

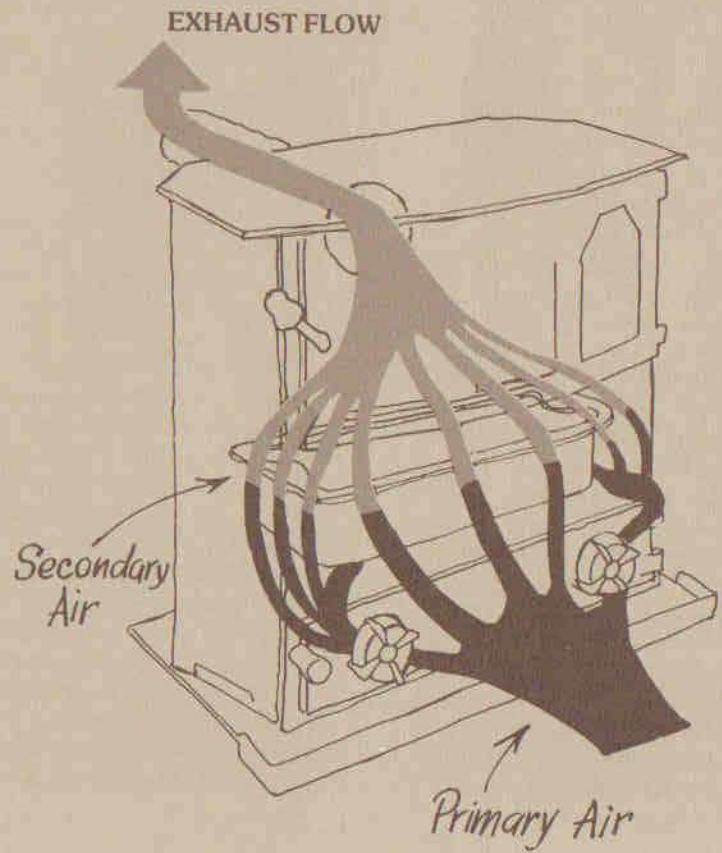
Crane Stoves

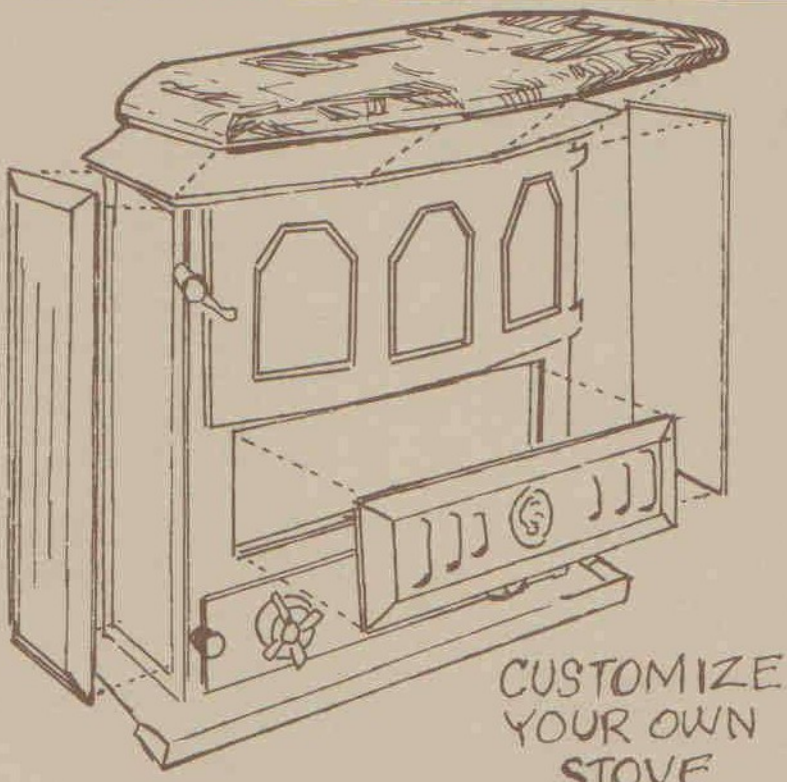
5th Edition

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The solid cast iron top level load door has a deep gasket channel to insure that, when the door is securely latched, the only air entering the system is through the dual controls on the equally well gasketed bottom level service door. Having separate opening doors, both above and below the firebox is critically important for precise coal burning. You will find this feature leads to more effective startups and cleaner operation. In addition, the bay window will allow much wider angle viewing for all to enjoy the mesmerizing fire.

Several modular features are worth paying particular attention to as they offer unique benefits to the consumer. For example, consider the question: "How big a stove should I buy?" One size fits all is terrific if you are buying rubber gloves to wash dishes. When buying a stove however, it is wise to fully understand the range of outputs a unit is designed to produce. Heating requirements





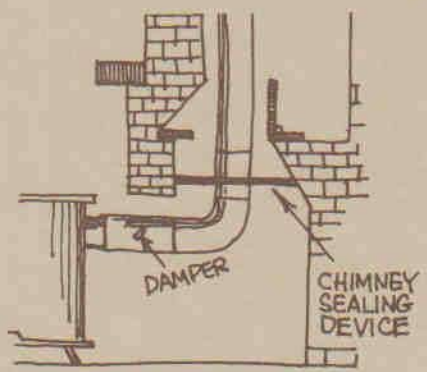
stove requires very little effort to operate manually. Think of it as an automatic transmission or power steering for your car. Shaking down the stove will soon become a job even the kids will want to do.

Another nice ability is having a blower system available with your stove. A word of caution here. A blower will provide you with no more additional heat. It will only move the heated air around better. This is an option that should only be considered after installing your stove.

We at Crane Stoves feel we have the most comprehensive series of solutions to the challenge of energy independence. The Model 404 represents the ideal of comfort, economy, convenience and beauty. Our unique approach to meeting different needs and tastes enables you to achieve basic goals today and to acquire what you may need later, when your outlook changes.

