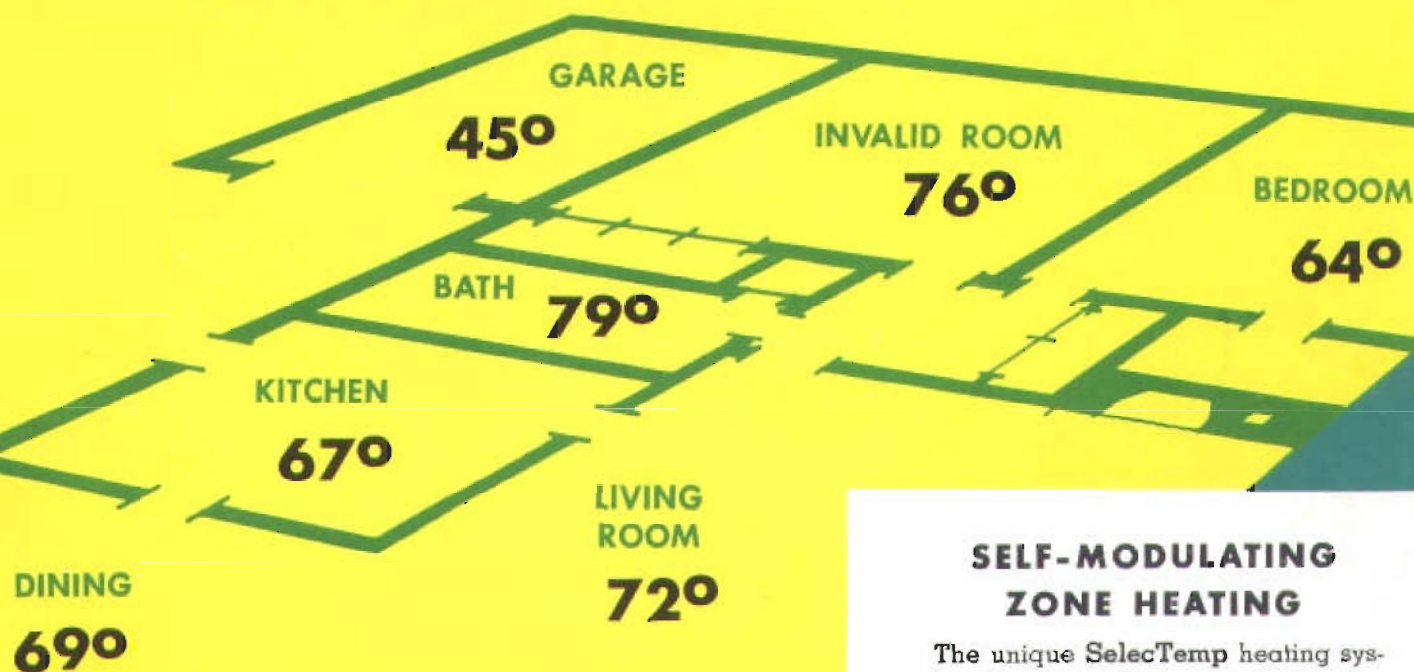


# SelectTemp

TRADE MARK

PRODUCT OF IRON FIREMAN

INDIVIDUAL THERMOSTATIC CONTROL OF TEMPERATURE IN EACH ROOM



## SELF-MODULATING ZONE HEATING

The unique SelectTemp heating system sets an entirely new and better standard of indoor comfort. Every room in a home or building is an individual zone, with its own thermostat. Each room is heated with filtered, warm air, continuously circulated by a compact, recessed wall unit. Low pressure steam, supplied to the unit through small flexible copper tubing, provides heat and also power for the circulating fan. Ideal for new construction or modernization. SelectTemp systems are engineered and manufactured by Iron Fireman, famous since 1923 for fine heating equipment.

*For every size  
and type  
of building*



RESIDENCES  
HOTELS AND MOTELS  
APARTMENT HOUSES  
HOSPITALS  
INSTITUTIONS  
OFFICE BUILDINGS

**IRON FIREMAN**  
MANUFACTURING COMPANY  
CLEVELAND 11, OHIO

# Now

## INDIVIDUAL THERMOSTATIC CONTROL OF TEMPERATURE IN EACH ROOM

*at a cost which permits its use  
in any building from the smallest  
home to the largest residential  
or commercial building*

Here is a new and better heating system that makes it possible for people to be *individually* and *independently* comfortable, under the same roof!

Young or old, physically active or sedentary, well or ill, people require different degrees of warmth for greatest comfort. Grandma with her knitting needs a different temperature than the young people in the recreation room. Father in his home workshop and baby in his bath each have different heating requirements. With separately controlled SelecTemp room units, every space, in every building, has its own ideal climate.

*Because SelecTemp units have individual thermostats they provide extremely important advantages over usual systems of heating that have the conventional "master" thermostat to control several or all locations in the building.*

The "master" thermostat used in ordinary heating systems is generally located on an inside wall, in a center hall or other location, where it is supposed to "average" the temperature of the entire building.

If the "master" thermostat of a conventional heating system is reset for a changed heat demand at some particular location, then *all* the radiators or registers that this thermostat controls will respond proportionately. The warmth of all other places that were too hot, too cold, or just right, will be changed for either increased comfort or increased discomfort—depending upon the previous "average" thermostat setting. But a change in the thermostat setting of any SelecTemp unit will not affect units in other locations.



77°



79°



73°

Individual SelecTemp thermostats in each room unit respond quickly and accurately to maintain the warmth level selected for each room or space. They automatically compensate for variations in temperature due to changes in outdoor temperatures, variations in solar heat gain from incident sunlight, and changes in velocity and direction of the wind.

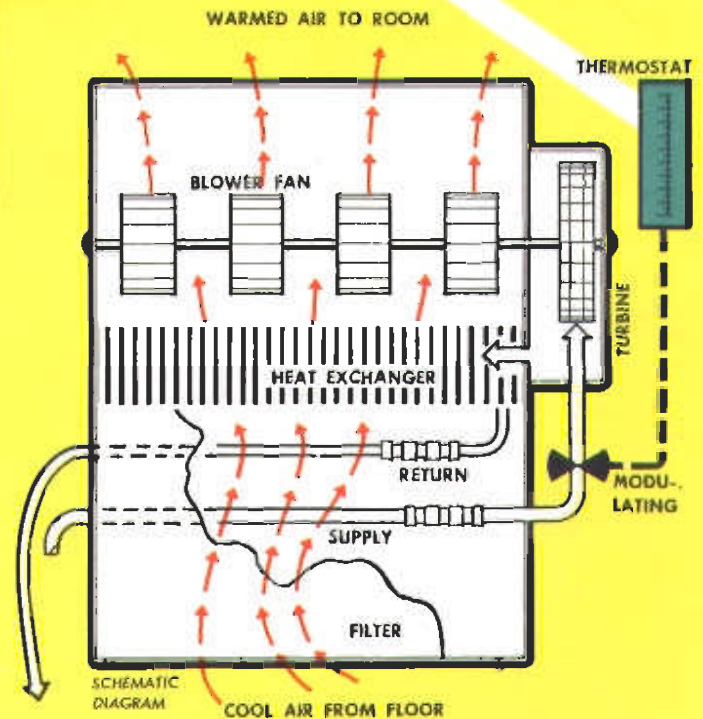
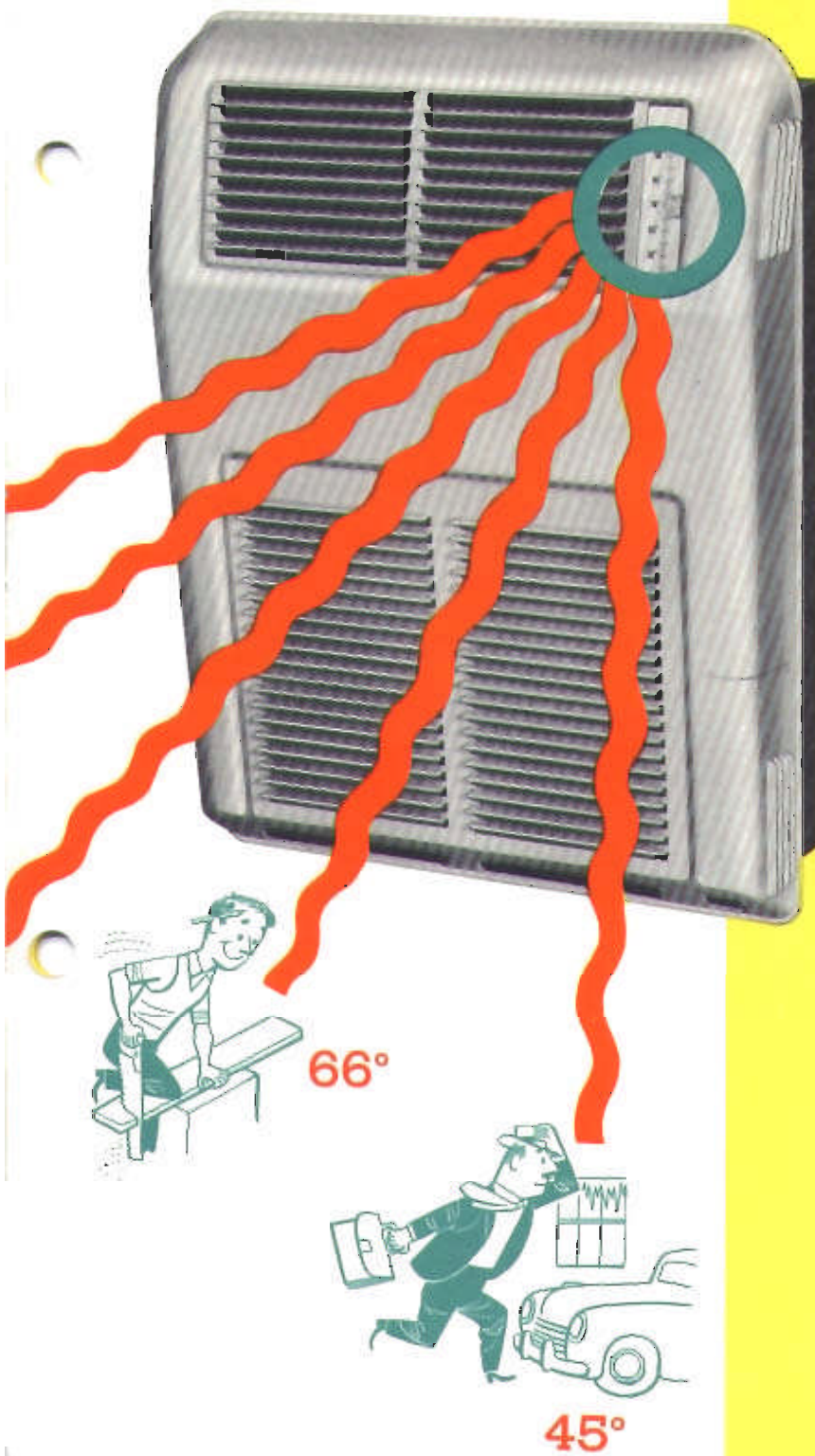
A room with a fireplace burning or a kitchen where the oven is operating needs less heat from the central heating system. Temporary opening of windows or doors causes heat loss. Rooms occupied

# SIMPLE OPERATION OF SELECTEMP UNITS

The key to the comfort and economy of the SelectTemp heating system is that each separate heater unit is *individually* controlled. Each unit delivers a *continuous* flow of filtered warm air—in the *exact* amount needed to maintain the temperature selected for the location. Here is how simply the SelectTemp unit operates:

**STEAM SUPPLY**—Each SelectTemp heater unit receives its own supply of steam through a  $\frac{1}{4}$ " copper tube. When the thermostat setting of one room unit is changed it does not affect the heat output of any other unit. Boiler location has no effect on the steam supply to individual room units.

**THERMOSTAT**—Each SelectTemp unit is separately controlled by its own non-electric thermostat through a temperature range of 40° to 90°F. Warmth level is accurately maintained by the thermostat actuation of the modulating valve. This valve in turn, controls the flow of steam that drives the turbine and air-circulating blower fan, thus regulating both the fan speed and the heat output.



**TURBINE AND BLOWER FAN**—Mounted on the same stainless steel shaft that turns in self-aligning Graphiter bearings, the turbine and fan operation is smooth and quiet. No lubrication or service is required. The speed of the fan varies according to the heat output demanded by the thermostat. SelectTemp eliminates the usual "on-and-off" cycles that result in "cold 70°" stratification. The unit operates between slow and full speeds to supply a continuous flow of heat varying from 1/20th to maximum output capacity.

**FILTERED AIR**—All circulated air is filtered through a high-capacity, removable, spun glass filter. Air is drawn in through the lower louvers and travels through the filter before it is warmed by passage through the cells of the heat exchanger. It is then delivered to the turbine-driven blower fan.

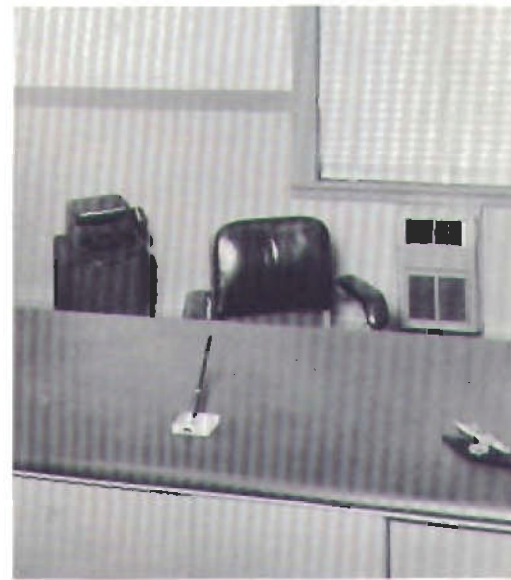
**HEAT EXCHANGER**—Steam travels from the turbine chamber to a highly efficient automotive type copper heat exchanger that always operates at a slight vacuum. The fan delivers a gentle and continuous flow of warmed, clean air to the room through diffusing louvers near the top of the SelectTemp heater unit. Condensed steam from the heat exchanger returns by gravity to the boiler through a  $\frac{1}{8}$ " copper tube.

by several people require less heat than rooms where there are only a few, because people give off heat. SelectTemp units adjust to these conditions automatically, to keep each room at the temperature for which its own thermostat is set.

With SelectTemp, heat in rooms temporarily unused can be turned down, to as low as 40 degrees, just as easily as the electric lights are switched off when not needed. And an unheated room can be brought back quickly to comfort level simply by resetting the thermostat.



**ABOVE:** A bathroom with plenty of counter space in the Dale Mehring residence, Toledo, Ohio. **RIGHT:** An attractive bathroom in the home of Robert F. Kerhoff, La Porte, Ohio. Both these rooms have adjustable SelectTemp comfort.



**ABOVE:** The offices of the American Shipbuilding have individually controlled warmth from the SelectTemp for buildings for whatever use or size can have p

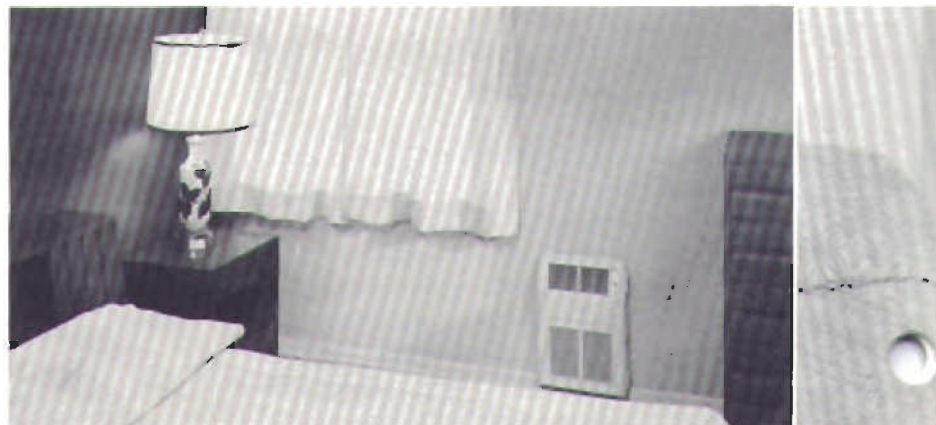


**ABOVE:** An inviting chair in the home of V. McGee in Maumee, Ohio, where young or old can have a look at the outdoors and enjoy the gentle warmth of the SelectTemp heating unit.

