Thrush SYSTEM OF HOT WATER HEATING

H. A. Thrush & Co.

PERU, IND.

Thrush System of HOT WATER HEATING

In this catalog are set forth the advantages of Thrush Regulated Hot Water Heating together with useful tables of valuable data for heating contractors.

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PERU
INDIANA

What is the Most Satisfactory Method of Heating?

HOT water heating, in the opinion of the best modern Heating Engineers, is the most satisfactory and economical method of heating for residences, apartments, greenhouses, garages, and store rooms. Careful tests lasting over several years prove that even gravity Hot Water Heating Systems actually save 20% in yearly fuel consumption over steam. *The Thrush Controlled Hot Water Heating System provides the most highly efficient and economical heating plant possible,* saving 30% to 40% in fuel consumed as compared with gravity Hot Water or with Steam.

Why Hot Water is More Satisfactory

In a steam heating plant the temperature of the steam cannot be controlled because steam must always carry at least 213 degrees temperature. *Steam is either on full force or it is shut off entirely.* There is no "in between" stage for moderate weather. If the steam is shut off at the radiator, coal is being wasted at the boiler because the steam is there just the same doing no useful work.

In a Hot Water Heating plant, on the other hand, *the temperature of the water can be delicately controlled* to provide just the right amount of room temperature for the requirements of the weather. Hot Water will heat rooms sufficiently warm in the coldest of weather and it will keep the rooms comfortable in mild weather without waste of fuel. With Hot Water you generate *just as much heat as you need.*

WEATHER FOR AVERAGE HEATING SEASON
In New York, Boston, Chicago, Pittsburgh and St. Louis

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Highest temperature degrees F.	87	68	61	55	50	71	82
Lowest temperature degrees F.	34	24	6	12	4	6	16
Mean temperature month, degrees F.	58	46	34	32	28	37	50
Greatest daily range, degrees F.	29	24	29	29	26	37	38
Least daily range degrees F.	6	5	5	5	5	7	6

This chart is compiled from U. S. Bureau reports.

The Flexibility of Hot Water Easily Accommodates the Weather Changes

The undoubted advantages of hot water over steam and hot air heating are

1. Mildness and consequent healthfulness.
2. Elasticity of operation.
3. Ease of installation.
4. Economy in fuel consumption.

Thrush Regulated Hot Water

When you add to these advantages of the ordinary hot water heating plant, *the positive control of temperature provided by the Thrush System of Automatic Temperature Damper Regulation,* you reach the highest point of efficiency in heating possible.

The Thrush System provides *a closed system under pressure* that promotes rapid circulation and intensifies the heat in the radiators by increasing *heat transmission.* The Thrush System makes any hot water heating plant vastly more efficient.

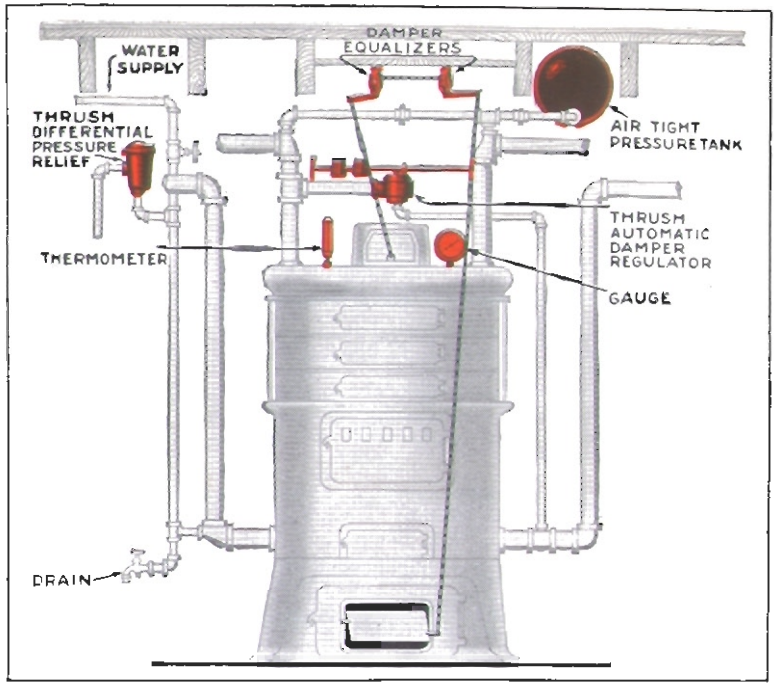
How Best Control Temperature?