HOW TO PREPARE YOUR CHIMNEY OR FIREPLACE FOR OUR STOVE

Have your masonry chimney inspected, cleaned, repaired and otherwise readied for installation. Have its condition approved by a local building inspector or fire marshal. Make absolutely certain that the chimney is not being used for another heater or an open fire in another fireplace unless specifically authorized by a properly licensed heating contractor and the local authorities. You should then block off the entire upper damper area with a non-burnable material and cut a 6" diameter hole for the flue connector pipe. This pipe should have a vertical rise of at least four feet to provide a good draft before it exits into the chimney. Under no circumstances should the uninsulated pipe pass through a wall or ceiling. The stove may rest directly on a multiple brick hearth or the standard ¼ inch thick asbestos mill board covered by 28 ga. steel or its equivalent.



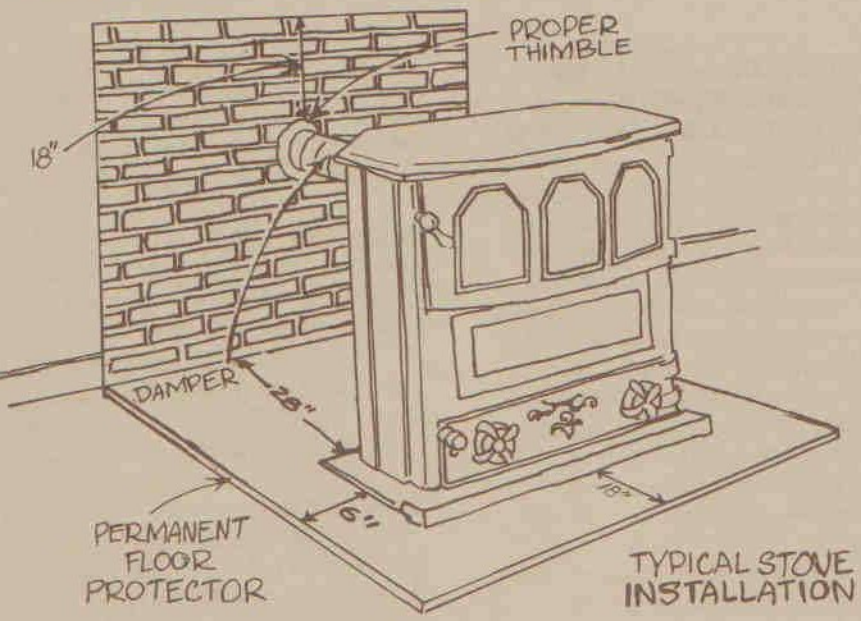
TYPICAL FIREPLACE INSTALLATION

INSTALLATION

Please plan on installing the stove when you have plenty of time on your hands and use a day when hardware stores are open. Keep your heat on in the house. Don't try to heat the house with the stove the first few days. Ask any wood stove owner and he will tell you that it takes a little experience with even the best wood stoves to get promised results. Coal stoves are easier to operate, much less tending etc., but usually take a bit more patience at first.

The Crane Stoves 404, like other quality solid fuel heaters, should be installed with three major considerations: the clearance to other parts of the room, the connector pipe, and the use of a proper chimney.

First, the instructions on clearances. The front of the stove should be kept 36" from combustibles. The sides of the stove should be kept 24" from combustibles. The rear of the stove should be kept 28" from combustibles. Combustible material is anything that might catch fire — like wood walls, chairs, T.V.'s etc. Non-combustible materials (steel, asbestos, brick etc.) may be no closer than 18" to the stove.



TYPICAL STOVE INSTALLATION

The stove should rest on a permanent floor protector, equal to or better than a ¼ inch thick asbestos millboard, covered by 28 guage steel, extending 18" in front of loading door, 6" on either side and rear.

Second, a flue connector pipe is that section that connects from the stove to your approved chimney (factory built or masonry). Floor protection for flue connector must be provided: 2" on either side and 2" beyond the point where vertical rise beigins. This pipe should be no closer than 18" from any combustible material. It shall be 6" in diameter, 24 guage steel or heavier (22 gauge recommended for coal especially). This is to be securely fastened to the flue collar of the stove by either using two screws or a 6" draw-band. This flue connector pipe may have up to a three-foot horizontal section with an upward slope of ¼ inch per foot before it enters your chimney. It should be well supported until it is securely placed into your approved chimney.

You may install a 6" cast iron damper in the flue connector pipe. Generally speaking, depending on your draft, you should keep it open when using coal. You may find closing it slightly is helpful on a well established wood fire. There is no substitute for the rewarding feeling associated with the knowledgeable operation of your stove. Closing the manual damper can lead to a slight increase in efficiency. Don't experiment with it until you have mastered operating the stove with the manual damper in the open position.

A barometric damper may be installed to compensate for overpowering drafts (in coal stoves) and creosote reduction (in woodstoves). [See Draft Pressure on page 26] In some states, safety codes require it. Check with your local inspection authorities to make sure.

Third, instructions on a proper chimney: in the case of a factory built chimney, you should only use a properly insulated and approved unit that is installed according to manufacturer's instructions. These instructions include specific limitations as to clearances from walls, ceilings, roof etc. In the case of your masonry chimney, you should have it inspected and cleaned. It should be in good repair with no cracks or loose bricks. Have it approved for use with solid fuel by your local building inspector or fire marshal. The chimney should not be used as an existing flue for another heater or for an open fire in a fireplace unless specifically authorized by a properly licensed heating contractor and the local authorities. In the case of a fireplace, you should block off the entire space around the flue connector pipe in the upper damper area with a non-burnable material. This pipe should have a vertical rise of 4 feet minimum before it is allowed to exit into the masonry chimney area. This provides a good draft. Under no circumstances should the non-insulated flue connector pipe go through a wall or ceiling. This pipe may be no closer than 18 inches from any combustible material.

Whether using an approved factory built chimney or an approved existing masonry chimney, a proper installation prevails over mistakes, disappointment and accidents.

We do not wish to take the place of your own contractor or your own common sense, but we do wish to offer the following 10 rules of masonry chimney basics:

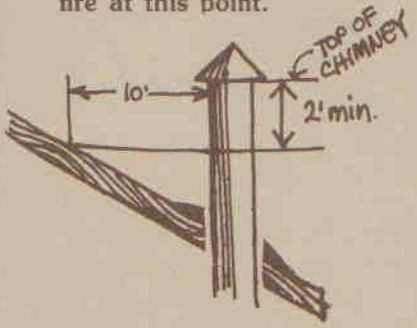
1. A safe masonry chimney must be lined. Suitable liners are clay tile, single wall stainless and poured refractory. Clay tile is preferred for straight chimneys that have interior dimensions allowing retrofit. Rigid and flexible stainless steel are appropriate for chimneys that have changes of direction. Both offer an easily cleaned hard surface and both do a good job of protecting the masonry from harmful byproducts of solid fuel exhaust. Poured refractory offers this and the additional benefit of insulation in the mix. A warmer chimney collects deposits at a slower rate. Being poured, it also can repair mortar joints that have failed, especially in masonry chimneys over 50 years old.