**FOR  
ANY COMFORT  
REQUIREMENT**



**BELOW:** A bedroom in the home of Robert F. Kerhoff, La Porte, Ohio. **ABOVE:** A unit of the De Ohio, with a detail of the bedroom shown **LOWER RIGHT**. Fine motels are providing SelectTemp guests to make them as comfortable as if they were at home.



# lized warmth for work, play, or rest

## IMPORTANT *SelectTemp* ADVANTAGES

1. Each heater unit operates independently of all others, to provide localized comfort to suit occupants of every room or zone.
2. Units respond quickly and automatically to changes in weather or indoor heat gain to maintain desired temperature.
3. Modulated heating; fans run faster or slower in response to varying heat demands. No "stop-and-start" cycles with resulting "cold 70°". Instead, controlled and continuous circulation of warmed, filtered air.
4. No fuel waste. Heat supplied to each room in exact amount needed, without overheating or underheating. Heat can be turned down to as low as 40° when a room is not in use, with quick response when heat is again wanted. Negligible heat loss from small diameter, 1/4-inch copper steam supply tubing.
5. Since each room has its own filter, cleaning and redecorating are reduced to a minimum. Odors, dust or bacteria are not circulated throughout house or building.
6. Low installation cost. Use of small soft copper tubing saves time and money in new construction and modernization. *SelectTemp* is non-electric—no wiring required. Residential boiler can be installed anywhere, for maximum economy and convenience—in main floor utility room or basement.
7. Recessed wall units are compact and attractive in appearance, and occupy very little space. They can be finished to fit any desired color scheme.
8. Water coils in boiler provide continuous, economical year-round domestic hot water supply.



Company of Lorain, Ohio, *SelectTemp* System. The rooms provide localized comfort.



Hotel in Toledo, Ohio, providing heating for their



ABOVE: People who enjoy a warm breakfast can enjoy a quickly warm room, too, as in this breakfast room of the Robert F. Kerkhoff home in La Porte, Ohio.



ABOVE: Entrance to the Wick Drive-In Hotel, Youngstown, Ohio, and UPPER RIGHT is a corner of the lobby. At the RIGHT a glimpse of a bedroom in the Cleveland Motel in Cleveland, Ohio.



ings in every climate and all kinds of weather

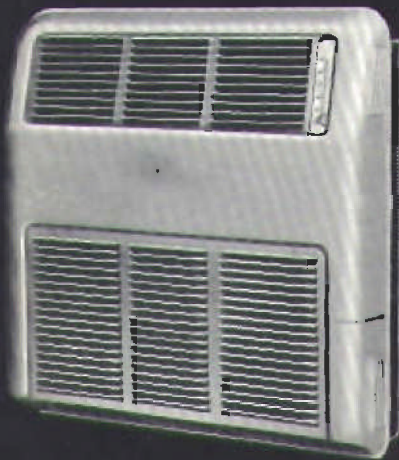
# 3 SIZES FOR ANY COMFORT REQUIREMENT



**H-6**



**H-12**



**H-18**

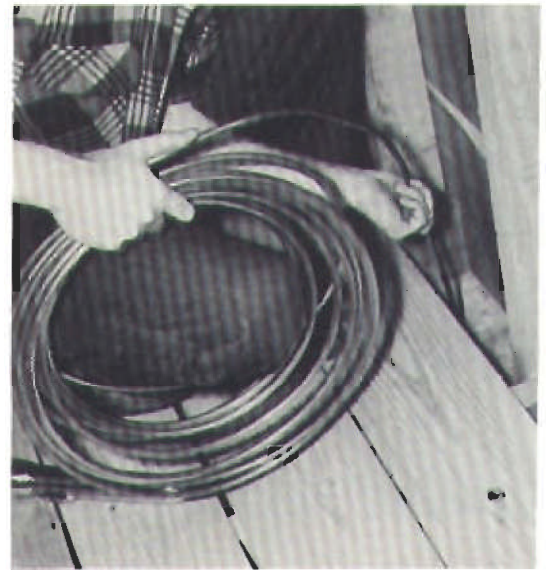
IRON FIREMAN

**SelectTemp** IS  
TRADE MARK

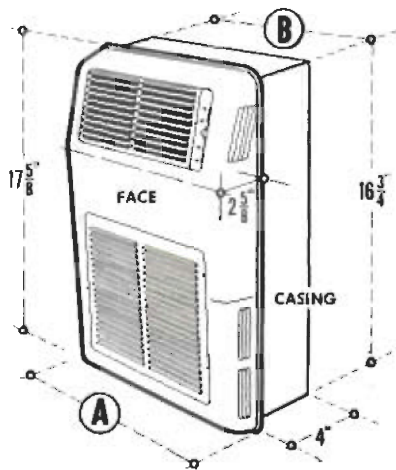
## PIPING IS EASY TO RUN AS WIRING

RIGHT. A mechanic is feeding the flexible copper tubing down through a wall on a remodeling job. Unlike "hard" piping, the long lengths of the soft copper tubing are snaked into the wall for most direct runs, with minimum of cutting and fitting.

For usual runs up to about 40 ft., the 1/4" I.D. supply lines and the 1/8" I. D. gravity return lines are of soft copper tubing. Tubing is easily bent by hand for streamlining around obstructions. Headroom is not reduced, which often saves on building costs. Small size of tubing greatly reduces transmission heat losses



## HIGHLY EFFICIENT HEATING UNITS



LEFT. The louvered front is easily removable, and is finished in a neutral color baked enamel. When mounted in the wall the heating unit is unobtrusive, and can be refinished to match or harmonize with decorating scheme, or left with its neutral finish. The steel casing enclosing the heater element is mounted in the ordinary stud space in the wall.

Provisions can be made for supplying fresh, filtered, warmed, outside air through the heating units. The resulting ventilation is controllable, regardless of wind or temperature.

Under some conditions, two separate rooms may be heated by a single unit located in the dividing partition.

The individual thermostat control is conveniently located for finger-tip operation and the unit is completely non-electric.

	H-6	H-12	H-18
Max. Btu delivery	6000	12000	18000
Min. Btu delivery	300	600	900
A—Face width	9 1/4"	13 5/8"	18"
B—Casing width	6 1/4"	10 1/2"	14 7/8"
Weight of unit	13 lbs.	18 lbs.	22 lbs.
Air volume CFM	60	120	180

# SIMPLY AND QUICKLY INSTALLED

The speed and economy of installing **SelectTemp** is not restricted by the type of construction; size, shape or arrangement of plan; whether a new or existing building; with or without basement.

The various parts of the **SelectTemp** system have been engineered for flexible installation without time-wasting or costly special provisions under widely diverse architectural conditions. **SelectTemp** units are assembled in steel enclosures for mounting in wall stud spaces.

The replacement of worn-out or unsatisfactory heating systems in existing buildings with **SelectTemp** re-

quires a minimum of cutting and patching, without interruption of normal activity in home or building.

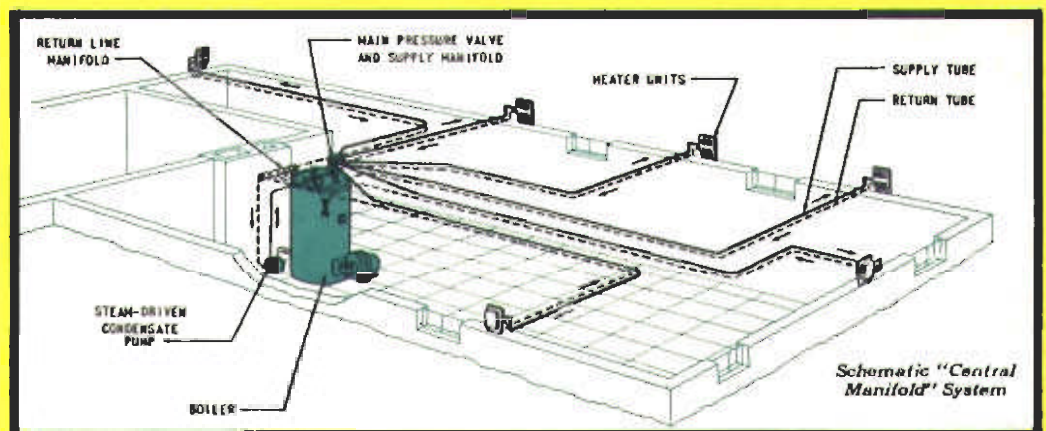
Conventional heating systems requiring ducts or rigid piping must have chases, framing headers or trimmers, or other provisions for concealment and accommodation. This adds to cost, and frequently weakens the structure or adversely affects most efficient plan arrangement.

The compact boiler needs space no larger than a closet, and can be located anywhere from basement to attic. With no problem of headroom, unnecessary building height is eliminated as an item of cost.

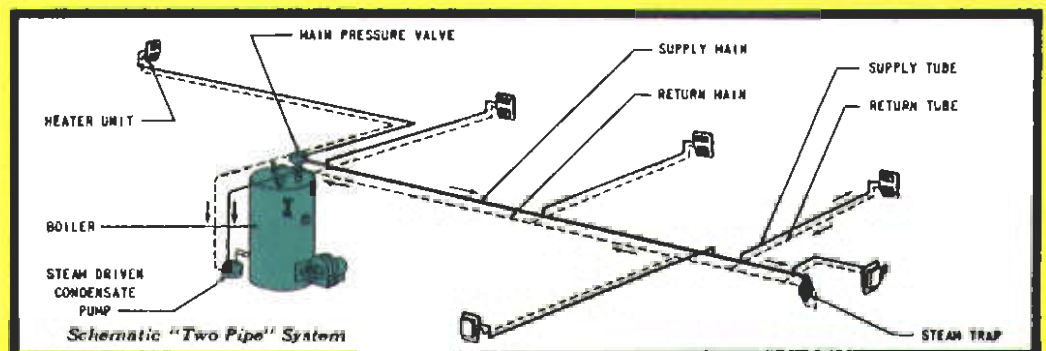
For new or old buildings, multi-storied or single floor, of any size or use, in all climates.

## CENTRAL MANIFOLD SYSTEM

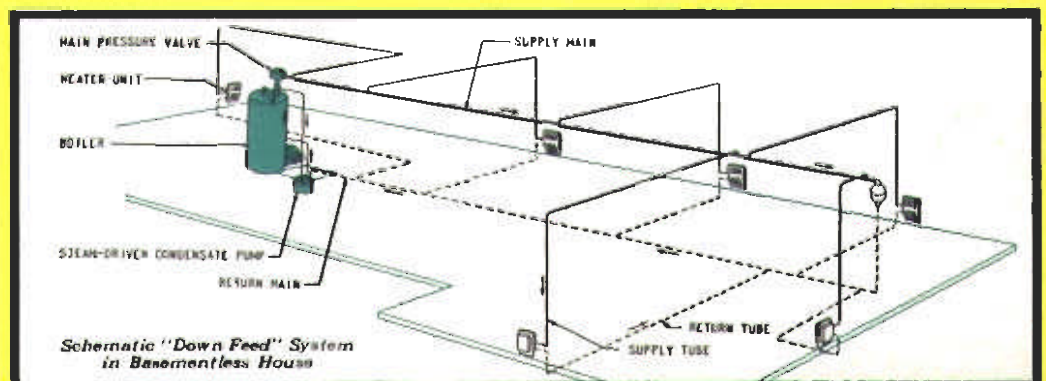
... Small compact buildings, with the boiler centrally located, normally use the Central Manifold System, in which individual supply tubes connect the boiler to each heater, and individual tubes return the condensate to the pump.



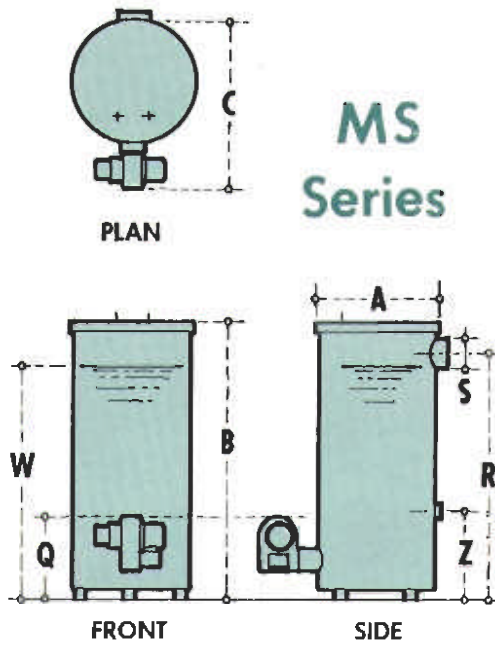
**TWO PIPE SYSTEM** ... Where the boiler is located near one end of a larger building, a Two Pipe System is frequently used. A steam main, usually a  $\frac{3}{4}$  inch pipe, delivers steam to the heater supply tubes. A return main, usually a  $\frac{1}{2}$  inch pipe, returns the condensate to the pump. The heaters are connected to the main with small tube branches.



**DOWN FEED SYSTEM** ... Piping layout for a typical slab construction basementless house, with steam supply pipes overhead and return pipes below the floor level. With this construction the return pump is depressed below the floor level. The Down Feed System may be of the two pipe type as shown, or it may be of the Central Manifold type, or a combination of both types.



# SelectTemp GAS OR OIL-FIRED STEAM BOILERS



Oil-Fired Model MSO-140  
Illustrated

OIL FIRED	114	140	180	240	320	400	500	750	1000
GAS FIRED	142	175	225	300	400	500	625	937	1250
Gross Btu Output—1000's	114	140	180	240	320	400	500	750	1000
Input Btu Rating—1000's	142	175	225	300	400	500	625	937	1250
Net Rating, Steam—Sq. Ft.	300	400	500	700	900	1100	1400	2100	3000
Oil Burner Capacity G.P.H.	1.0	1.25	1.75	2.25	3.0	3.5	4.5	7.0	9.0
Max. Steam Gauge Pressure	15	15	15	15	15	15	15	15	15
A—Boiler Diameter	21	23½	26	28½	31	33½	37	42½	49½
B—Boiler Height	57½	60½	64	66¼	70½	72¾	76¾	79	86¾
C—Boiler and Oil Burner	35½	38	40½	43	45½	48	51½	.....	.....
W—Water Line	51	54½	57¾	59	63	65	68	67¾	76½
S—Stack Diameter	7	7	7	8	9	9	10	10	12
R—Stack Outlet Above Floor	57½	54¾	58	60	64	66	68¾	68¾	77¾
Q—Oil Burner Top to Floor	19½	20	21	21	21	21¾	21¾	21¾	21¾
Z—Return Height	5½	16½	16¾	18	19½	5½	6¼	6¼	6¾

The use of steam as a heating medium eliminates the initial, operating and maintenance costs of circulating pumps required by forced hot water systems, or circulating fans required by warm air systems. Pounding noises or "hammer", hissing air vents, radiator traps, valve packing, and other problems usually associated with steam heating systems are eliminated.

BOILER is either oil or gas fired. Compact, well insulated, attractively jacketed, and skilfully engineered for economical operation and long life. Flexibility of PIPING allows

complete freedom in locating boiler and convector units. CONDENSATE PUMP is steam-driven. It returns condensate to the boiler automatically. HOT WATER COILS are built-in, instantaneous type, to supply year-round domestic hot water.

These boilers are designed and built to the highest standards of performance for the SelectTemp System. They are compact, very well insulated and highly efficient. The jacket is of heavy gage metal, with smooth baked enamel finish.

## COST OF SelectTemp COMFORT

**COST ANALYSIS**—Comparison of cost of SelectTemp with other types of heating is misleading, since no other system combines such top comfort and operating economy. For budget purposes *only*, the initial cost of SelectTemp on new construction will compare favorably with radiant baseboard or other hot water or steam systems—and slightly higher than conventional forced warm air systems. It is appreciably less than other systems having more than single zone temperature control. SelectTemp is by far the best and most economical method of heating for modernization projects.

**DESIGNING COSTS**—Since SelectTemp systems do not require complicated planning of every part from the basement to farthest room and back again, the cost of designing and laying out working drawings for ducts, piping and other elements is reduced to a minimum.