There are various methods of temperature regulation. The Thrush method controls temperature at the source. Not at the radiator in the room nor by the temperature of the room,—*but by the temperature of the water itself*, is the only basically correct method of control. Room temperature regulation not only does not accomplish its purpose but wastes fuel. By the time the room is hot enough to operate the mechanism the fire is going so strong that the mere closing of the dampers will not check it. The chances are that by the time the room cools off enough to open the dampers again the charge of fuel will be so nearly consumed that the opening of the dampers will not suffice to restore the proper room temperature.

Features of Thrush Regulation

With the Thrush System installed the dampers are automatically closed when the *temperature of the water* reaches a point where it *will produce* the maximum temperature desired in the room. While the room may still be warm, the Thrush System opens the dampers again as soon as the *temperature of the water* has dropped to a point which would eventually reduce the temperature of the room to a point below the minimum if the dampers were not immediately opened. By this you can see that Thrush System provides the most practical heat regulation and also conserves the fuel with the utmost possible efficiency.

The Expansion (or Pressure) Tank is one of the important factors in connection with any hot water heating system. It must be capable of providing sufficient capacity for the range of temperature fluctuations which must be encountered, without wasting the hot water from the system unduly. The expansion and contraction of the water in a hot water heating system is as constant as the change of the water temperatures, which usually vary from 110 degrees to 200 degrees throughout the heating season. Thus there is an almost constant flow of water to and from this tank, which must serve as a reservoir for the surplus water when the system is hot, and to replenish the water back to the radiators when the system cools. *It is the surest and most dependable means yet devised to automatically perform this work.*

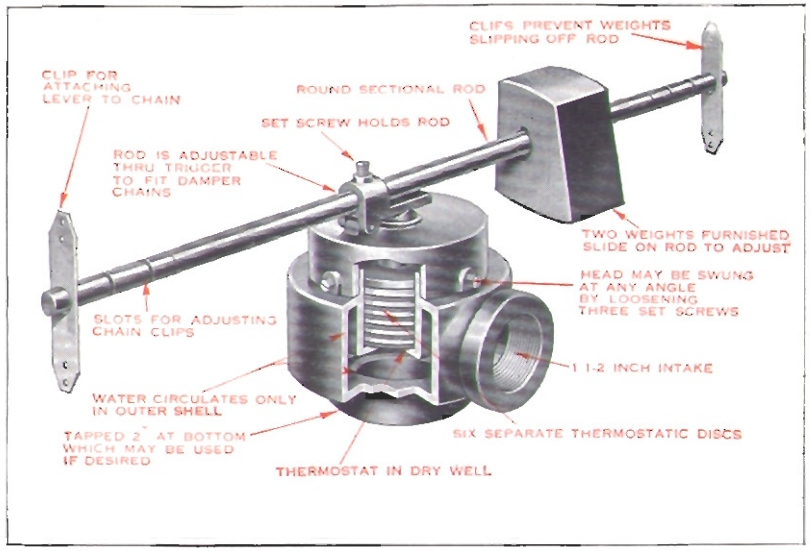


The Complete Thrush System

Class "A" Equipment

Briefly, Thrush System Class "A" Equipment as shown above comprises the Thrush Automatic Damper Regulator, The Thrush Differential Pressure Relief, the Air Tight Pressure Tank, the Thrush Damper Equalizers, Thermometer and Special Gauge. It is all complete ready to install, with diagrams and charts for every type of boiler in common use.

Thrush System is a controlled hot water heating system operating under a slight pressure. The Expansion (or Pressure) Tank is placed close to the boiler in the basement, making installation easy and eliminating all danger of freezing. By reference to Figure 1 above, it will be seen how simple it is to install the entire Thrush Equipment, while it requires on the average eight hours for a steam fitter and his helper to properly install the old system with the expansion tank in the attic. The saving in labor and material will more than neutralize the added cost of Thrush Equipment.



The Thrush Automatic Temperature Damper Control

The operation of this Regulator depends upon the temperature change of the water circulating through the heating system and *not upon pressure*. Changing the pressure in the system does not affect the operation of the Thrush Temperature Regulator in any way. For maintaining different water temperatures, only a simple adjustment of the weights on the lever is necessary—sliding back and forth on the rod.