2. The chimney must not be used to support any part of the structure, otherwise, a settling or shifting of the house will crack the chimney. There

should be 2 inches of free clearance around the chimney. This keeps excess heat from igniting combustibles.

3. A chimney used for solid fuel heat should be built from the ground up. A chimney supported by brackets can be easily damaged by a chimney fire and a house fire may result. A shifting or sagging of the bracket will cause the chimney to crack.

4. If your chimney has more than one smokepipe inlet, cover these with a piece of clay tile liner and fill up the inlet with masonry material equal to the chimney thickness. Thin metal snap-in covers are not safe. The initial explosion of a chimney fire often blows such a cover out of the chimney. This opening would then provide oxygen for the chimney fire. You can no longer control it and many times the house catches fire at this point.



5. A chimney must extend above the roof.

6. Your chimney must have a metal cleanout door at the bottom. You need this to remove the soot loosened after a chimney cleaning. Otherwise, the chimney will eventually fill with soot and plug the smokepipe resulting in a houseful of smoke. The cleanout door is really handy for inspecting the inside of the chimney. You do not have to stand on your head — just use a mirror to see inside.

7. Another reminder is to check the inside of the flue with a mirror before the heating season. It is surprising what can happen. On one occasion, a chimney was blocked with a wad of insulation which blew over from a nearby construction project.

8. Vent only one heating device into a chimney. Several things can happen including an automatic furnace failing to ignite and raw fuel is pumped into the chimney. Hot exhuast from a wood fire could then cause an explosion. Fuel oil furnaces and space heaters often fail to function properly, wasting fuel and may cause a house full of smoke. What happens if a chimney fire occurs? You cannot control it because you cannot shut off the draft openings of a gas or fuel oil device. With only a wood space heater vented into the chimney, you can control the chimney fire by shutting off the draft (air supply). Dangerous combustion gases also may be forced into the dwelling.

9. If you plan on building or using an exterior masonry chimney, it should have eight

inches of brick around the flue liner. This thickness is necessary to keep the gases from cooling and forming creosote.

10. Now, for the don'ts. Do not use an old chimney without a proper liner. Do not use a chimney built on brackets. Do not use a chimney with poor mortar. Do not use a chimney built outside the exterior wall of the dwelling made of concrete block for wood heat. This type of chimney is too cold, promotes creosote buildup and has a very high chance of a chimney fire. Also, this type of chimney has a short life. Concrete block can be used for an inside chimney as long as the part above the roof is built of brick or stone. In other words, use a warm chimney surrounded by warm rooms.

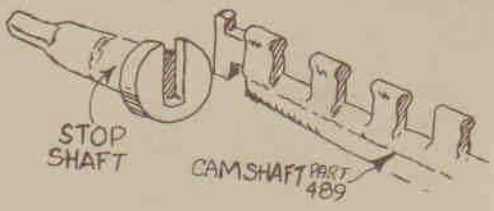
This stove is not for mobile homes.

Should you have any question as to proper installation, you are strongly urged to seek specific advice. Too many severe accidents have occured because of faulty installation. You may consult with the manufacturer and your local stove dealer in addition to the building inspector and fire marshall in your home town or state government. For further information on using your heater safely, obtain a copy of the National Fire Protection Association publication, "Using Coal and Wood Stoves Safely," NFPA, HS-10-1978. The address of the NFPA is Batterymarch Park, Quincy, MA 02269.

FULL COAL SYSTEM INSTALLATION INSTRUCTIONS:

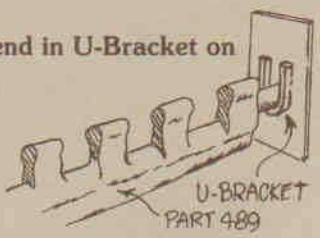
The complete coal system is styrofoam packed in two cartons. No tools are needed and installation time is under 15 minutes.

1) Remove stop shaft plug on left rear of stove and insert stop shaft from the inside so that square portion of shaft faces left. The U-shaped channel should be open at the top on the inside.



2) Insert the camshaft.

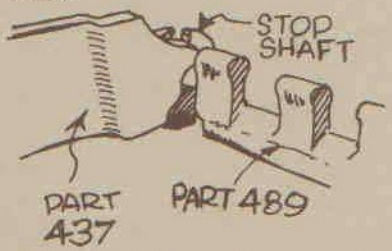
Right end in U-Bracket on right



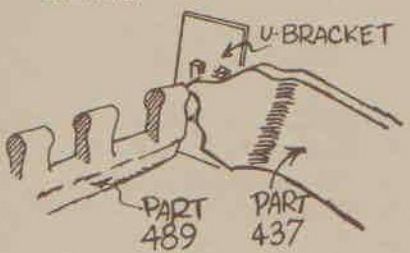
Flat end in stop shaft channel on left

3) The camshaft high-rise and low rise sections correspond exactly with the slotted support bracket already in the stove.

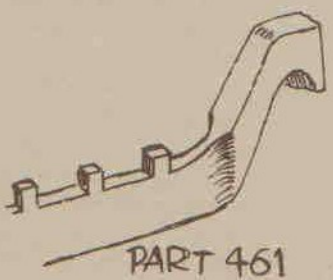
4) There are 21 grate pieces. The 2 end plates sit on extreme left and right sides of the camshaft. The left side end plate touches the end of the stop shaft.



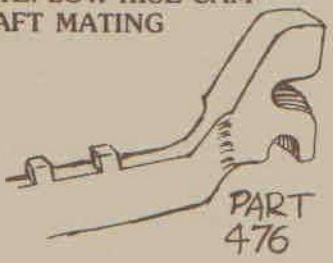
The right side end plate touches the end of the U-bracket.