**INSTALLATION COST**—The construction expense for framing, trenches, chases and other elements, combined with the prolonged time of job completion, increases the cost of installing most conventional heating systems. With SelectTemp, this is not a problem.

**OPERATING COST**—The cost of fuel for overheating or useless heating is avoided with the SelectTemp system. Heat is delivered when and where it is wanted, just as is electric lighting.



NEW HOMES SELL FASTER... REMODELING IS EASIER WITH

29i  
1r

IRON FIREMAN

SelectTemp<sup>®</sup>

SELF-MODULATING ZONE HEATING



*the Revolutionary*

**CENTRAL HEATING SYSTEM**

*with a Thermostat in Every Room*

**SELECTEMP HEATING IS IDEAL FOR:**

Homes, Motels, Hotels • Schools, Churches  
Apartment Houses • Institutions  
Office Buildings • Stores, Hospitals  
Buildings of every type and size

# There's Nothing Like

# IRON FIREMAN

# SelectTemp<sup>®</sup>

# HEATING

HERE'S a *revolutionary* new development in heating. It's so simple, so practical, brings such a new degree of indoor comfort, that many ask, "Why didn't someone invent SelecTemp years ago?" Engineered and manufactured by Iron Fireman, famous since 1923 for fine heating equipment . . . SelecTemp brings more comfort and economy *than any other heating system known*. SelecTemp accomplishes what heating engineers for years have tried to do. It provides a sensitive, dependable system of temperature control for *each room*, plus modulated, circulating heat, at a down-to-earth installation and operating cost.

## A THERMOSTAT IN EVERY ROOM

This is the comfort-convenience that appeals to *everybody* — home buyers, home modernizers, the occupants and owners of all types of buildings. A thermostat in every room means *individual* heat control. At the same time — in the same home — you can keep it warm in some rooms, cool in others, tailored to individual comfort *throughout the house*.

## FILTERED, CIRCULATING WARM AIR HEAT FROM STEAM

Steam heat? Hot water heat? Warm air heat? SelecTemp combines the finest features of all these reliable heating methods to achieve remarkable results. Low-pressure steam from a central boiler goes quietly and swiftly under its own power to each SelecTemp room unit. There it generates and circulates filtered warm air.

The same steam that supplies heat also operates the turbine which turns the circulating fan. No wiring or electricity is used, either for fans or thermostats.

## YEAR-ROUND HOT WATER AT LOW COST

SelecTemp boilers are available with built-in water heating coils, eliminating need for separate water heaters. There is an abundant, dependable year-round supply of hot water — at very reasonable cost.

## HELPS SELL NEW HOMES

SelecTemp heating appeals at once to prospective home buyers. Wives appreciate the practical need for individual heat control in every room. Husbands are impressed with its efficiency and its economy of operation. SelecTemp heating gives homes the outstanding *extra feature* that means *quick sales and profits*.

## Read What These Prominent Builders Say About IRON FIREMAN SELECTEMP HEATING

CHARLES J. KOWALSKI, *President*, CHARLES J. KOWALSKI, INC.,  
*Contractors*, Pittsburgh, Pennsylvania.

Last fall we installed an Iron Fireman SelecTemp heating system in the dwelling we built for the Pittsburgh Home Builders "Parade of Homes". We believe that the system tended to attract much attention to a home which has many outstanding features. During the course of the show we answered many, many inquiries about the heating, which we believe will result in additional SelecTemp installations in this area.

The dwelling was sold just after the close of the "Parade of Homes", and we are certain that the folks who purchased it were impressed with the type of heating system we had used.

SAMUEL BLOCK, *Partner*  
Homeland Builders, Detroit, Michigan

Your Iron Fireman SelecTemp heating system which we installed in our 18-unit apartment building at 12122-12130 Sanford, in Detroit, has proved very efficient and economical to run.

We do not hesitate to recommend your system, as it has proved itself to be very satisfactory to us.

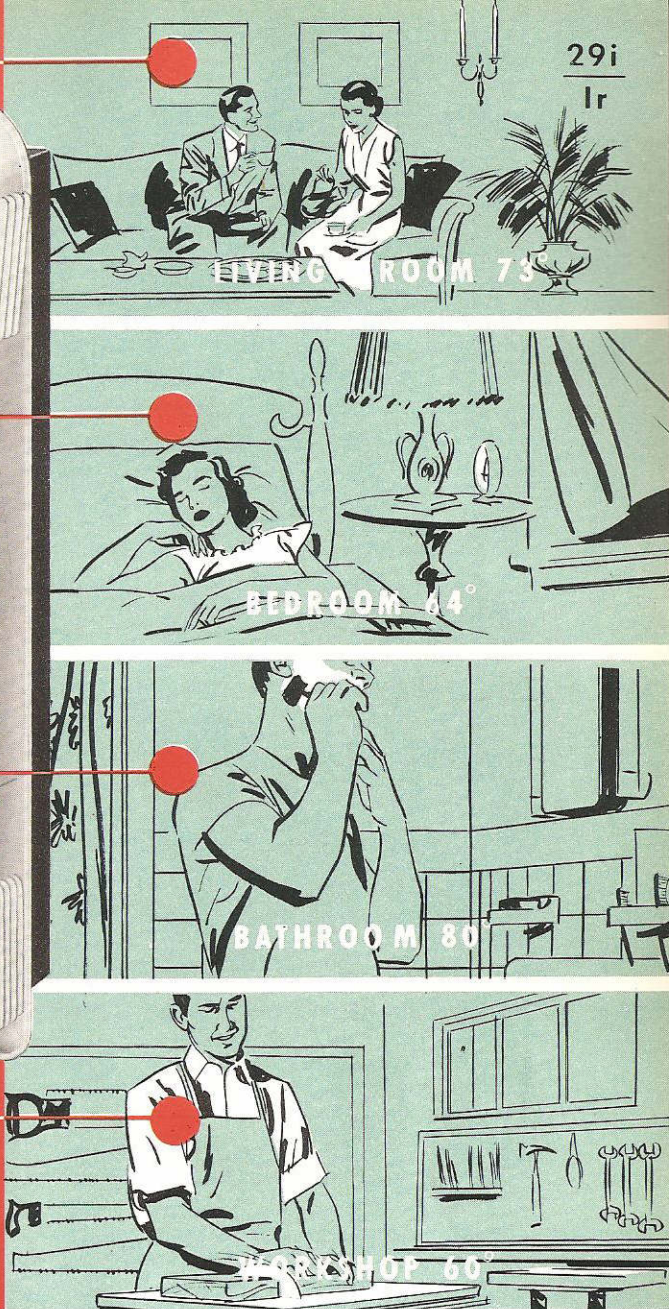
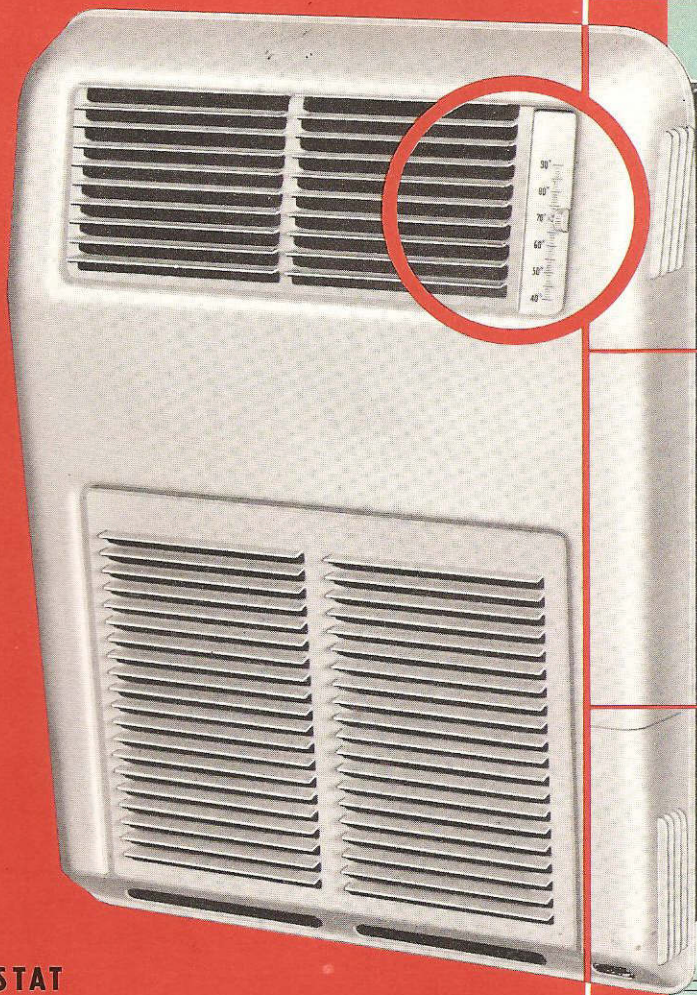
MR. N. LABRIERE, *President*  
The Nelson LaBriere Company, LaBriere Homes, Canton, Ohio

We have been looking for a flexible system of heating equipment to properly heat our split level homes, with open planning and large glass areas. We have found it in your Iron Fireman "SelecTemp" system.

We obtain amazingly uniform heating, regardless of the task. Our customers like the individual thermostats on their units. We have found that fuel savings of 25% or more are common with your system.

The SelecTemp system is so flexible that we have to give very little thought to planning our homes in regard to the space necessary for installation of units and supply lines. This saves us considerable time in planning labor and materials.

We are always glad to show our customers the SelecTemp system, for we think it a great sales feature.



29i  
1r

A THERMOSTAT

IN EACH **SelectTemp** UNIT

GIVES INDIVIDUAL ROOM CONTROL

## Here's Why Home Buyers Like SELECTEMP Heating



- ▶ *Occupants can select the exact temperature they desire in each room.*
- ▶ *Steady uniform heating — modulated flow of warmed filtered air.*
- ▶ *Heat responds quickly to thermostat adjustment — temperature is maintained very accurately at selected level.*
- ▶ *Saves fuel — you can turn heat down in unoccupied rooms, but quickly reheat them.*
- ▶ *No electricity needed to operate heating units.*
- ▶ *Plenty of year-round hot water at very moderate cost.*
- ▶ *Attractive heating units — can be painted to match rooms; use no floor space; won't interfere with carpeting or furniture placement.*

**And Here's How SelectTemp Heating Helps You Sell Houses**



# Make the 3-step **SelecTemp** Heating Demonstration

## ... A Short Cut to Closing Any Deal

YOU'LL FIND IT much easier to sell a home when you have installed SelecTemp and can actually *show* your prospects what an ultramodern heating system the house has. SelecTemp has wonderful demonstration value. The way it delivers filtered warm air, smoothly and steadily, is a revelation. And it gets equally warm response from prospective home buyers.

*(If you yourself would like to see how SelecTemp heating operates, ask your nearest Iron Fireman dealer for a demonstration . . . in your own office if you wish.)*



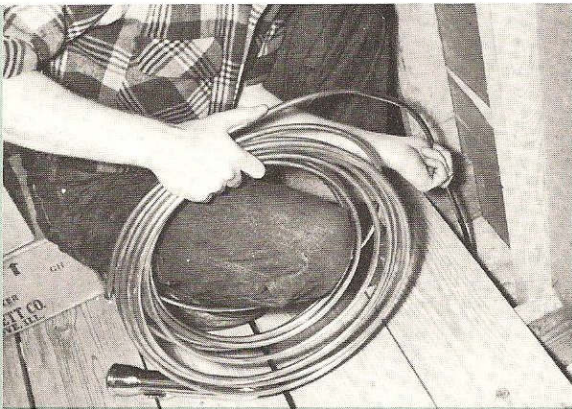
*Explain SelecTemp heating advantages to prospective buyers — the thermostat in every room, modulated flow of filtered warm air, low fuel and electric bills, and other advantages mentioned on page 3.*



*Ask home buyer to set thermostat on the SelecTemp unit so he can see how easily this is done. Explain how home owners can turn heat down in unused rooms — yet reheat them quickly to the temperature desired.*



*Have him note how quickly the unit responds to the higher temperature setting. Also have the prospective home buyer feel the filtered warm air smoothly flowing from the upper SelecTemp grille.*



## Installation is *Fast and Easy* Whether You're Building or Remodeling

SelecTemp heating is almost as easy to install in an older home you're remodeling as in a new one. SelecTemp piping is as easy to run as electric wiring. Above, a mechanic snakes the copper tubing down through a wall on a remodeling job. Unlike "hard" piping, the flexible copper tubing can be snaked into the wall for most direct runs, with minimum of cutting and fitting.

Flexible copper tubing of only  $\frac{1}{4}$  inch I.D. carries steam to individual room heater units. Return lines are  $\frac{1}{8}$  inch I.D. Tubing is easily bent by hand for streamlining around obstructions.

Extra headroom is not required for ducts or pipes, which often saves on building costs. Small size of tubing makes heat losses from piping negligible.

NO OTHER HEATING SYSTEM  
OFFERS SO MANY ADVANTAGES AS

IRON FIREMAN®

SelectTemp®

Just compare these advantages of Iron Fireman SelectTemp heating with those offered by any other system — at any price — and you'll agree that this unique heating system sets an entirely new and better standard of home heating comfort . . . at minimum cost.

**THERMOSTAT IN EVERY ROOM** Temperatures can be varied in every room to fit the "activity plan" and personal preference of the occupants.

**MODULATED HEAT** Both temperature and volume of air are automatically modulated, as required to offset heat loss from room.

**FILTERED CIRCULATED AIR** Individual room air circulation prevents transmission of odors or bacteria from other rooms. Air is cleaned by a spun glass filter in each unit.

**BOILER LOCATION** Boiler can be placed in any desired location, with proper distribution of heat to every room. Boilers with built-in, year-round domestic hot water coils available. Fuels: Gas, oil or coal.

**LOW POWER COST** No electricity required to operate circulating fans. Non-electric thermostats.

**LOW INITIAL COST** Easily installed in either new or old construction. Small soft copper tubing ( $\frac{1}{4}$  inch I.D.) carries steam to individual room heater units. Return lines are  $\frac{1}{8}$  inch I.D. Substantial savings in installation costs are the result.

**LOW FUEL COST** Temperature easily reduced in unused rooms. Wasteful, uncomfortable overheating is entirely eliminated.

**AUTOMATICALLY BALANCED** No special adjustments of dampers, valves or orifices required to balance heating system. Each unit continuously regulates heat needed for each room. Automatically compensates for external heat sources such as fireplace or solar heat, without affecting temperatures of other rooms.

**All These — and YEAR-ROUND HOT WATER TOO!**

**. . . economically supplied by coils built into the boiler**

## AND IT'S TODAY'S BIGGEST HEATING VALUE

**INITIAL COST COMPARES FAVORABLY** Because SelectTemp heating offers so many *exclusive* benefits, in many ways it actually is *above* comparison with conventional heating systems. The initial *cost* of SelectTemp on new construction, while somewhat higher than conventional forced warm air systems, compares favorably with baseboard-or other hot water or steam systems. And it costs *far less* than other systems which provide modern zone control of temperature.

**LOWER DESIGNING COST** With SelectTemp systems, the cost of designing and laying out working drawings for ducts, piping and other elements is reduced to a minimum.

**LOWER INSTALLATION COST** The cost of installing most conventional heating systems is increased by the construction expense for framing, trenches, chases and other elements — plus the prolonged time of job completion. SelectTemp systems make this extra construction time and expense unnecessary.

## WHY ARCHITECTS SPECIFY SELECTEMP HEATING FOR EVERY SIZE AND TYPE OF BUILDING

The SelectTemp system can be installed profitably in very moderately priced homes, as well as in more expensive homes, because SelectTemp is such a good sales feature. It can be installed in homes with or without basements, including those of slab construction.

**OFFICE AND BUSINESS BUILDINGS** SelectTemp appeals to owners of large commercial buildings because it makes possible important fuel economies, and substantial reductions in steam consumption where district steam is used. Heat can be furnished only where needed — and only in the amount required. The fan in each room unit is operated by a small steam turbine, so no electric wiring is required.

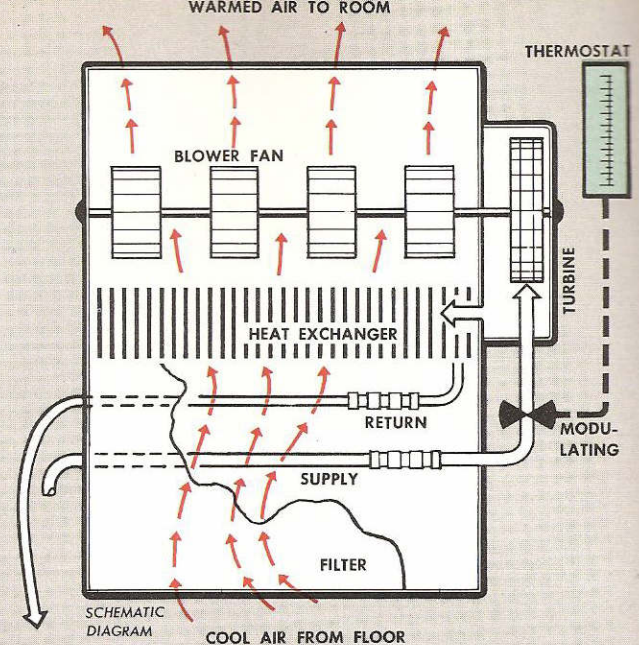
**HOTELS, MOTELS, APARTMENTS, SCHOOLS, CHURCHES AND HOSPITALS** In motels, hotels and apartment houses SelectTemp heating comfort attracts guests and tenants — yet saves fuel for landlords. In hospitals and schools, the speedy accurate temperature control of the SelectTemp unit is important to the health and comfort of patients and students. Air in each room is independently circulated and filtered. For all large buildings, SelectTemp offers substantial fuel economies because temperature in unused rooms can be kept low — yet the rooms can be quickly reheated.

# SelectTemp<sup>®</sup>

**OPERATES SIMPLY**

*... with minimum maintenance*

The key to the comfort and economy of the SelectTemp heating system is the fact that each separate heater unit is *individually* controlled. Each unit delivers a flow of filtered warm air — in the *exact* amount needed to maintain the temperature selected for the location. Here is how simply the SelectTemp unit operates:



**STEAM SUPPLY** — Each SelectTemp heater unit receives its own supply of steam through a  $\frac{1}{4}$ " copper tube. Boiler can be placed in the most convenient location without affecting steam supply to individual room units.

**THERMOSTAT** — Each SelectTemp unit is separately controlled by its own non-electric thermostat through a temperature range of 40° to 90°F. The modulating valve controls the flow of steam that operates the turbine and air-circulating fan, thus regulating both the fan speed and the heat output.

**TURBINE AND FAN** — Mounted on a single stainless steel shaft, the turbine and fan operate smoothly and quietly.

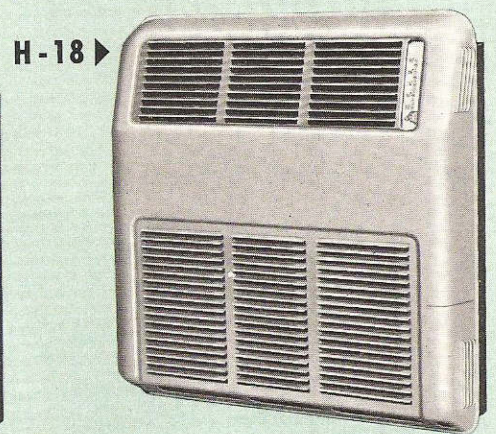
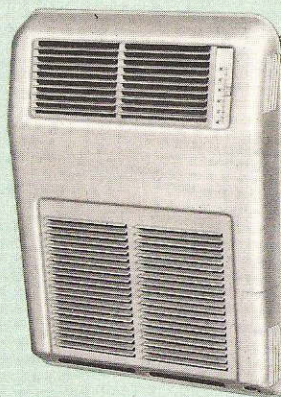
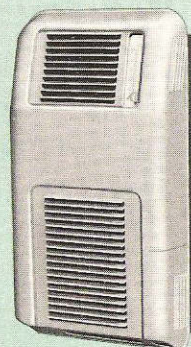
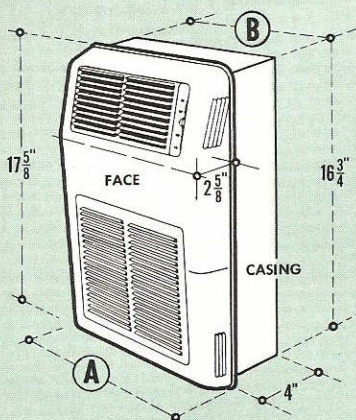
No lubrication or service is required. The speed of the fan varies according to the heat output demanded by the thermostat. SelectTemp eliminates "on-and-off" cycles that result in "cold 70°" stratification.

**HEAT EXCHANGER** — Steam travels from the turbine chamber to a highly efficient automotive-type copper heat exchanger, where it heats the circulating air.

**FILTERED AIR** — All circulated air is drawn in through the lower louvers, travels through the removable spun glass filter and is warmed by the heat exchanger. The fan then delivers a gently modulated flow of warmed, clean air to the room through adjustable diffusing louvers near top of unit.

## *Small and Compact* with 3 sizes to choose from

Small unobtrusive recessed wall units are mounted in wall stud space. They extend into the room only  $2\frac{5}{8}$  inches, are less than 18 inches high. They do not interfere with modern wall-to-wall carpeting or furniture arrangement. The attractive louvered front is easily removable — may be refinished to match decorating schemes or left with its own neutral finish.

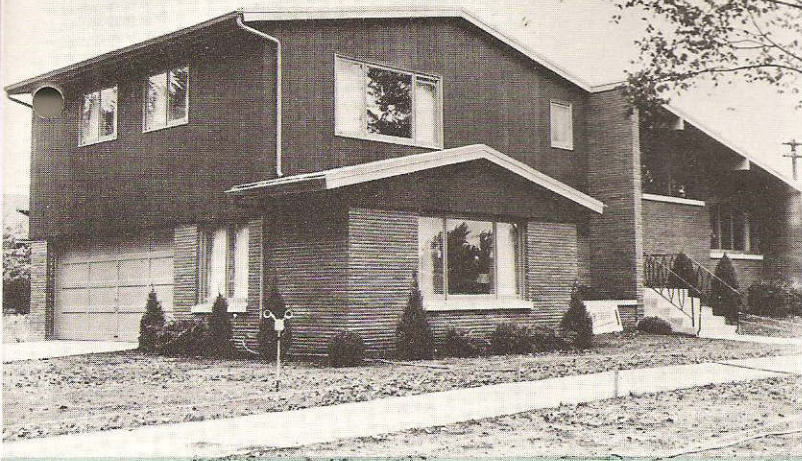


	H-6	H-12	H-18
Max. Btu delivery	6000	12000	18000
Min. Btu delivery	300	600	900
A — Face width	9 $\frac{1}{4}$ "	13 $\frac{3}{8}$ "	18"
B — Casing width	6 $\frac{1}{4}$ "	10 $\frac{1}{2}$ "	14 $\frac{7}{8}$ "
Weight of unit	13 lbs.	18 lbs.	22 lbs.
Air volume CFM	60	120	180

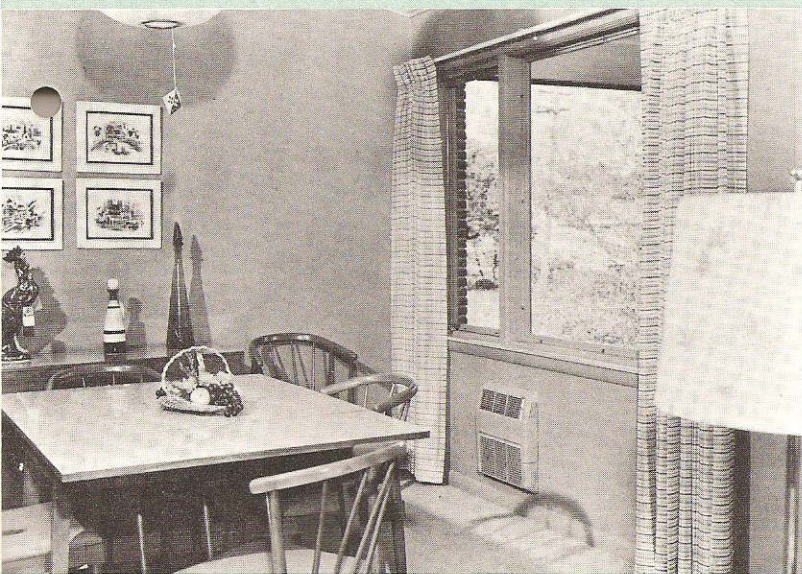
### SelectTemp Boilers are Gas or Oil-Fired

Built to highest performance standards, SelectTemp boilers are compact, well-insulated, skillfully engineered for economical operation and long life. Built-in hot water coils furnish instantaneous hot water all-year-round.

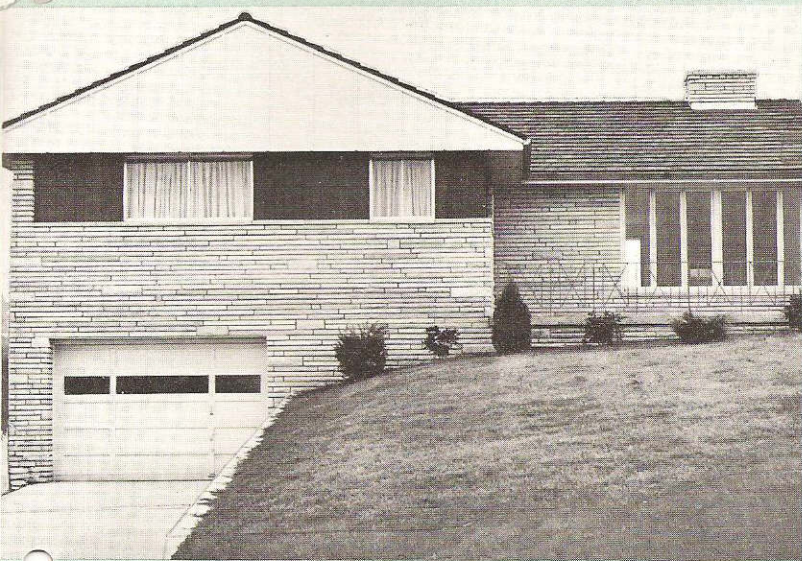
**CLEVELAND** This custom-built SelecTemp heated house was displayed by the builder for two days, attracting 5,000 visitors. Builder and SelecTemp dealer ran tie-in newspaper advertisements.



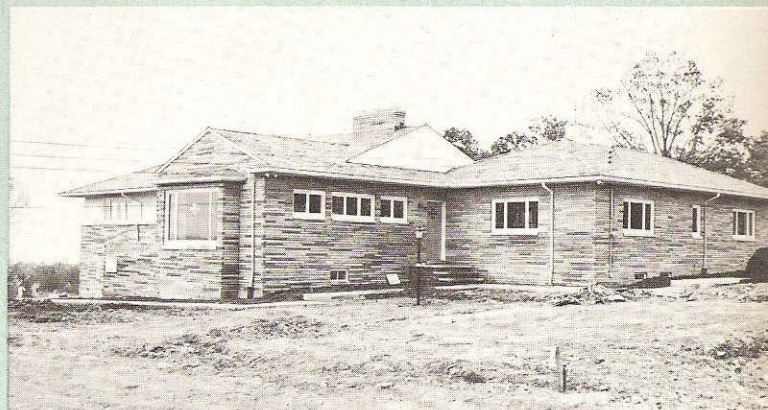
**LA GRANGE, ILL.** This model home was chosen "Home-of-the-Month" by *Suburban Life*, a newspaper circulated in the mid-west. Much of the appeal of this home is due to its SelecTemp heating system.



**LA GRANGE, ILL.** Interior view shows attractive, unobtrusive SelecTemp unit. Units can be painted to match color schemes — and do not interfere with furniture placement or wall-to-wall carpeting.

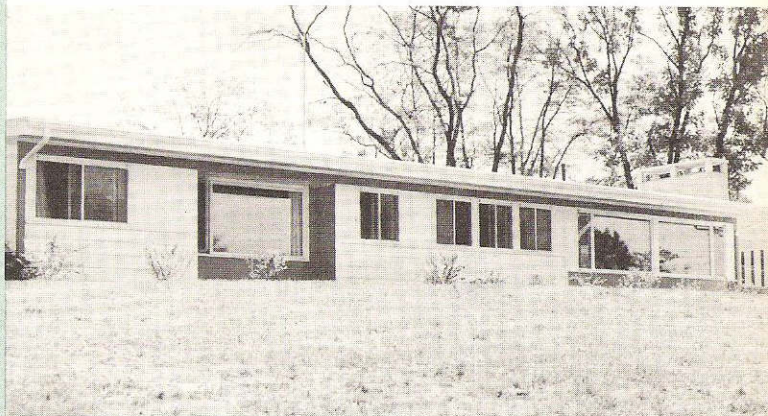


**PITTSBURGH** SelecTemp heating was featured in this model home, on display during the "Parade of Homes". After seeing the SelecTemp system, several visitors ordered SelecTemp heating for their homes.



## IRON FIREMAN® SelecTemp® Installations "Stole the Show" in these Model Homes

BUILDERS EVERYWHERE have found SelecTemp heating a sure-fire way to beat competition in the new-home market. SelecTemp systems tie in with the trend to give greater value in new homes by including "extra" features. And a SelecTemp installation often makes the difference between a quick profitable sale and a slow unprofitable one.



**MIDDLETOWN, O.** The SelecTemp installation in another *Better Homes & Gardens* "Home for All America" aroused much interest and resulted in a number of SelecTemp installations in this area.

# IRON FIREMAN® SelectTemp®

National Advertising

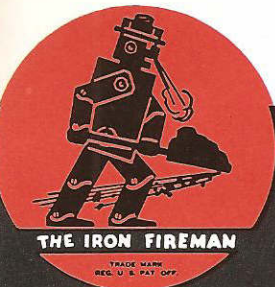
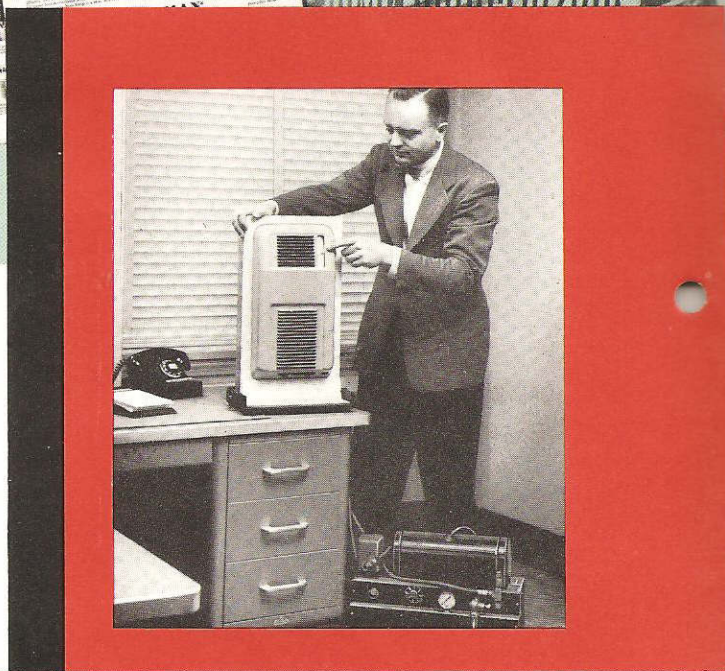
*Pre Sells*  
Your Prospects

Your prospects and customers are reading about the revolutionary new SelectTemp heating system. For a steady, planned publicity and national advertising campaign is keeping Iron Fireman SelectTemp in the public eye. Advertisements are appearing in such leading magazines as *Saturday Evening Post*, *Newsweek*, *Better Homes and Gardens*, *House and Garden*, *House Beautiful*, *Living*, *Small Homes Guide*, *Popular Science*, *Popular Mechanics*, *Home Modernizing* and others . . . making the Iron Fireman SelectTemp system known from coast-to-coast for the finest in heating comfort and convenience.



## Get a FREE Demonstration of SelectTemp

Ask Your Iron Fireman Dealer to Demonstrate SelectTemp Today! In your own office, using our portable demonstration unit, it takes only a few minutes to show you SelectTemp in operation. See your Iron Fireman dealer or write direct. There's no obligation.