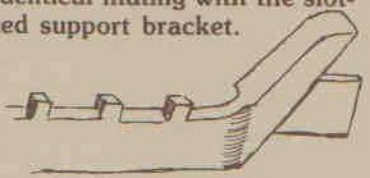
5) There are 10 4-nub pieces that begin and end the alternating array. NOTE: HIGH RISE CAMSHAFT MATING.



NOTE: LOW RISE CAMSHAFT MATING

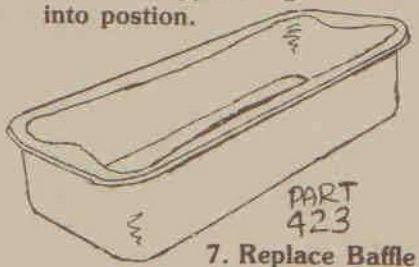


All moving grate pieces have identical mating with the slotted support bracket.



5. Remove exhaust baffle. Slide up, lay flat.

6. Insert the Firepot by using a helper handle that is as long as the inside of the firepot (17¾"). Fit the handle under the crescent grips and lift all 47 pounds one end first into the stove. Line up the firepot over the support ring and lower into postion.



7. Replace Baffle

Partial Coal System – Installation of Mini Firepot

1. Repeat steps 1-4

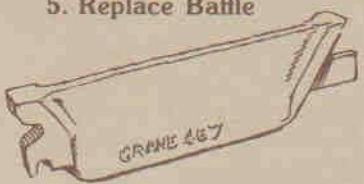
2. Remove two of the 4 nub pieces (3rd from both ends) and replace with mini-pot grate panels. These grate panels reduce secondary air by-pass

and create a fuel cylinder when the mini-pot is inserted

3. Remove Baffle
4. Insert Mini-Fire Pot



5. Replace Baffle



SPRUCING UP THE STOVE

Your Model 404 can be adapted to accept a variety of exterior appearance packages. Each package has a mating system corresponding with holes that have been factory installed with knock out studs. These studs must be removed to reveal the hole.

To remove studs from stove wall, strike the exposed stud from the inside of the stove with a confident blow of an ordinary hammer. The front panel studs may require a center punch as your line of sight may be hampered. Once removed, these studs can not be replaced.

INSTALLING INLAID PARQUET SOAPSTONE

Tools required — scissors, hammer, pliers

You are to make an airspace between the unexposed side of the soapstone and the outside of the stove to assure long service life. Take two 1"x1" gasket squares and press over each stud. Gasket material is provided for this.

Once gasketed, the panels are ready to be attached to the stove. Line the threaded pins up with the holes and slip all four in together. Pressing lightly with the palm of the hand on the exposed face of the soapstone, place the nuts on threads and tighten — finger tight. Using the pliers, tighten each nut only ½ turn more.

If you can not affix nuts to the lower pair of holes on the front panel, a nut driver will help. These nuts are not critical and you may elect to leave them off.

INSTALLING INLAID SOLID SOAPSTONE

Solid soapstone inlays have holes drilled in them that correspond with the holes in the stove. Take the threaded studs and place them in the holes from inside the stove facing out and secure with nuts. When finished the stove's inlay plates will have 4 rigid pins to mount the soapstone inlays. In this mounting system a second nut will hold the stone secure. This decorative nut is available at any lighting supply store. Ask your dealer for advice. Also, with this mounting system the first nut creates an air space but two gasket washers are still required.

INSTALLING INLAID SOLID CAST ENGRAVING

Tools required — screwdriver

Cast engraved inlays have pre-drilled holes in the mounting bosses on the unexposed side. We recommend fitting the self tapping screw to each hole prior to mounting on the stove. Do this by laying inlay face down and inserting and removing each screw. Then place inlay in correct position on stove and re-insert screws. Again, use a double thickness of gasketing material at each hole location.

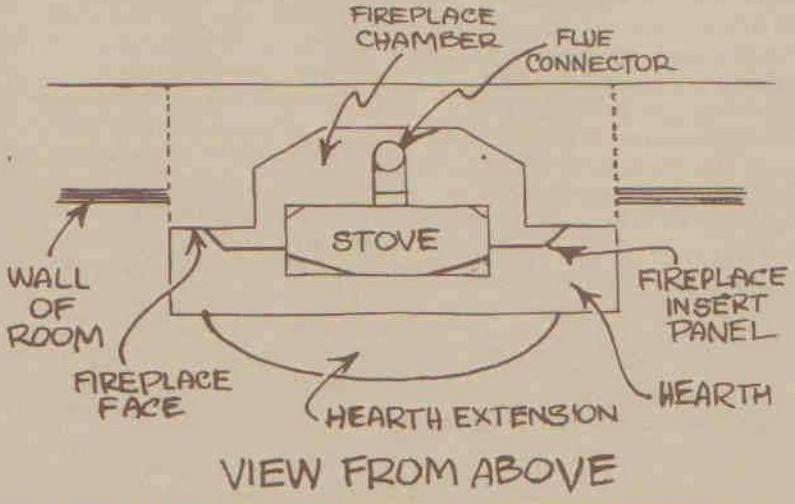
INSTALLING SOAPSTONE TOPS

It is desirable to create an airspace between the underside of the soapstone and the top of the stove. Place gasketing material (provided) on the stove in the positions diagrammed prior to easing the top in position.



INSTALLING FIREPLACE INSERT PANEL

This panel is ready to slide on to a completely installed stove. It has a small service access door on the left and right hand side. Open these, slide panel until it makes full contact with the fireplace, and close them again. Opening the left access foor allows you to shake the stove.



VIEW FROM ABOVE

INSTALLING THE AUTO-SHAKE

The Auto Shake is a motorized articulated arm that is attached to the base plate of the stove and to the stop shaft shaker control. Mounting it to the base plate secures the unit while mounting the arm to the stop shaft creates the drive linkage. A separate spring loaded push button engages the unit and does not require mounting.

OPERATING INSTRUCTIONS

Full Woodstove (No Coal System)

A stove is not a plug-in appliance. Successful operation requires patience and preparation.

After you have properly installed your Crane Stove Model 404 and you have received approval from local authorities, you are ready to begin enjoying the comfort you have been waiting for.

Helpful Tip: The initial firing of any stove produces a miserable odor as fumes from the oil in the stove are driven off. Some people prefer to initially fire a stove outdoors the first few hours. If the initial firing is done indoors, ventilate the room by opening windows and outside exit doors. Keep your conventional heating system on.