# IRON FIREMAN® SelectTemp®

**Iron Fireman Manufacturing Company**  
CLEVELAND 11, OHIO



Oct. 26, 1954

M. O. SWENSON ET AL  
STEAM OPERATED HEATER SYSTEM AND/OR  
APPARATUS WITH CONTROL THEREFOR

2,692,759

Filed Sept. 27, 1951

3 Sheets-Sheet 1

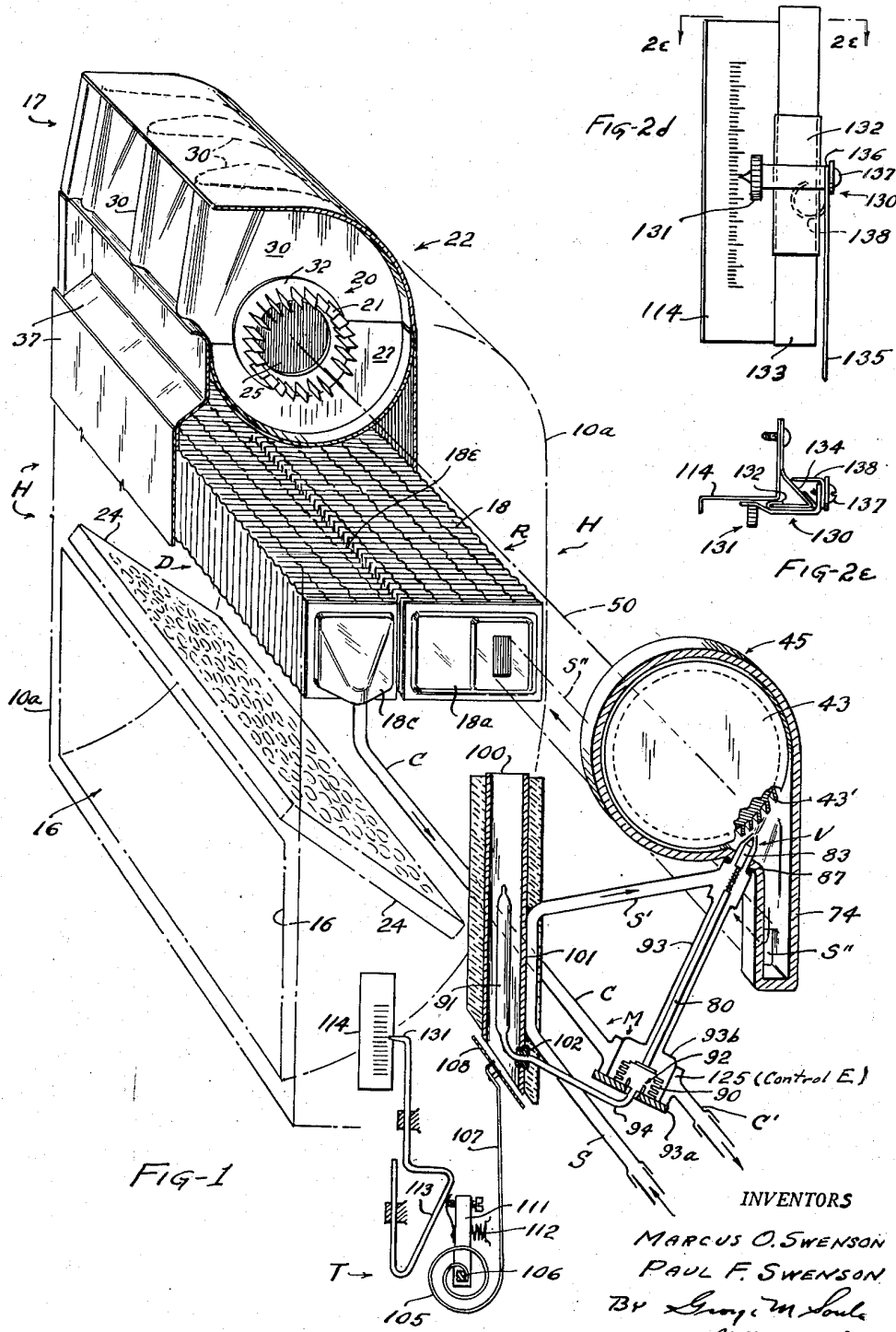


FIG-1

FIG-2d

FIG-2e

INVENTORS  
MARCUS O. SWENSON  
PAUL F. SWENSON  
BY *George M. Soule*  
ATTORNEY

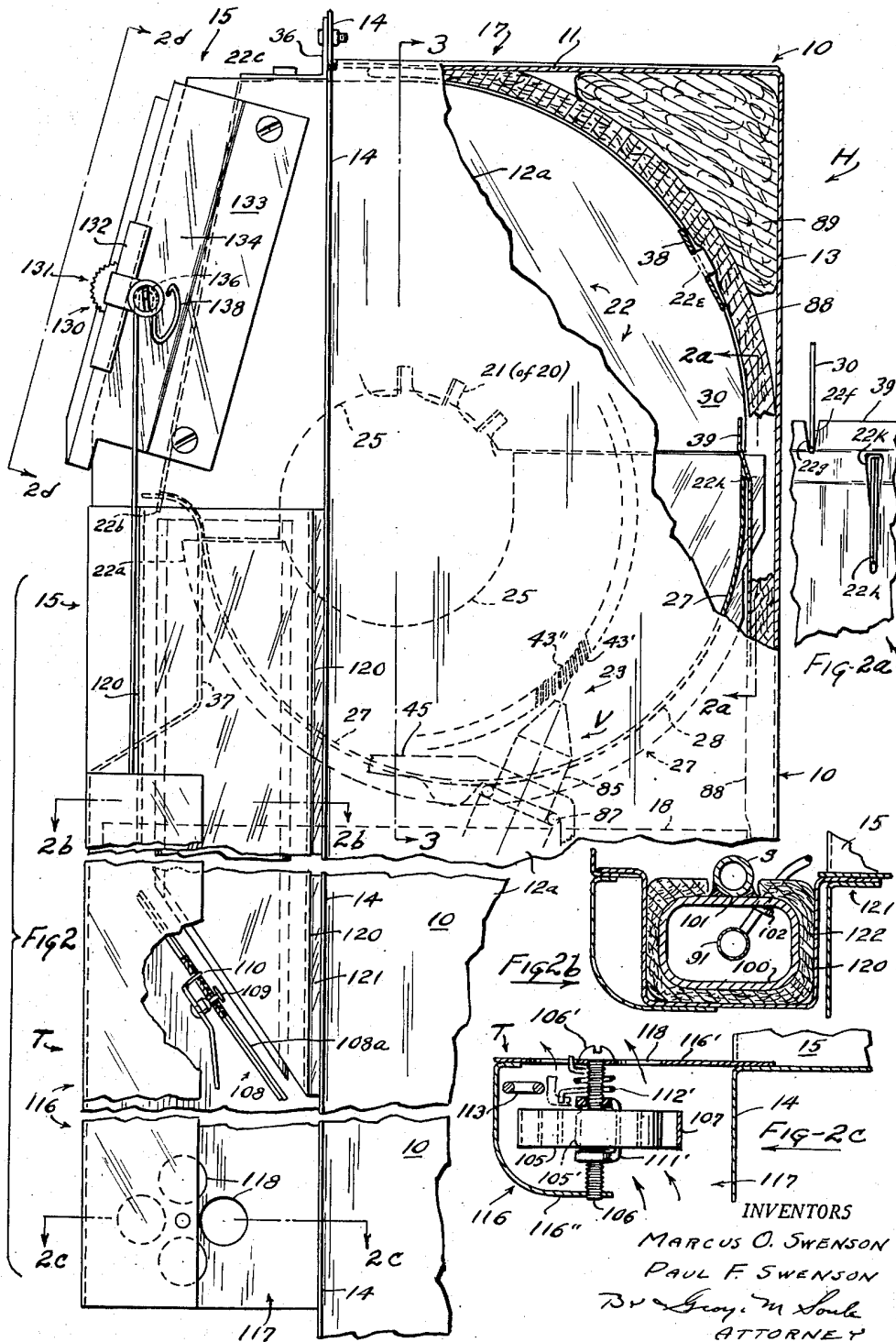
Oct. 26, 1954

M. O. SWENSON ET AL  
STEAM OPERATED HEATER SYSTEM AND/OR  
APPARATUS WITH CONTROL THEREFOR

2,692,759

Filed Sept. 27, 1951

3 Sheets-Sheet 2



INVENTORS  
MARCUS O. SWENSON  
PAUL F. SWENSON  
BY *Gray, Du Loue*  
ATTORNEY

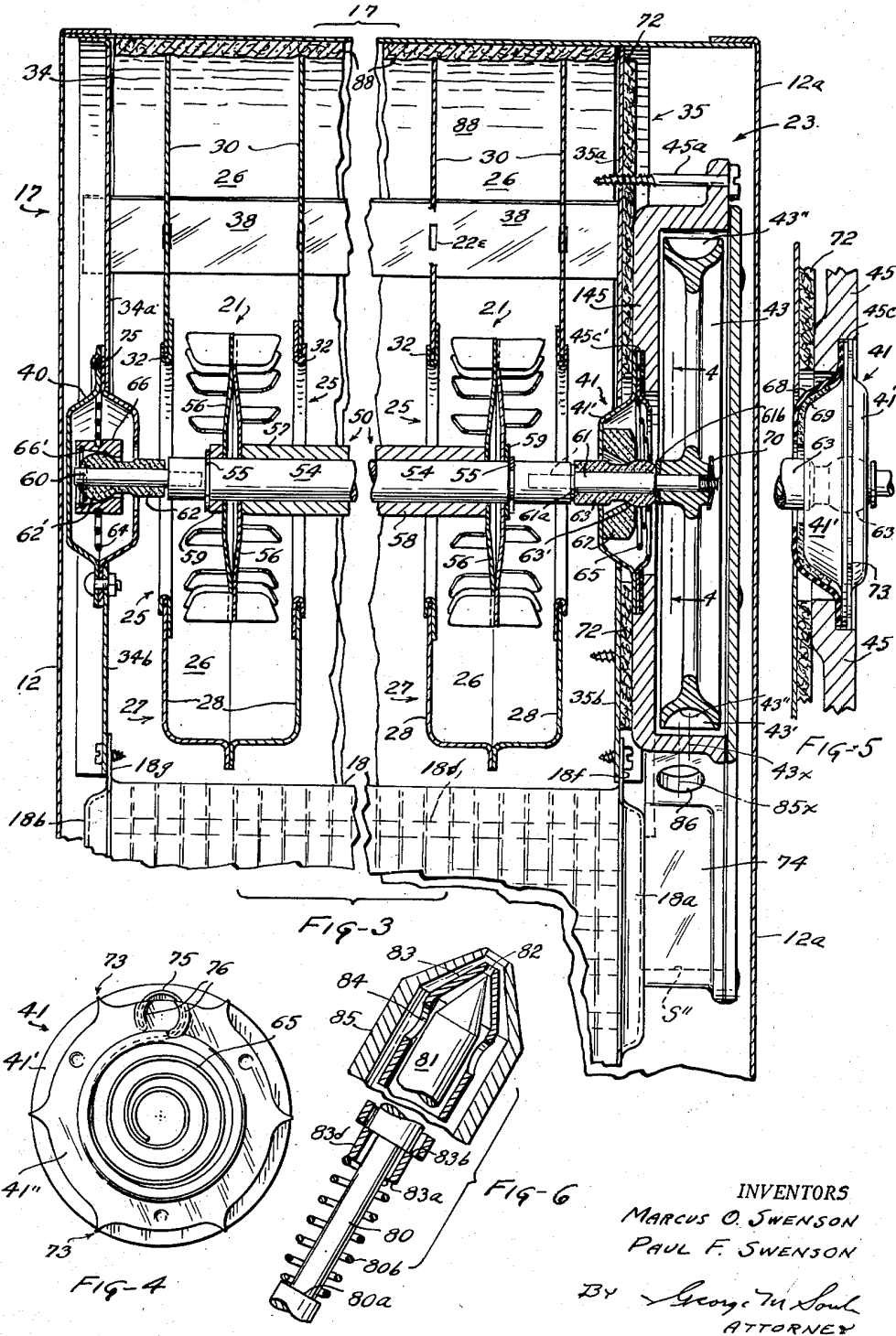
Oct. 26, 1954

M. O. SWENSON ET AL  
STEAM OPERATED HEATER SYSTEM AND/OR  
APPARATUS WITH CONTROL THEREFOR

2,692,759

Filed Sept. 27, 1951

3 Sheets-Sheet 3



# UNITED STATES PATENT OFFICE

2,692,759

## STEAM OPERATED HEATER SYSTEM AND/OR APPARATUS WITH CON- TROL THEREFOR

Marcus O. Swenson and Paul F. Swenson, Cleveland Heights, Ohio, assignors, by mesne assignments, of thirty-seven per cent to Otto Wanek, two per cent to Kenneth J. Kitchen, ten per cent to Paul F. Swenson, ten per cent to Marcus O. Swenson, four per cent to Myron T. Cooper-rider, eleven per cent to Wilma G. Stupka, eleven per cent to Wilma G. Stupka, trustee, ten per cent to J. A. Weeks, and five per cent to Earl P. Schneider, trustee

Application September 27, 1951, Serial No. 248,592

17 Claims. (Cl. 257—2)

1

The invention, as specifically shown herewith, relates to a steam heater and an automatic control mechanism for it.

The objects include provision of a new or improved mechanism, system, method and/or apparatus for heating generally enclosed spaces, particularly through the use of steam, a steam/air heat exchanger and positively moved or forced space air; a new or improved modulating or gradually acting heater control, as against an "on-off" control; a new or improved exhaust-temperature-operated emergency control particularly for a steam heater; a new or improved, self-contained, wholly steam-powered heater unit with provision for positive air movement and fully automatic concurrent control of steam and air flow; a new or improved turbine and blower mechanism for a forced-air steam-powered heater; a new or improved heat exchange element or radiator unit for a heater; a new or improved throttle valve mechanism for a heating fluid medium; a new or improved temperature amplifying or thermal relay apparatus operative for effecting modulated control of a heating fluid medium input; a new or improved air-space-temperature-responsive or primary thermostat mechanism for a heater control of the illustrated type; a new or improved rotary air blower assembly and free floating support for it, a new or improved air blower and turbine assembly including novel casing, framework and other constructional features applicable generally to space heater units of the disclosed type.

Other objects and novel features will become apparent from the following description of the illustrative embodiment shown in the accompanying drawings, wherein:

Fig. 1 is a schematic largely perspective view of the principal heater and control elements.

Fig. 2 is a full scale fragmentary side elevation of the main heater cabinet or framework including a primary control assembly housing, portions being broken away and shown in cross section.

Figs. 2a, 2b, 2c and 2d are detail sectional or elevational views taken as conventionally indicated on Fig. 2, Fig. 2e being a top view of the assembly shown in Fig. 2d.

Fig. 3 is a fragmentary sectional assembly view principally showing the turbine wheel-blower as-

2

sembly and its shaft support, the principal plane of the section being indicated at 3—3 on Fig. 2.

Fig. 4 is an end or main face view of one of two shaft bearing case assemblies for the blower and turbine wheel.

Fig. 5 is a slightly enlarged scale view of a preferred form of bearing case assembly mounting, being a modified arrangement in relation to the corresponding portions of Fig. 3.

Fig. 6 is a greatly enlarged scale central sectional fragmentary view of the preferred throttling valve V for controlling steam input to the heat exchanger via the turbine casing.

### GENERAL ARRANGEMENT

*Heat exchanger; blower-turbine; framework*

Subject mechanism, as shown, is particularly adapted for use in dwelling spaces, i. e. homes, workrooms and other such generally enclosed spaces, wherefore the illustrated physical embodiment is represented as a unit H, applicable to ordinary frame building constructions, for wall-inset-installation as between studding. The units are provided in various horizontal lengths, as determined by room size and shape, and of uniform heights and depths. Heating capacity is generally proportional to unit length. Because of using forced air at relatively low velocity, and modulating control, as will be explained and described, subject units H require only a fraction of the space usually occupied by conventional steam radiators of comparable capacity (convection type) and practically no otherwise-useful room space, providing the units H are largely wall-contained as they are designed to be used. The automatic modulating control requires no special power source, hence no fire hazard is involved; installation expense is very low and service expense is negligible or absent.