Let's light the fire! Open your flue damper, close the ash door and open the round air controls all the way. Take 10 sheets of newspaper and make grapefruit-size balls. Place 9 of these on the bottom of the stove through the top loading door. Add some light-weight kindling, old shingles, small dry pine branches and the like. Not too much! Being the first fire, you want to heat the glass and painted metal slowly, to cure and bake.

Place one paper ball in the flue collar and light it. This will begin moving the stagnant air up the chimney and establish a draft immediately. This will help prevent smoke from entering the room. Draft is established when the paper burns rapidly and makes a small roar. Light the paper at the bottom of the stove and close the top door. The paper will burn, igniting the kindling.

Never use gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fluid, or similar liquids to start or freshen up a fire in this heater. Keep all such liquids well away from the heater while it is in use.

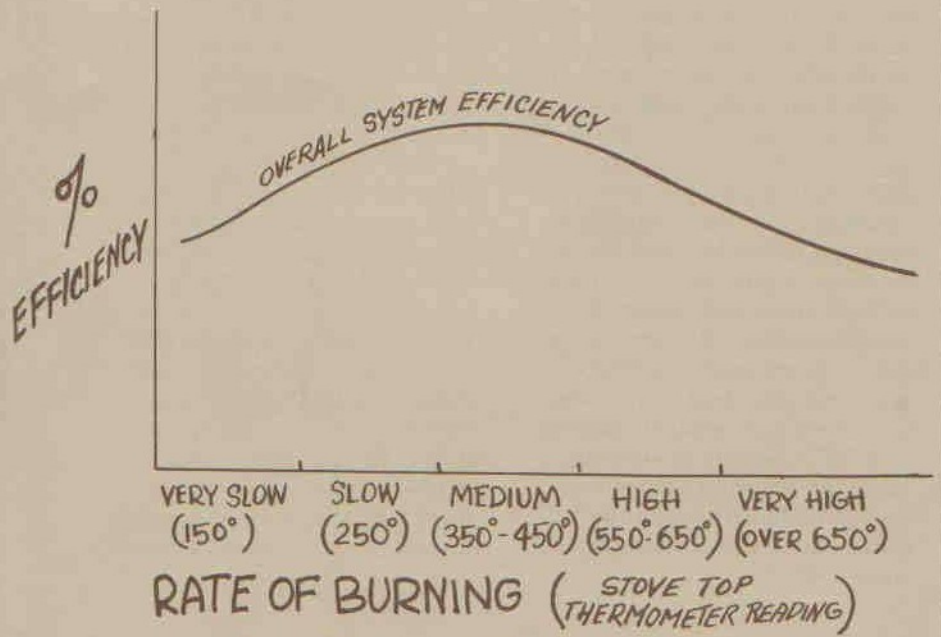
Once the kindling is lit add more kindling and 2 or 3 logs no bigger around than your wrist. Once the smaller logs are ignited, add more kindling and a few more logs. Once these logs ignite you have established a fire! Two things need to be looked for: 1) it is not necessary to heat the stove over 400 degrees for the first 24 hours, so adjust the draft controls as necessary to restrict air flow; 2) as the oil in the steel burns off, you will think there is a hole in the stove emitting smoke from the fire, especially from the series of ventilation exhaust holes on the left and right sides. Be patient, it will gradually stop.

There are two kinds of fires to learn how to maintain. One type of fire is employed in not so cold weather. Starting with the fire we have just made, we will maintain it by adding a couple of logs every hour. This fire will chase the chill away and does not require a full fuel load. It is a serious mistake to load the stove completely and starve it for air because it gives you too much heat. Certainly lower heat output is attained just as certainly as large quantities of creosote are produced! Creosote is the volatile material that can catch fire in the chimney and is to be avoided at all costs. To chase the chill keep a small bright fire and not a big dull one. Safety first!

Colder weather demands a second type of fire. Fill the stove to capacity (not above bottom of top door) and let it burn at a rate that matches your need for comfort. Refill the stove every 4-6 hours to keep output consistently high.

For the all night burn, when our need for heat is lower, we will close the air controls, on a full load, to keep it burning until we wake up. Our goal is to have enough glowing coals in the morning to avoid relighting the stove.

Creosote will form during this overnight burn but it can be easily taken care of. Since every morning finds us longing



for some extra comfort, the first person up should open the air controls and put in some wood. As the hot fire comes to life, the creosote will burn away. At temperatures above 500 degrees on the surface thermometer for one hour or more, all the creosote is gone. Do, however, inspect your chimney once a month to become familiar with accumulation. Excessive amounts can be dangerous and should be removed with a stiff brush. Consult a professional chimney sweep for on sight advice. Once a year cleaning is only a minimum requirement.

Unlike the dial on the wall, stoves are not specific about meeting your comfort requirements. There are many reasons why your experience can vary from your neighbors. Some houses are easy to heat, while others are not. Some wood burns well, while other wood does not. There are as many types of chimneys as there are people. It is entirely possible to produce reliable, steady comfortable heat from a stove as anyone who has done so for 2 years will gladly tell you. Be patient. Experts agree that it takes time to adjust to any stove and that to become an expert you must be patient.

NEVER run the stove with doors open during operation. Open the door to clean the ashes out of stove, perhaps once a week.

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of a slow-burning wood fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire. The chimney connector and chimney should be inspected at least twice monthly during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire. A similar explanation is that creosote can be the result of the incomplete combustion of wood. When combustion is not complete or when wood doesn't burn completely, unburned gases are given off. These unburned gases will be drawn through the stove into the smoke pipe and exhausted up the chimney. When these unburned gases cool down, creosote results. The colder they get, the harder the creosote forms. The harder it forms, the harder it is to remove. Creosote is still combustible and will burn uncontrollably if ignited. Creosote build-up can be avoided or kept to a minimum by: 1) burning only seasoned dry wood, 2) maintaining hot fires, 3) using inside chimneys and 4) using coal.