Unit H, for the use mentioned, and, as shown particularly in Figs. 2 and 3, has a generally rectangular, box-like, sheet metal casing or framework 10 (10a, Fig. 1) including a top wall 11, sides 12 and 12a, a back wall 13 (Fig. 2), a bottom wall (not shown), and all-around front flanges 14 for attachment to the building in which the unit is installed. Frontal portions 15 (Fig. 2) of the unit which extend forwardly of casing 10, rigid therewith, usually project into the room

or space to be heated in which case those portions are conventionally covered by a decorative or protective sheet metal or other facing and grill structure (not shown) which, in that event, would provide the air inlet opening 16, Fig. 1, preferably near the floor, for reception of room air into the unit.

A diffuser unit or assembly 17 (shown more or less schematically in Fig. 1) contains or supports the steam-air heat exchanger 18 (hereinafter, for convenience, sometimes called "radiator"), also the blower assembly 20 with vanes 21 and an air receiving and directing scroll cell structure generally indicated at 22, Fig. 1.

Various constructional features of the diffuser and casing assembly, parts or portions indicated by characters 22a through 22k, Figs. 2, 2a and 3, are intended to form the subject matter of a separate or divisional application; and, since the parts or features so indicated are made self evident in the drawings, they will not be further discussed herein.

The blower apparatus, except as hereinafter especially qualified, operates as a conventional multicell, scroll type centrifugal blower which discharges into the room space served the air which is received into grill opening 16 and is then warmed by the radiator.

Power for operating the blower is preferably supplied through a steam turbine mechanism or assembly 23, Figs. 1 and 3, operated by heat input steam from line S, S', Fig. 1, en route to the radiator through line S''.

The radiator 18, Figs. 1 and 3 has hollow, steam-inlet and condensate-outlet headers 18a and 18b respectively (Fig. 3 only) and a similar, steam and/or condensate return header 18c (Fig. 1 only), which headers interconnect the horizontal steam passages 18d (Fig. 3) of the radiator. As shown the radiator comprises an appropriately cut section of conventional radiator core stock and, for part of its length, as indicated 18e the air-contacting fin structure is divided (between horizontally adjacent steam passages 18d) into a steam-receiving portion R and a condensate-discharging or heating-medium-return portion D as will later be discussed more in detail. Condensate return line or exhaust from the radiator as indicated at C, C<sub>1</sub>, Fig. 1.

The room air, received at grill opening 16, is filtered through a conventional, readily replaceable, filter unit or frame 24 placed obliquely between the principal plane of the inlet or grill opening 16 and that of the radiator 18 in or on a suitable guide or attaching frame not shown.

By comparison of Figs. 1 and 3 it is apparent that room air entering unit H through grill opening 16, passes through the filter 24 to and through the radiator 18 and into lateral circular openings 25 of the individual scroll cells 26 containing the fans or air-impellers 21. The fans and cell walls diffuse and expel the warmed air into the room horizontally of the unit H.

Bottom scroll cell sections 27, each comprising two rigidly joined mutually complementary half shells 28 are vertically aligned with the defining walls of top scroll-forming elements 30. Elements 30 are generally U-shaped metal stampings (cf. Fig. 1) the bottom edge margins of which align with associated top edge margins of the half-scroll, composite bottom sections 27. All around the rotational axis of the fans 21 the upper and lower scroll shell elements 27 and 30 are detachably joined together by paral-

lel-flanged coupling rings 32 whose rounded inner peripheral surfaces (defining the air-inlet openings 25 of the scroll cells) conduct the air, which necessarily travels through the effective restrictions of openings 25 at relatively increased speed, smoothly and with little or no tendency to whistle even at maximum impeller speed.

The supports for the scroll cell parts 28, 30 described above comprise, as shown, main, oppositely flanged diffuser frame end or header members 34 and 35 (Fig. 3) which, in order to facilitate assembly of the blower etc. into the diffuser unit, may be formed as separate upper and lower sheet metal sections 34a, 34b and 35a, 35b.

The flanges of the frame end members 34, 35 support front cross connectors shown at 36, 37, Figs. 1 and 2, and rear cross connectors 38, 39, Figs. 2, 2a and 3, which can be joined to the end frames in any suitable manner, e. g. by welding or so called "sheet metal" screws (neither shown).

The heat exchange radiator 18 is detachably supported by the flanged end members 34b and 35b of the diffuser frame, as clearly shown by Fig. 3. The sheet metal header members 18a, 18b and 18c of the radiator have upstanding flange extensions 18f and 18g, as partially shown in Fig. 3 only, for attachment to the diffuser frame elements as by screws.

The flanged end members 34 and 35 of the diffuser frame also support, respectively, bearing cases 40 and 41 for the fan rotor shaft assembly 42 which is extended to the right, Fig. 3, beyond bearing case 41 to carry the impeller wheel 43 of turbine assembly 23. Casing 45 of the turbine assembly is also carried by frame end wall 35 as will be more fully described later herein.

#### ROTOR ASSEMBLY, FLOATING SUPPORTS, SEAL, ETC.

As shown particularly by Figs. 3, 4 and 5 the rotary parts of the blower and turbine assemblies 20, 23 are made of very light weight materials and unitarily mounted for free turning and laterally floating movement, as has been found highly desirable, if not practically essential, in order to minimize generation or transmission of sound vibrations and to minimize power requirement. Power saving is especially important when the power is borrowed from the heating steam supply as in the present embodiment. It is also practically necessary that the bearings for the rotor shaft shall operate indefinitely without deterioration under relatively high surrounding temperature conditions and without requiring attention, e. g. for lubrication or adjustment.

Rotor shaft 50 as shown in Fig. 3, has a relatively large diameter fan-supporting portion 54, preferably aluminum, grooved for receiving snap rings 55, between which axially resilient (concave-convex) fan-forming (e. g. aluminum) stampings 56 (mirror images of each other as assembled) are secured in axially compressed, i. e. flexed, condition through provision of spacer sleeves 57, 58 slid onto the shaft between adjacent pairs of fan stampings 56, and, further, of dimensionally appropriate clearance-takeup washers 59 at one end or both ends of the fan blade and spacer sleeve assembly.

The reduced-diameter cylindrical end portions 60, 61 of the shaft 50 are made separately from the main body 54 of the shaft, as stainless steel

5

pins or stubs pressed into place in end sockets of the aluminum body. The pins 60, 61 provide adequately hard and polished surfaces for contact with polished bores of carbon bearing sleeves 62, 63 which are used because of proven long life, oil-free service. The pressed-in portions of the pins 60, 61 are of reduced diameter relative to the carbon-sleeve-contacting surfaces of the pins. In the case of pin 61 the reduced diameter provides a shoulder which clamps a stainless steel washer 61a tightly in place on the shaft. A similar stainless steel washer 61b is tightly held on the shaft by the turbine wheel and its attaching means, nut 70; and the two washers by alternate abutment with the ends of the carbon sleeve 63 locates the shaft 50 and all parts carried by it axially in position.

The carbon sleeves 62, 63 are resiliently supported on light gage spiral springs 64, 65 in the respective bearing cases or housings 40 and 41, see Fig. 4. The carbon sleeves 62, 63 have generally spherical head portions 62' and 63', shown as seated respectively in a metal collar 66 and a carbon sealing ring 67 (described later) for universal movement (hence free self-alignment) relative to those members and the bearing cases. An inner shoulder of collar 66 bears leftwardly (Fig. 3) against the spherical head portion 62' under the influence of a very light retaining coil spring 66' seated like a snap ring in an internal groove of the collar. The inner coil of the bearing-supporting spiral spring 64 is expanded into an external groove of collar 66 and the various spiral coils thereby hold the carbon sleeve 63 in free floating position axially on the shaft stub or pin 60 while permitting lateral floating movement of the associated end of the shaft assembly. The spiral spring 65 in casing 41 is, by engagement of its inner coil with spherical head 63' of the associated sleeve, sprung slightly out of the normal plane in which the spring is originally coiled or formed; and, since the axially opposite portion of the spherical head 63' bears against the carbon ring 67, the latter is always maintained in sealing contact with the inner smooth face of the adjacent case part 41'.

The bearing case part 41' (see Fig. 5 for preferred assembly and construction) is appropriately sealed and sound-proofed as by a compound gasket 68, 69, against and around an inner circular margin of the turbine housing 45; hence air around the fan shaft within the diffuser head 17 is prevented from entering the turbine chamber, by way of the right hand floating bearing assembly, when there is a considerable pressure differential between turbine chamber and diffuser. Such differential tends to be created centrifugally by the turbine wheel. Gasket 69 is preferably of cork or other cellular cushioning material and is provided to absorb whatever sound the carbon ring 67 may make (in event of slight unbalance in the rotor assembly) in sliding against bearing case stamping 41'.

NOTE.—Turbine housing 145 as shown in Fig. 3, except for the location of its bearing-case-receiving counterbore 45c' (corresponding to 45c', Fig. 5), is intended to complement Fig. 5 in showing the turbine housing features which are omitted from Fig. 5.

The turbine housing 45 (or 145), when attached to the diffuser frame end wall 35 as by screws 45a, preferably holds a loose-fiber asbestos sheet 72 tightly against the diffuser frame. The sheet 72 serves principally as a sound absorptive, cush-

6

ioning pad for the turbine assembly and a vibration damper for the diffuser wall 35 which would otherwise tend to amplify sound generated by turbine operation at certain critical speeds. Bearing case 40 (left Fig. 3), is shown as bolted to diffuser wall 34. The other bearing case 41 (cf. Figs. 3, 4, and 5) has one of its sheet metal parts (41'' as shown) formed to provide a circular series of relatively sharp points 73 projecting beyond the outer rim of the complementary part (41') so that the entire case 41 and the bearing members supported thereby will be held securely in place in the illustrated position (see Fig. 5 especially) by over-center toggle spring or snubbing action of the points 73 as forced into place in the relatively smaller, receiving circular depression or counterbore 45c (or 45c', Fig. 3) formed in the turbine housing.

Fig. 4 illustrates the preferred manner of securing the spiral springs 64 and 65 in the bearing cases 40 and 41, essentially the same construction being used for both. An anchor loop 75 of the spiral spring is designed to be held securely between the embracing parts of the two stampings (i. e. composing the cases 40 or 41) when those stampings are finally secured together as by spot welding. For example, part 41'' is recessed as at 76 (Fig. 4 only) to receive the spring loop 75, and the loop is especially held securely by local welding not shown. Thereby the center carbon-sleeve-supporting loops of the two spiral springs 64 and 65 are yieldingly maintained centrally of the respective bearing cases.

#### 35 STEAM-AIR HEAT EXCHANGER (continued)

It has been mentioned that the exchanger 18 is a single section of conventional radiator core stock with certain ones of the horizontal steam inlet passages divided, principally by headers 18a, 18b and 18c from the passages which communicate directly with the condensate outlet pipe C; and, in effect, that for part of the horizontal length of the exchanger, in the direction of steam passage therethrough, cross conduction of heat from portion R to portion D is interrupted by separation of the heat radiating fin structure into two parts, as by the vertical through slot 18e (Fig. 1) in the core structure. Such slotting has the effect of producing: (a) an approximately uniform average air temperature at the diffuser unit outlets from blower cells 26; (b) minimized cross or lateral conduction of heat from the inlet larger area portion R to outlet smaller area portion D, thus allowing a relatively low heating-medium-exhaust temperature; (c) an inlet radiator section and an outlet radiator section (comparable, in operation, to superposed, serially connected sections) but in a single inexpensive and vertically compact arrangement with the necessary heating fluid connections at a common end, and (d) an economically manufactured, operatively integral, multiple fin and tubing radiator core or exchanger structure of proven type which is not subject to destructive strains when relatively large portions of it operate with a high temperature differential therebetween. Such portions are represented (Fig. 1) by the steam inlet side R and condensate or outlet side D.

#### 70 TURBINE AND NOZZLE; STEAM THROTTLE VALVE

Valve mechanism V, Figs. 1, 2, and 6, as already mentioned, is the thermal-amplifier-controlled or adjusted throttling valve for fluid heating medium input to the heater H and operates as a

two stage steam turbine nozzle which (inter alia) insures that at low heat requirements of the heater, when the volume of steam flow is minimized, the steam will be caused to impinge on the turbine blades at sufficient velocity to insure turning of the turbine impeller and air blower assembly 20. The compound nozzle tends to maintain uniform rotor-blade-driving effective force in the various throttling positions of the valve.

Motor device or bellows M, Fig. 1, operates the throttle valve, as will be still further described later, through friction-free stem 80 connected to a central needle valve pin or plug 81 of the throttle valve, see Fig. 6. Needle or pin 81 variably closes a tapered seat intersecting port 82 in a sleeve-needle 83 the interior of which is always in communication with steam input line S as through lateral passages 84, Fig. 6, in the sleeve. Sleeve needle 83, in turn, seats against a tapered inner face of a main nozzle fitting or thimble 85 which enters an opening 86, Fig. 3, of the turbine case 45 or 145 and is sealed around that opening as by an elastic O-ring 87, Fig. 2. Fitting 85 is held firmly against the turbine case, around the opening 86 by appropriate means not shown.

Control needle valve part or valve pin 81 is constrained to open its port 82 in sleeve-needle 83 before the sleeve-needle can open its relatively larger port in the fitting 85. For that purpose a lost motion yielding connection is provided between the operating stem 80 and the sleeve-needle 83. As shown the stem 80 has a shoulder 80a and the sleeve-needle a shoulder 83a between which shoulders a light gage helical spring 80b is held in compression at all times. Thereby, as the stem 80 moves in the valve-opening direction, its first operation is to unseat the central valve needle 81. Upon further valve-opening movement of the stem the head formed by the valve pin 81 abuts a shoulder 83b of the sleeve 83 thereby withdrawing the sleeve-needle from contact with its seat in fitting 85. To minimize valve seating areas, and further to contribute to freedom of operation, the tapers of the needle plugs (81 and 83), in the described order of unseating, are of increasingly divergent relationship with respect to their seating surfaces, as illustrated. Shoulders 83a and 83b are provided by radially distorting the wall of the shell which forms the sleeve-needle 83 (portion 83d) after the stem, spring and sleeve needle are relatively assembled.

The needle valve parts 81, 83, 85 are normally coaxial with turbine housing case opening 86; and the nozzle axis thereby established (see 85x, Fig. 3) is preferably eccentric to the principal central plane 43x (Fig. 3) of the turbine impeller wheel 43 about which plane the impeller blade and bucket formations 43', 43'' are symmetrically disposed.

The turbine wheel 43 is preferably an aluminum casting having its blades and buckets formed as tangential cuts intersecting the originally cylindrical periphery as shown by comparison of Figs. 2 and 3. Since noise and required air flow limit air impeller diameter and speed the turbine wheel is made adequately larger than the fans 21 to nevertheless achieve efficient turbine blade velocity at average available steam velocity. The selected proportions, as illustrated tend to insure rotation of the impeller assembly at very low steam flow.

At relatively high turbine speeds which result from correspondingly high steam jet velocity,

the individual jet impacts on the blades will be relatively small. In practice we provide 180 blades on the approximately 4" impeller wheel illustrated with approximately .005" thick blades and .040" wide, uniformly tangential slots to form the buckets. The high frequency sound waves generated in operation of the turbine at maximum speed, being highly directional are easily muffled by appropriate sound damping provision discussed below. The large number of blades causes the individual sound waves emitted by the turbine to be of low amplitude and at a frequency above the audible range.

The sound muffling of the apparatus as a whole includes the loose fiber asbestos sheet 72 already described and (Figs. 2 and 3) a sheet of fibrous mineral material, e. g. fiber glass 88, backed up by a filling wad 89 of the same or similar material, all contained between the diffuser assembly 17 and the main outer casing 10. Sheet 88, as will be evident from comparison of Figs. 2 and 3, forms or may form an upper part of the blower scroll cell structure 22 already described in some detail. Fig. 1 is wholly schematic as to the upper scroll cell structure (top shown as though composed of a solid imperforate sheet, not used).