In the event that you should experience an uncontrolled or runaway fire in the stove, smoke pipe (flue connector pipe), or chimney, do the following immediately:

1. Close all doors, dampers, air controls, etc., on the stove. This will starve the fire of air and cause it to die down.
2. If there is a manual damper in the stove pipe (flue connector pipe), start closing it down slowly.
3. Call your local fire department.
4. If the fire is brought under control without any serious damage done to the building, and the stove appears to be operational, check it over thoroughly before putting it back into service.
5. Carefully examine the stove, dampers, controls, smoke pipe (flue connector pipe), and chimney from top to bottom. By following these basic steps you bring the fire under control. The time it takes to bring it under control depends upon the amount of fuel in the stove and the rate it is burning at the time it is detected. Smoke detectors and fire extinguishers are an absolute must and should be a standard part of any heating system.

COAL SYSTEM — WOOD OPERATION

Early and late season coal users have a need to chase the chill from their homes with the spot heat bursts a modest wood fire can provide. Since this is also the foundation for full coal operation, let's begin by starting this type of fire.

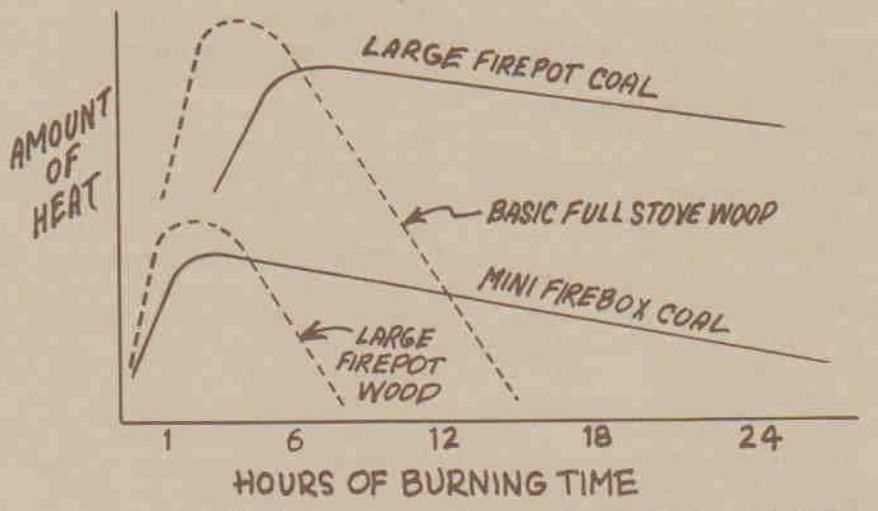
Crumple 6 sheets of newspaper into grapefruit size balls. Place 5 of them on top of the shaker grates and one in the flue collar. Place kindling on top of the newspaper. Light the paper ball in the flue collar to create a draft. Light the rest of the newspaper and shut the top level loading door. Make sure the draft controls on the bottom level service door are open all the way.

Our goal is to heat the entire exhaust path with a modest fire. This secures and stabilizes the draft. Once the kindling is fully involved, add more kindling and 3 or 4 small logs. Once the logs are fully involved, add a little more kindling and 2 or 3 more logs. Set the draft controls on the bottom level service door to maintain a stove top temperature reading of 500 degrees.

To maintain this fire and this output level, add logs every hour or so. If your demand for heat is short term, stop adding wood 4-6 hours before you expect your demand to cease. If your demand for heat increases, you may add more wood and more air, or, you may switch to burning coal.

COAL OPERATION

The hot coals from an established wood fire are the ideal beginnings of successful



4 WAY SOLID FUEL PERFORMANCE

coal burning. Add 10 lbs. of coal, enough to provide a layer 2" deep on a base of hot wood coals. Open draft controls all the way and wait 10 minutes. When the coal is glowing red, add 10 lbs. more coal. Wait 10 minutes. When the second 10 lbs. is glowing red, add 20 lbs. more coal. Never add more coal than is already burning! Wait 10 minutes. When the last 20 lbs. is fully involved, a nice blue flame dances vigorously across the fuel bed.

Close down the draft controls one at a time. Close one completely and re-open one full turn. Close the other completely and re-open one full turn. This gradually reduces output to a level of performance that combines comfortable output over a long time. At this level of performance, expect the stove to maintain a stove top temperature reading of 550-650 degrees for 12 hours. If the temperature reading is above 650 degrees, close the draft controls ¼ turn each to bring this temperature to bear. It may take 2 hours to reach this point. Be patient.

If you should notice the firepot beginning to glow red, this is an indication that the stove is operating in excess of its nominal output. Again, close the draft controls to bring the temperature down to an appropriate level of 550-650 degrees. Continually operating the stove at extreme temperatures can damage the stove and affect your warranty privileges.

There comes a time when you will want to refuel the stove. This can be as the out-

put declines, or it can be because you intend to leave the stove unattended for a longer period of time. This time varies between 8 to 20 hours.

Let's say you are retiring for the evening and want to leave the stove with enough operating potential to re-establish the combustion cycle in the morning. First, open the draft controls all the way and wait 10 minutes. Add enough coal through the top level loading door equal to the amount already burning. Close the door. Wait 10 minutes. Shake vigorously for 30 seconds.

Open the bottom level service door and inspect the underside of the grate system with a small mirror. There should be an even brightness — dark areas indicate ash residue. Continue shaking until this residue is gone. Close the door. Top off the fuel bed, reset the draft controls and the stove is set for the night.

It is a common misconception to think that adding more coal will produce more heat as is the case with wood in a fireplace. This is not true because coal responds slowly to change. An addition of coal reduces heat output for 15 minutes.

Any coal stove should be filled to a specific depth of coal. If the depth is shallow, it will not sustain itself. Too deep and it will form clinkers and pockets and be inefficient. American anthracite coal should always have the following depth of fuel bed:

Pea Size: 4-6 inches
Nut Size: 6-9 inches
Stove Size: 9-15 inches

When adjusting the stove for an overnight burn, make sure it is shaken down completely, loaded with fresh coal with the fire going well and that it is closed up properly.

It's really easy with patience and a little practice to become an expert with your installation. As a matter of fact, as the weeks go on, you will be amazed at how easy it is to maintain a slow, clean, even heat with coal.

There is a nice and easy routine used once in the morning and once in the evening. Just follow these instructions for flawless operation:

1. Open bottom air controls all the way (for increased draft you open the bottom level service door, but only for this process.)
2. Wait 10 minutes. This allows a good draft to develop.
3. Open top level loading door and add one fourth the amount of coal you would use on a daily basis (7-12 lbs.). Close the top door.
4. Wait 10 minutes. This allows the fresh coal to get started in preparation for shaking.

5. Shake vigorously for 30 seconds. Open bottom level service door and inspect underside of shaker grate with small mirror. Additional shaking required if uneven brightness indicates ash buildup.

6. Open top door and add one fourth the daily amount. Close top door.

7. Close bottom door and adjust bottom air controls for a long burn. This is usually one full turn on each draft control. The exact setting depends on your chimney, fuel quality, outside air temperature, wind velocity and, of course, how warm you want to be. Some people even marvel at the fact that their setting depends on the stars.

On a daily basis, you should remove ash that accumulates in the bottom of the stove. Simply use any standard fireplace shovel and remove the ashes. Should a small amount remain after cleaning, it does not matter at all. Do not allow them to build up more than a two-inch depth. If the ashes are allowed to accumulate near the grate, you are asking for trouble in any stove. This will block air from flowing through the grate. The air flow is what keeps the shaker grate from overheating, cracking or distorting.

Disposed ashes should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a non-combustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have been thoroughly cooled.

MINI-COAL OPERATION

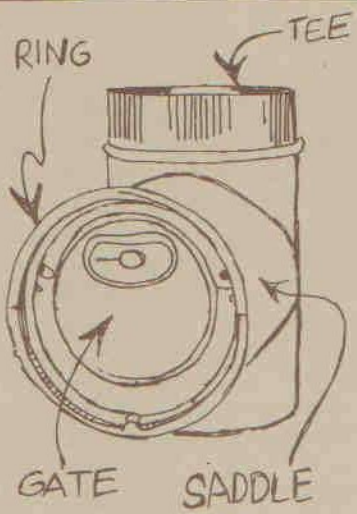
Once the Mini-Coal system is installed, the procedure is the same as full coal operation with minor differences. Secondary air holes should all be blocked. Kindling pieces need to be smaller. When inspecting the underside of the shaker grates during shaking, the left and right sides will be dark on the outside of the mini-firepot.

If acquiring smaller kindling is a problem, use 2-3 lbs. of charcoal. Use charcoal already impregnated with starting fluid and NEVER use liquid starter in your stove. Once the charcoal is glowing red, proceed with adding coal.

DRAFT PRESSURE

Draft pressure is the difference in air pressure between the inside and outside of a chimney. Positive draft means an upward and outward flow of air. Negative draft means a downward and inward flow of air.

All solid fuel appliances require a positive draft for adequate venting of the by-products of combustion. All chimneys exert a natural pull on the appliances



attached to them. Draft pressure is affected by chimney design, temperature (inside and outside the chimney), wind direction and velocity, and atmospheric pressure. People who live in a valley typically have lazy drafts while people living on top of hills have vigorous drafts.

Too little draft or a negative draft and smoke or gases may enter the living environment. Modifying the chimney will solve this. Too much draft can turn the stove red hot and pose a safety threat to you and your family.

The Crane Stove Model 404 operates best in a range of flue collar draft of .03 to .06 (inches of water). If draft pressure consistently exceeds this level, damage to the appliance may result. Under these conditions, the proper installation of a barometric damper (ring and gate) is very helpful.

First, to test the chimney for draft pressure, locate a draft meter. Some dealers have loaners. Light a fire in the stove. Once a modest fire is established, drill a hole in the flue connector large enough to insert the probe from the meter. Make the proper zero adjustment on the meter prior to inserting the probe. It is best to take the reading over at least a 60 second interval to allow the meter to completely respond to changes in pressure. After you have taken the reading, remove the probe and plug the hole.

Barometric dampers are automatic draft regulators that admit air to the flue connector to compensate for excessive pressure. They are installed in "T" connectors and consist of a ring and gate mechanism. The ring is a frame from which the gate is hinged and is adjustable to provide dead level swing. The gate has a sliding counter weight that will enable you to balance the draft. For a Model 404, it should be adjusted to admit air to the vent at a .07 draft pressure reading. Check this setting with the draft meter. It should not go above .06 if the gate is properly balanced. See your dealer for additional installation advice.

MAINTENANCE AND SPARE PARTS

THE BASIC STOVE

The Model 404 is as maintenance free as any stove available. At the end of the heating season, disconnect the stove from the flue connector and vacuum all the ash from the stove. There are two areas

of maintenance the homeowner should perform — functional and cosmetic. Let's take functional maintenance first.

Rope gasket seals the door and door frame mating. Opening and closing the door constantly tests the resilient nature of the gasket. Some people replace the gasket every spring just as some people change their car's oil every 3,000 miles. Certainly this provides optimum results. If you don't replace gasket every year, do it every other year. Window gasket is under constant compression and is not subjected to the same stress that rope gasket is. However, intense heat from the stove eventually degrades the gasket's resilient nature. Check the glass placement. Rattling or wobbling indicates gasket replacement is required. Gasket maintenance is vital to air control. Overlooking this owner maintenance can overheat the stove in the next heating season and repairing it then will deprive you of the comfort the stove provides. Also, broken glass must be replaced. Scratched or crazed glass does not leak and replacement is optional.

Cosmetic maintenance is unrelated to stove performance. The finish on the stove is a heat resistant paint. This finish resists flaking, peeling and fading. To keep the stove looking new, wipe with a cloth and apply a heat resistant paint. One aerosol can will give satisfactory results.

Inlay soapstone is a soft material and requires less maintenance if left unfinished. Lightly rubbing with fine steel wool removes most scratches. Finished stone, like painted stoves, will require re-application of finish to restore appearance of newness.

The dealer can provide all these maintenance supplies as well as spare parts list. The work itself is provided by the homeowner. Some chimney sweeps offer service contracts for system maintenance that could include labor and parts for stove maintenance if you choose not to do the work yourself.

COAL SYSTEM MAINTENANCE

This includes all the checks described for the basic stove. Additional maintenance includes carefully examining individual grate pieces for distortion. When cast iron changes shape, it is due to excessive heat. Since coal **can** generate significantly more heat than wood, accidental overfiring can distort an individual grate piece. Fortunately, this coal system has been designed to make replacement simple and inexpensive. Remove any distorted part and replace with a new one to keep the shaking mechanism operating freely.

TOTAL SYSTEM MAINTENANCE

A complete system maintenance check includes careful examination of the stove, flue connector pipe and chimney.