#### AUTOMATIC HEATER CONTROL

The control mechanism is principally shown in the schematic diagram, Fig. 1, complemented by Figs. 2, 2b and 2c which show an actual physical arrangement of certain of the components. The control, as designed for operation with saturated steam, is represented partly by a well known type of sealed vapor pressure generator and motor device M which, as shown, includes a flexible metal bellows or diaphragm 90, separate vapor generator bulb 91, and a connecting capillary tube 94. The motor proper or bellows has its movable end wall connected directly to the throttle valve operating rod or stem 80 which is designed for movement with nearly complete freedom from friction in a generally upright light gage metal tube 93. The relatively heavy base 93a of the tube 93 forms a fixed support for the bellows. The rod 80 and tube 93 are of low heat conducting metal and of such length as will thermally isolate the bellows portion of the assembly to prevent control action on the bellows directly by incoming steam.

The tube 93, in effect, is part of the input steam line S', ahead of the throttle valve in the direction of passage of steam to the heater. After commencement of heater operation, the tube and its enlarged base portion become filled, around the valve stem and the bellows, with trapped condensate. The water column thus maintained contributes to thermal isolation of the bellows 90 from the steam chamber or upper enlarged portion of tube 93 around the throttle valve, and at the same time transmits the steam pressure to the movable wall of the bellows.

At a given supply steam pressure, after an equilibrium point of steady operation has been reached, further opening or closing of the throttle to satisfy varying heat demand has negligible effect on the pressure in the throttle valve chamber, due principally to the fact that the effective needle valve outlet or throttling orifice for steam is very small in relation to the supply conduit cross section and to the effective area of the diaphragm or bellows 90. The average nozzle orifice effective area, in wintertime heating of average dwellings, bears to the effective area of

the diaphragm or bellows a ratio of between 1/300 and 1/400.

The control mechanism further includes an extremely delicately acting primary thermostat mechanism T which is designed for full range operation with a small room or space temperature change (around 2° F.). Mechanism T initiates steam-valve-throttling operation of the motor device M and thereafter modifies its action on the steam throttle valve in accordance with room temperature.

The control mechanism (as a further outline of arrangement and operation) is a device in which a delicately acting or highly sensitive thermostat (hence necessarily of low power) when subjected to relatively small variations of room air space temperature, is enabled to develop or cause stable operation of a relatively strong force by amplifying or magnifying the small air space temperature variations or signals to corresponding or proportional large relay output temperature variations for throttling-power-control. The amplifying ratio is desirably in the magnitude 1:5. Such temperature amplifying or thermal relay operation affords throttle-valve-positioning, modulating control through a relatively large range, and, as will be shown, is independent of steam pressure fluctuations within fairly wide limits. The relatively strong throttle-valve-operating force mentioned above is derived, in the control mechanism as illustrated, as a function of steam input heat, as a suitable source resulting in a relatively high secondary or thermal-relay-output equilibrium temperature, the acting force being gradually varied or modified by operation of the primary thermostat T.

Bulb 91, as shown, is subjected to steam input temperature by being located in a heat-reservoir and air conduit 100 formed as an externally insulated (e. g.) copper flue or chimney appropriately joined in intimate heat conductive contact with a portion of the steam inlet pipe S, S' as at 101. The bulb thus obtains its relatively high temperature principally, if not wholly, by radiation of heat thus absorbed by the chimney.

Since the primary purpose of introducing room temperature air into the chimney under the control of thermostat T is to cause variation of bulb temperature in accordance with room temperature change, it is of advantage so to design this part of the apparatus that only one of the three processes of heat transfer is effective as a function of input heat to the mechanism as a whole. Thus, preferably, the bulb is subjected steadily to radiant heat by the surrounding chimney wall and is cooled by convection.

In order that the bulb can be simultaneously sensitive both to input (steam) heat and that of space or room air (samples of which as needed for the modifying or tempering action being induced to enter the chimney by convection as will be explained) the bulb and its capillary tube are generally isolated from contact with the chimney. As shown a double flanged elastic ring or collar 102 acts to support the bulb firmly in spaced or loosely enveloped relation to the copper chimney by snug engagement with the wall of an opening or slot in the chimney and by snug embracement of the tube.

In order for the temperature of bulb 91 to accurately reflect the position of the damper valve 103, as determined by the primary thermostat, extraneous heat losses from the bulb and capillary tube must be minimized. In other

words, bulb heat loss must be primarily due to the cooling effect of room air admitted to the chimney and should not be by way of the capillary tube or otherwise to air externally of the chimney. For that reason the capillary tube 94 is preferably stainless steel the heat conductivity of which is very low as compared to copper which is generally used for capillary tubes. Additionally, the capillary tube may have a barrier or insulation sheath (not illustrated), for the purpose of minimizing generator heat loss.

Since air introduced into the chimney is progressively heated by the chimney its temperature increases as it passes through the chimney. The chimney, in turn, being cooled by the passage of air therethrough, is progressively cooler from the air outlet end toward the air inlet end. Thus if the bulb is located near the outlet end it will be heated more rapidly by the high temperature end of the chimney and cooled less rapidly by the high temperature air; while if the bulb is located near the intake end of the chimney it will be heated less rapidly by the cooler chimney portion and cooled more rapidly by the cooler intake air. By properly locating the bulb between the chimney ends a desirable relationship between throttle opening rate and throttle closing rate may be selected. For example by proper location the two rates can be made approximately equal.

For installation of the capillary tube and collar 102 into the receiving chimney wall opening the bottom edge margin of the copper chimney is preferably slit (not illustrated) into intersection with the chimney wall opening which receives the collar to permit a small portion of the chimney wall metal to be bent out of place and then returned to position in engagement with the collar.

#### PRIMARY (ROOM AIR) THERMOSTAT

The thermostat mechanism T, as schematically shown in Fig. 1, includes a bimetal coil 105, which, as mentioned, is designed to be delicately responsive to room air temperature change (return air to the heater). The coil 105, for desired-temperature range or control point selection by room or space occupants, has in effect a pintle mounting at 106 and a wholly free arm portion 107 (not usually a bimetal member) which is the sole support for a damper or valve 108 freely pivoted on the arm (see 109, 110, Fig. 2) in normally free juxtaposition to one end of the chimney (oblique bottom end as shown) for controlling the amount or volume of room or space air (could be any other low and generally constant temperature fluid) which can enter the chimney as draft induced by its heat.

The bimetal coil support includes an arm 111 suitably biased as by a spring 112 toward an adjusting cam 113 part of which, shown as a pointer 131 in Fig. 1 is associated with a graduated temperature scale 114 (preferred, arrangement explained later in connection with Figs. 2, 2c, 2e and 2d).

It is important that the thermostat element 105 be isolated from operational heat of the mechanism (unit H) as much as practically possible in a self contained heater and control, hence, as shown by Figs. 2 and 2c, the coil is disposed in a light walled protective case or guard 116 made, as will be apparent from the views, to provide a generous sized inlet 117 for room air near the base of the unit H and at one side of it. Air usually travels over the bimetal coil in directions indicated by arrows in Fig. 2c, leaving principally through openings 118 and the open top of case or guard



116 as induced by recirculation of room air through operations of the blower in conjunction with the room walls.

Part of the air control damper (e. g. top plate 108a, Fig. 2) is preferably non-metallic (e. g. hard asbestos or plastic) as a partial barrier against radiation of chimney heat to the bimetal. Damper-aligning tongue or finger 110, Fig. 2, and damper-supporting pivot pin 109 are of very small cross section, hence those parts are ineffective to transmit appreciable chimney heat to the coil (lost by radiation from the relatively long arm 167 which may be of low conductive material).

Referring further to chimney 100 and associated features, as shown particularly by Figs. 1, 2 and 2b, the chimney is preferably mounted in a supporting case member 120 of channel-like form attached, as at 121 to the heater housing 10, and practically the entire space around the chimney and within the case member 120 is packed with insulation material 122 for the full height of the chimney. That concentrates the chimney heat largely on the vapor generator bulb 91 and further tends to prevent chimney heat loss and radiation to the bimetal coil notwithstanding the fact that the chimney and coil are fairly near each other. Channel 120, as shown, supports part of thermostat case or guard 116.

By comparison of Figs. 1, 2 and 2c it will be apparent that with the bimetal coil supported as indicated and subject to room air return circulation the filter 24 (Fig. 1 only) isolates the coil from influence of heat radiating from the heat exchanger 18 and its associated metal parts.

#### PRIMARY THERMOSTAT SETTING MECHANISM

The pintle mounting 106 for the bimetal coil 105 can be very conveniently made (Fig. 2c) as a uniform diameter screw 106' threaded for its full length. Threads of the screw engage both parallel main walls 116' and 116'' of the thermostat guard or case 116. The bimetal coil 105 has its inner end 105' firmly fixed to a rigid, U-shaped sheet metal arm 111' having spaced parallel portions which are apertured to receive the screw. At least one of the apertures has internal threads mating the screw threads so that the arm 111' is held by the threads in properly spaced position between the guard side walls 116' and 116'' and is still free to pivot as necessary for setting or adjustment of damper position. The follower spring for holding arm 111' in contact with cam 113 comprises, as shown in Fig. 2c, a torsion coil spring 112' around the screw 106' with one of its ends bearing against the arm and the opposite end hooked into one of the air openings 118 of guard wall 116'.

As shown in Figs. 2, 2d and 2e the arrangement for setting cam 113 of the thermostat mechanism in reference to graduated dial 114 includes a slider assembly 130 having a pointer and manipulator button 131 the support for which assembly is a generally C-shaped vertically elongated saddle 132 rigid with the pointer end freely slidable on a sheet metal bracket 133 which, together with the dial, is suitably secured fixedly to one side of the frontal portion 15 of the main heater casing as will be apparent from inspection of the views. The bracket 133 has a flat panel portion 134 the plane of which is oblique to its front, saddle-supporting portion as shown best in Fig. 2e.

The coil-position-adjusting cam 113 (actual production design not shown) has an adjustable

operating connection with the saddle and pointer assembly 130 including a relatively stiff metal wire 135 which has an attaching loop 136 at its upper end receiving an attaching screw and clamping washer 137 and an additional, spring, loop 138 integral therewith. As shown particularly by Fig. 2 the spring loop 138 is forced out of its normal plane by contact with the oblique panel 134 of bracket 133 so that it serves as a spring friction shoe to hold the slider assembly, securely in set positions.

#### VAPOR PRESSURE GENERATOR AND MOTOR MECHANISM

##### *Constructional principles; operation*

Metal bellows 90 (a commercial or standard part) is selected for proper spring rate for stabilization of throttle valve action and, of course, with regard to throttle valve stroke, chimney/bulb design or interrelationship, type of vapor fluid to be used and other factors generally following recognized practice. For example, the filling fluid used to charge the vapor space or chamber provided, in the illustrated arrangement, by the bellows 90, bulb 91 and capillary tube 94 of motor M must be so chosen as to have a vapor pressure/temperature relationship (rate of pressure change with temperature) such that the desired throttle valve movement will take place as the effective heat of the chimney is modified by damper valve action of the primary thermostat. Additionally, since the vapor pressure action in the bellows (tending to close the steam valve) is opposed by steam pressure which varies within certain limits, the vapor fluid pressure change with temperature must be selected to be in the same magnitude as that of the steam within the range of steam pressures to be used. Thereby the effects of such steam pressure variations on the throttling control will be minimized.

If a portion of the vapor generator and motor is to be used for condensate-temperature-operated emergency control (E, described later) this function places an additional limitation upon the selection of filling fluid and the normal bulb operating temperature range. When such condensate-temperature-operated mechanism is used then, since normal condensate temperature establishes the lower minimum operating temperature for the bulb in the chimney and emergency control temperature establishes the maximum operating temperature in the chimney the normal damper-modulated bulb temperature for throttle operation must be located within those two limits.

The vapor space or chamber (bellows, capillary tube and bulb) is preferably fully charged with a single vapor generator fluid, methyl alcohol for example, at ordinary room temperature while the bellows is retained in a partially collapsed condition (top bellows wall in contact with an appropriate stop as at 92, Fig. 1, for example) against the inherent opposing force of the bellows spring. Thereby the throttle valve will be fully open when steam is first admitted to the system as through pipe S, and immediately start heating the exchanger and circulating room air. Additionally during an idle period when room heat is not required the bellows arrangement and charging procedure provides a minimum of steam bleeding through the unit necessary to maintain the chimney at a suitable energy supplying level. Maintenance of chimney temperature during idle periods is desirable to insure rapid response to a change of room heat loss. It can be seen that as the chimney cools due to lack of steam flow

the bellows filling procedure described will cause throttle opening and thereby the re-establishment of chimney temperature. Incidentally should rupture or leakage of any movable wall of the bellows occur at any time, the internal and external pressures will be equalized and the bellows spring will then close the throttle valve.

It may be noted at this point that when the assumed saturated steam is first supplied to the system through pipe S (assuming the room temperature is below the desired temperature at which the primary thermostat T is set) steam will first be supplied to the heater through the throttle valve, starting room air circulation and maximum heat supply to the heat exchanger 12. Concurrently the applied steam pressure will through the tube 93 which surrounds the valve stem exert pressure on the top side of the valve-connected wall of the bellows, biasing the valve toward open position. Since the bimetal coil 195 is sensing an assumed room temperature below its set range and thus has allowed a relatively large chimney opening, the incoming steam will be heating the chimney toward an equilibrium temperature as established by the chimney damper setting.

The bulb or vapor pressure generator located within the chimney is now heated to a temperature dependent upon chimney temperature and damper-controlled air. This, in turn, will cause vapor pressure corresponding to the modified generator temperature for the selected vapor fluid to be transmitted to the throttle valve motor bellows 90 in a throttle closing direction. As the bimetal coil senses an increase in room air temperature, caused by room heat addition from the heat exchanger 18, the chimney opening will be restricted with a resulting higher chimney temperature, a higher bulb temperature, and an increased throttle closing biasing force of the vapor fluid pressure. When the room air temperature sensed by the bimetal reaches the lower portion of the temperature control range the corresponding bulb temperature and vapor pressure force will be sufficient to cause throttle closing action to a stable point where the vapor pressure plus the remaining spring biasing force of the motor (bellows) are equal to the oppositely acting or biasing steam force.

A stable position of the throttle valve will result since the spring biasing force acting conjointly and codirectionally with the vapor pressure force decreases in the throttle closing direction while the steam pressure remains substantially constant. Thus there will be only one combination of vapor pressure force and throttle position with a net force equal to steam pressure force.

It can be seen that as the room air temperature approaches the upper portion of the control range steam throttling will be accomplished such that, within the capabilities of the unit for the steam being supplied, the room heat losses will be just equalled by the heat addition and the unit will maintain temperature, assuming that heat loss to be constant, at a point within the temperature control range corresponding to the necessary throttle valve position.

As room heat loss (e. g. by lowering of outside or weather temperature) commences to exceed heat input to the room the same action as already described takes place and the throttle valve is further opened until the rate of room heat supply again balances the rate of loss.

#### EMERGENCY CONTROL AND OPERATION

Condensate return from heaters of the class de-

scribed is usually as a liquid to an unsealed condensate tank at atmospheric pressure. Thus any flow of steam from the condensate return line is highly undesirable, being a source of loss of boiler water and being capable of adversely influencing condensate return from other normally operating units.

The emergency control E hereof, by restricting steam flow to the heater to such a point that the condensate temperature must be appreciably below the saturated steam temperature at atmospheric pressure, operates to prevent steam flow through the return line C, C' and limits exhaust to a liquid. Control E, limits the maximum quantity of steam that can be supplied to unit H within the immediate condensing capability of the unit.

In order to prevent premature operation of the emergency control, as when the heater is required to operate at full capacity (maximum steam and air flow at maximum steam pressure) the condensing capacity of the heater should, through proper design, be adequate, under the condition mentioned, to limit return line temperature to a point well below the normal bulb temperature control range.

In event air circulation in the room served by the heater becomes restricted, as by accidental blockage of the heater air inlet or outlet passages, the emergency control mechanism E operates to reduce or cut off the supply of steam to the heater as will be described.

The emergency control mechanism, as shown schematically in Fig. 1 only, includes a heat exchange relationship between condensate return or exhaust fluid pipe C and the bellows 90 of motor M, represented by a chamber portion 125 of the return pipe around the bellows housing or hollow enlarged chamber portion 93b of the condensate collector tube 93 which contains the throttle valve stem. For simplicity of installation a uniform diameter return pipe is secured as by a clamp (not shown) in heat conducting contact with the metal base plate 93a which supports the bellows.