Flue connector pipe has a service life directly related to the type of steel (galvanized, cold rolled or stainless) and how thick it is (28 gauge, 26 gauge, 24 gauge or 22 gauge) 22 gauge stainless flue connector has the longest service life, lasting in some cases indefinitely.

Typical installations have 24 guage black pipe and are considered to have a medium duty service life, 26 guage or 28 guage galvanized or black pipe are generally unacceptable as they can wear out quickly enough to warrant replacement before a single season passes! Since most people check their pipe once a year, they may not see the perforations that can allow the flame path to escape, creating a fire hazard.

Perforations occur in two places more frequently than any other: 1) where the pipe sections connect to each other and overlaps. The part not seen, perforates and dangerously weakens the joint; 2) whenever the flame path changes directions — at elbows and tees.

Detach every piece and wire brush it thoroughly to locate excessive wear. Press firmly with thumb any suspicious area. If brittle, your thumb will puncture it completely. Discard section and replace with a new piece.

Heavy gauge pipe is typically twice as expensive and lasts twice as long as medium guage pipe. What you are buying is a greatly increased margin of safety and greatly reduced reinstallation time. In any case; if burning coal, buy the most durable pipe available as coal burning is even more corrosive than wood burning.

Chimney maintenance is a task many people prefer to entrust to professionals. Very tall chimneys, very steep roofs, the expense of professional quality tools are three reasons that come to mind that reflect this attitude. Cleaning chimneys is not a simple, clean, straight forward task.

Inspecting chimneys is a simpler matter. Today's codes require cleanout and inspection ports that give the home owner access to the chimney close to the base. Using a small mirror and a flashlight will enable you to get some idea of the quantity and quality of the deposits inside the chimney. It is important to be familiar with these deposits as they tell you when to clean or have cleaned the chimney.

If in doubt about what you see, call a professional chimney sweep to analyze and

	Conventional Fuel Central Heating			Solid Fuel Stove Heating	
	Electricity	Oil	Gas	Wood	Coal
Raw BTU in the Fuel	3413/ KWH	140,000/ Gal.	1000/ Cu. Ft.	6,000/ lb.	13,000/ lb.
Loss due to Combustion Efficiency	0%	20%	10%	20%	10%
Loss due to Heat Transfer Efficiency	0%	20%	20%	5%	4%
Loss Due to Impurity of Fuel	0%	4%	2%	35%	10%
Total Loss	0%	44%	32%	60%	24%
Net BTU Available in Living Areas	3413/ KWH	80,000/ Gal.	680/ Cu. Ft.	10 Million Per Cord	20 Million Per Ton
Units Needed For One Heating Season Using 50 Million BTU	15,000/ KWH	600/ Gal.	70,000/ Cu. Ft.	5 Cord	2½ Ton
Price Per Unit	10¢/ KWH	$1.30/ Gal.	1¢/ Cu. Ft.	$100/ Cord	$140/ Ton
Heating Cost For One Season	$1,500	$800	$700	$500	$350

- Bulk purchasing of fuel reduces your cost
- Heating living areas of home only and not including hot water
- Fuel price will vary with geography and time of year
- Your best buy is wood when it's free!

evaluate the deposits with you. There is no substitute for being well informed regarding this important safety matter.

Your dealer may also be able to assist you. He will have books and most tools available for purchase if you choose to do the work. He will probably know the reputations of area chimney sweeps and can make recommendations if you don't want to do the work.

Maintenance items and spare parts are usually in stock and available from your local dealer. We highly suggest that you purchase them before they are needed. However, when necessary, they may be ordered from the factory, subject to a $20.00 minimum charge and a 6 week delivery.

THE DIAL ON THE WALL VS. SOLID FUEL

The above chart reflects reasonably accurate estimates for prices in effect from Portland, Maine to Harrisburg, PA for 1982/1983. This is to act as a guide in helping to determine the cost effectiveness of providing supplemental solid fuel support to an existing central heating set up.

There are many ways to interpret any list of statistics. Bias abounds. Yes, you can save money with solid fuel. Yes, you will be warmer in the main living area of your home. No, you probably won't eliminate 100% conventional fuel needs, nor should you. No, it is not as simple to heat with solid fuel as it is to write out a check for a monthly utility bill.

WHAT NEXT?

Reading an operations manual is like getting married. You are being told what to do and that it is good for you, but you know only time will tell. Knowledge forestalls disappointment.

A common complaint for stove owners is low heat output. All this money invested and you can't boil water! Ideally, any stove will operate to its nominal output if a temperature reading measured by a surface thermometer (top rear center of stove) falls between 550-650 degrees F. Low heat output indicates a fuel deficiency for woodstoves and a draft deficiency for coal stoves. If you burn wood, try drier wood. If you burn coal, boost the primary air supply by opening the bottom door. CAUTION: Do Not Use This As A Permanent Solution, Only To Identify The Problem. If performance improves, what you need to do for a permanent solution is to modify the draft characteristics of the chimney. Options include making it taller (increases draft), lining it (reduces turbulence), and installing an electric draft inducer in the flue connector. The last method is the easiest to do, the least expensive and guaranteed to work.

Monitor system performance with a surface thermometer. A stove gets hot, but how hot is it really? It is the least expensive way to get answers to performance questions. Buy a thermometer when you buy the stove and eliminate guesswork.

A common complaint for coal stove users is gradually declining output. Four days after starting the fire the heat output becomes unacceptable. What went wrong? Typically, the operator has not adequately shaken the stove down. The secret to keeping heat output consistent is to recreate the environment of the first fire or — ash free. When you feel you have shaken the stove enough, open the bottom service door and inspect the bottom of the shaker system. Using a mirror avoids standing on your head. Uneven areas of brightness indicates excess ash blocking the air supply and displacing fuel. Continue shaking until all dark areas disappear.

Finally, getting the correct size stove means that once you get it working at rated capacity, you will neither overheat or underheat your home. If the temperature on the top of the stove is 650 degrees, pushing it beyond that point to keep the house comfortable is probably not as desirable as getting a larger stove. People mostly buy too big a stove and aside from wasting their money, are continually frustrated by the inability to control their comfort. Be honest in your assessment of how much of your house you want to heat. Work carefully with your dealer and listen to his advice. You **can** have your cake and eat it too!