Complete emergency throttle closing action (shutdown) results from attainment by the vapor fluid in the bellows of a temperature as high as that to which the vapor generator bulb 91 is subjected by damper-controlled convection in order to cause movement of the throttle valve to closed position.

When room air circulation is restricted as mentioned the normal removal of the steam heat content by the room air does not take place; the room air heating is reduced, and the primary thermostat T causes opening movement of the throttle. This necessarily results in an increase of condensate temperature. If the air flow restriction is sufficient to cause the condensate to approach a temperature at which saturated steam tends to pass through the exhaust line, throttle closing movement is caused by vapor generation in the bellows. Such throttle valve movement actually continues only until the steam flow is reduced to the current condensing capacity of the heat exchanger mechanism, hence for complete shutdown the air blockage or restriction would have to reduce the condensing capacity practically to zero value.

Since exhaust from the heater is limited to a liquid by the above described emergency control action, it follows, as an additional feature of control E, that pressure in the turbine chamber is prevented from rising to a value such as could

cause steam leakage from the chamber into the adjacent portion of the diffuser or blower housing.

#### VARIATIONS

The following alternatives for the control mechanisms thus far described and as shown in the accompanying drawings while not yet fully investigated for practical application would appear to be within the spirit and scope of the present invention:

1. Reversal of the direction of operation of steam and vapor generator pressure on the throttle valve V and reversal of action of room thermostat mechanism T. In this case vapor pressure in the generator of motor M, in response to input-heating-medium temperature as modified by damper-controlled convection in the chimney 100, would oppose throttle-valve-closing steam pressure on the bellows 90 aided by a suitable stabilizing spring opposing and overcoming the inherent spring action of the bellows wall in case a metal bellows is used; and the bimetal coil 105 would then have its operation reversed so as to open the damper 108 to increase steam flow as room or space temperature falls. This arrangement would require a continually open by-pass bleeder for steam around or through the throttle valve in order to maintain an initial-throttle-opening bulb temperature. This arrangement requires a special emergency control e. g. separate vapor generator system to shut off steam or for steam throttling in response to abnormal return line temperature rise.

2. An arrangement in which the metal bellows forms a pocket inside a vapor-fluid-containing and supporting case or capsule sealed around one end of the bellows and free from the opposite end, the pocket being open to the throttle valve chamber ahead of the valve and the bellows having its free or movable end wall connected to the end of the valve stem opposite the valve plug.

The above form ("2") of vapor generator and valve assembly can (a) be supplemented with remote bulb and connecting capillary tube and fully substituted for the illustrated arrangement (all functions the same) or (b) be used as the tempering-fluid-sensitive part of the vapor fluid chamber (with or without separate bulb and capillary tube) in which case condensate is free to enter the bellows around the valve stem, the movable or free end wall of the bellows thus being subjected to steam pressure on one side and vapor pressure on the other; and, if a capillary tube and bulb are also used as mentioned, then the bulb is disposed remotely of the bellows and capsule unit (e. g. outside the tempering fluid conduit or chimney) for emergency control, heat-exchange association with exhaust (i. e. condensate) fluid.

We claim:

1. A control for a space heater operated by a heating fluid medium, comprising: a throttle valve for heating fluid input to the heater, fluid motor means operatively connected to a movable element of the valve and including a sealed chamber for thermo-responsive vapor fluid, the chamber having two relatively isolated thermo-sensitive surface portions, means arranged to subject one of said portions to a heating medium input temperature function ahead of the valve, space-temperature-responsive means controlling the flow of a tempering fluid into heat exchange relationship to said one thermo-sensitive portion for modifying the throttling action of the motor means in accordance with space temperature

changes, and emergency control means arranged to subject the other thermo-sensitive surface portion to an exhaust heating fluid temperature function for moving the same throttle valve element toward closed position in event of increase in exhaust temperature to a predetermined point.

2. A control for a space heater operated by steam, comprising: a throttle valve for steam input to the heater, fluid motor means operatively connected to the valve and including a sealed chamber for thermo-responsive vapor fluid, the chamber having two relatively isolated thermo-sensitive surface portions, means arranged to tend to maintain one of said portions at a temperature generally in the magnitude of that of the input steam, means operating normally to maintain the other of said portions at a temperature materially less than that of the input steam, space-temperature-responsive means acting variably to cool said one thermo-sensitive portion for modifying the throttling action of the motor means in accordance with space temperature changes, and emergency control means arranged to heat the other thermo-sensitive surface portion as a condensate temperature function for limiting condensate temperature.

3. A self-contained steam-powered space heater unit and control comprising in combination: a forced air heat exchange mechanism including a radiator, a rotary air impeller, a steam turbine connected to drive the impeller, a throttle valve for input steam including a nozzle directed to operate the turbine, and means to conduct turbine exhaust steam to the radiator; the control comprising a thermal relay including a motor operatively connected to the valve and having a first thermo-sensitive control element normally and continually subjected to approximately the temperature of the steam as supplied to the radiator for operation over a relatively large control temperature range and a second thermostatically operating control mechanism subjected to space air temperature and having a relatively small temperature control range, and means to cause the second control mechanism to vary the flow of a low temperature fluid into cooling relationship to the first thermo-sensitive control element to initiate throttle-valve-positioning operations of the motor.

4. A steam-operated space heater unit having a heat exchange radiator and an air blower mechanism including an impeller adapted to be driven by input steam en route to the radiator, a steam throttling valve and input steam passage means leading thereto, a motor mechanism including a thermo-sensitive actuator element and motor element actuated thereby and operatively connected with the valve, an air conduit around and in spaced relation to the actuator element and comprising a tubular heat-conductive hence heat-radiating wall in intimate heat-exchange relationship to a portion of the input steam passage means, space-temperature-sensitive means arranged to control the flow of air from a portion of the space served by the unit into the conduit, said means comprising a flap valve element disposed across one end of the conduit and supported for movement wholly by a bimetal thermostat element, and means to conduct space air to the bimetal element while substantially isolating said element from operational heat of the unit.

5. A control mechanism for a room space heater adapted for operation by a heating fluid medium under pressure, comprising: a throttle valve for the heating fluid, a sealed vapor pressure motor

mechanism having a thermally sensitive surface, means operative normally to maintain said surface steadily at a temperature generally in the magnitude of that of the heating fluid medium on the way to the throttle valve, the motor mechanism having a movable wall operatingly connected to the valve, the wall being continuously exposed on one side to vapor-fluid-pressure and on the opposite side substantially uniformly to pressure of the heating fluid on the way to the throttle valve, means operatively to maintain said opposite side at a temperature considerably less than that of the heating fluid on the way to the valve, and space-temperature-responsive means controlling the flow of a relatively low temperature fluid into heat-exchange relationship to said thermally sensitive surface of the motor mechanism.

6. The mechanism according to claim 5 wherein the last mentioned means thereof comprises a space-temperature-responsive thermostat motor remotely of all previously mentioned elements, the thermostat motor having an output member forming the sole support for a damper arranged to control the flow of room space air in a manner variably to cool said thermally sensitive surface.

7. A control mechanism for a room space steam heater requiring for its operation steam input under pressure, said control comprising: a throttle valve for the steam, a sealed vapor pressure motor mechanism having a motor portion and a separate but connected thermo-sensitive generator portion, the motor portion having a movable wall connected for opening and closing the throttle valve as a vapor pressure function of the generator, the motor portion of the motor mechanism normally containing vapor fluid in liquid form only, means operative during the admission of steam to the valve to maintain the thermo-sensitive generator portion steadily at a temperature generally in the magnitude of that of the input steam, means operative to subject one side of said wall substantially to input steam pressure while simultaneously sufficiently isolating the wall from input steam temperature to insure that the vapor fluid in contact with said wall will normally remain in liquid form, and room space temperature responsive means operative to control the flow of low temperature fluid in thermal exchange relation to said generator portion.

8. A modulating control for a space heater operated with saturated steam, comprising: a throttle valve for the steam, a fluid motor having an element operatingly connected to the valve and having a thermosensitive vapor pressure generator portion, means for concurrently causing the generator portion to sense the temperature of the supply steam by heat transmitted to it and said motor element to sense the pressure of the supply steam substantially exclusive of its temperature, whereby the heat-induced vapor fluid pressure tending to move the valve in one direction is opposed by steam pressure tending to move the valve in the opposite direction, air space temperature responsive means controlling the flow of cooling air into contact with the generator to cause generator temperature changes in accordance with air space temperature changes, and spring means connected to oppose movement of the throttle valve in one direction with a force which varies with throttle valve position, whereby to allow establishment of an equilibrium throttling position of the valve for each air space temperature.

9. A control mechanism for a steam-operated, space heater, comprising: tubular means forming

a throttle valve chamber having a steam inlet passage, a steam discharge port and an elongated condensate-collecting passage exposed to steam on the way to the port, a metal air conduit open at both ends and in thermal association with the steam-inlet-passage-forming portion of said means for heating of the conduit, a vapor pressure generator including a bulb in the conduit in spaced relationship to its metal wall, a metal bellows in said condensate-collecting passage and a capillary tube connecting the bulb and bellows and in spaced thermal-insulating relationship to the metal of the conduit, a throttle valve member in the valve chamber in steam-controlling relationship to the port and connected to the bellows by means passing loosely through the elongated condensate-collecting passage, and space-air-temperature-sensitive motor means arranged to control the flow of air through the conduit for variably cooling the bulb.

10. In and for a space heater, a control mechanism having a valve for throttling the input of a heating medium to the heater, a valve-positioning mechanism including a temperature-responsive actuator device and motor means rendered active thereby and connected to the valve to hold it in throttling positions, means to subject the actuator device steadily to relatively high temperature radiant heat during operation of the heater, and means to modify the temperature of said actuator device by the cooling effect of space air, the modifying means comprising a generally upright metal conduit containing the actuator device and having a downwardly open air inlet passage, air guiding means operative to conduct relatively low temperature air from said space to said air inlet passage, and a space-air-temperature-change-actuated mechanism for controlling the passage, the latter mechanism including a temperature sensing motor element remotely of said air inlet passage and a damper movably supported generally across the passage and normally out of contact with the conduit solely by an output portion of the temperature sensing motor element.

11. In a steam heater unit wherein steam is throttled through a steam turbine nozzle on the way to a heat exchanger, a throttle valve nozzle comprising a hollow steam-conducting body having a steam-guiding orifice converging toward the turbine along a fixed axis for delivery of the steam as a concentrated jet, a tubular plug communicating with the steam conducting interior of said body and movable within the body along said axis variably to restrict the orifice, said tubular plug having a relatively smaller discharge orifice also converging toward the turbine along said axis, an inner plug movable within and relative to said tubular plug along said axis, means providing a lost motion connection between the plugs for limiting said relative movement along said axis to predetermined extended and contracted relative positions, respectively, of the plugs and for causing movement of the tubular plug by the inner plug in a direction away from the orifice of the body after the plugs have reached said predetermined extended position, means including a spring and co-operating shoulder means on or connected with the plugs and operative during movement of the inner plug in a direction for opening the orifice of the tubular plug to hold the tubular plug in a position closing the body orifice until the inner plug has moved a predetermined distance to said relatively extended position of the plugs, and a motor con-

nected to the inner plug for axial movement of it whereby to control emission of steam successively through said orifices.

12. A modulating control for a steam heater wherein steam is supplied to a radiator under appropriate pressure to operate a steam turbine on the way to the radiator and the turbine drives an air impeller to extract heat from the radiator; the control comprising: a steam throttling valve having a closed position and various steam throttling positions in each of which the steam emerges from the valve into operating contact with an impeller element of the turbine as a concentrated stream, fluid motor means operatively connected to the valve and including a sealed chamber for thermo-responsive vapor fluid, means tending to maintain a thermosensitive portion of the chamber at a relatively high temperature, the motor means having relatively opposed, pressure-receiving surfaces, one subjected to vapor fluid chamber pressure and the other substantially uniformly to input steam pressure in all positions of the throttle valve, spring means connected to stabilize the valve in its steam throttling positions, and space-temperature-responsive means arranged to control the flow of relatively low temperature fluid into cooling relationship to the thermosensitive portion of the vapor fluid chamber.

13. A modulating control for a space heater connected for operation by steam at substantial pressure, the control comprising a thermal relay including a primary relay input thermostat sensitive to temperature of such space, a secondary relay output thermostat mechanism including a sealed vapor pressure generator having an actuating element exposed to steam temperatures as supplied to the heater and an expansible chamber motor element connected to the actuating element and having opposed areas, one subjected to vapor pressure of the actuating element and the other subjected to steam pressure as supplied to the heater, means operating at least partially to isolate said other area from the heat of the steam, a throttle valve for the steam including a port member and a control plug member, one connected for throttling movement by the motor element, the port and plug members providing a throttling orifice for the steam of such small average area in relation to those of said opposed motor element areas as to have substantially negligible unbalancing effect on the motor areas as the valve members are relatively moved between steam throttling and closed positions, spring means connected to act on the motor-connected member of the throttle valve for stabilizing the valve in steam throttling positions, and valve means connected for operation by the primary thermostat and arranged to control the flow of cooling fluid over the actuator element of the thermal relay.

14. In a space heater operated by steam and having a heat exchange radiator with inlet conduit means for steam and outlet conduit means for condensate; a throttle valve including a valve chamber, valve port and movable port-throttling means in the chamber; means forming a generally upright tubular pocket, having one end in open communication with the valve chamber for receiving steam on the way to the port, hence capable of collecting condensate of such steam; a vapor generator system including a motor vessel in the pocket and means mechanically connecting said vessel with the throttling means and extending through the open end of the pocket

out of frictional contact with its walls for full freedom of movement and so that the motor vessel will be more or less isolated from the heat of the steam by condensate in the pocket, said generator system further including an actuator vessel remotely of the pocket and arranged to derive motor-actuating heat from the steam inlet conduit means; air space temperature sensitive means arranged for controlling the flow of cooling air over the actuator vessel for thermal relay actuated control of the throttle valve; a portion of the radiator outlet conduit means being in heat-exchange relationship to said motor vessel to cause emergency throttling operation of the valve therethrough consequent upon attainment of a predetermined high temperature by said radiator outlet conduit means.

15. A self-contained steam powered space heater unit and control comprising in combination: a forced air heat exchange mechanism including a radiator, a rotary air impeller, a steam turbine connected to drive the impeller, a nozzle directed to admit steam to operate the turbine, a throttle valve for controlling the input steam, and means to conduct turbine exhaust steam to the radiator, and a control including a first thermally responsive motor means normally and continuously subjected to temperature changes of the input steam delivered to the radiator and operatively connected to the valve for moving the valve in the opening direction in response to decreases in the temperature to which the first motor means is subjected, and in the closing direction in response to increases in the last mentioned temperature, a second thermally responsive motor means subjected to space air temperature and having a smaller temperature control range than the first motor means, means to cause a flow of space air into heat exchange relationship with said first motor means, and means operated by the second motor means to decrease the flow of said space air into said relationship when the space air temperature increases and to increase the flow of space air into said relationship when the space air temperature decreases.

16. The unit and control combination according to claim 15 characterized in that said radiator has a return line for conducting fluid in the form of condensate and steam from the radiator, and means are provided for operatively subjecting the first motor means to the temperature changes of the fluid in said return line so as to urge the first motor means to operate in the valve closing direction as the temperature of the fluid increases.

17. The unit and control combination according to claim 15 characterized in that means are provided for applying the pressure of the input steam to the first motor means in opposition to the force applied for moving the valve in the closing direction by the first motor means.

#### References Cited in the file of this patent UNITED STATES PATENTS

Number	Name	Date
65 Re. 20,027	Wettstein	Jan. 30, 1936
297,937	Johnson	Apr. 29, 1884
658,586	Reiling	Sept. 25, 1900
1,764,463	Muller	June 17, 1930
1,806,393	Giesler	May 19, 1931
70 1,875,851	Carson	Sept. 6, 1932
2,046,643	Mackintosh	July 7, 1936
2,072,399	Giesler	Mar. 2, 1937
2,144,030	Potter	Jan. 17, 1939
2,285,305	Reid	June 2, 1942
75 2,626,187	Toftmann	Jan. 20, 1953