The Thrush Regulator consists of a three-inch Multiple Disc Thermostat which sets in a dry well surrounded by the hot water leaving the boiler, which circulates in a chamber around it.

The Thrush Temperature Regulator requires no personal attention to insure proper operation; no winding of motor or clock; no adjustment of Thermostat. There are no electrical connections to get out of order. It reduces care taking, saves running up and down cellar stairs and insures uniform and healthful heat. It is a fuel saver, is adaptable to any kind of hot water heater where automatic regulation is desired and it *can be installed on old jobs as well as new* with minimum discomfort to the occupants.

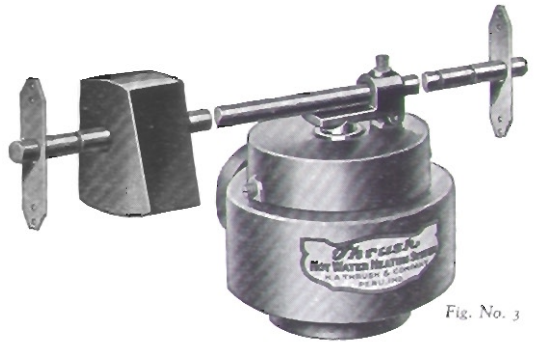


Fig. No. 3

Each Thermostat Works Independently

The Regulator may be connected with 1½" close nipple as shown on page 16, figure 17, or it may be connected circulating back to the return port of the boiler as shown on page 5, figure 1. The Regulator is slightly higher in efficiency when connected to the return port but will work very satisfactorily either way.

Twelve Real Features

1 Thermostats in six separate units; defect in one does not put Regulator out of service.

2 Thermostat units easily accessible by simply loosening three set screws and lifting head.

3 Thermostat sets in dry well so that units are preserved.

4 Heating plant doesn't have to be drained to remove thermostats.

5 Tappings suitable for any type of boiler.

6 Specially adaptable to many methods of installation.

7 Movable and adjustable head.

8 New style trigger with set screw to fasten lever in permanent position.

9 Trigger and lever so designed as to permit lever to be adjusted into best position for fastening lever to chains which control dampers.

10 Lever lies close to top, requiring less space above Regulator to accommodate lever action.

11 Special clips made to fit on lever, convenient for hook up—and also prevent weights from sliding off ends.

12 Lever is made in three sections and packed in same neat box with Regulator.

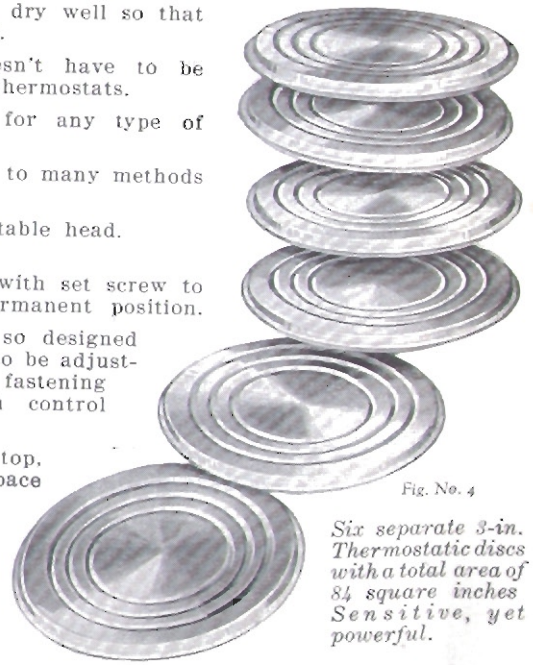


Fig. No. 4

Six separate 3-in. Thermostatic discs with a total area of 84 square inches Sensitive, yet powerful.

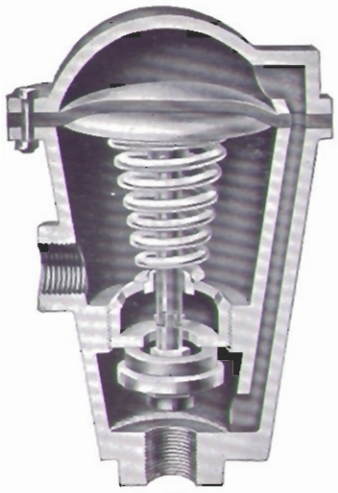


Fig. No. 5
Patented—Complies with Code
A. S. M. E.

The Thrush Differential Pressure Relief

The Thrush System is a closed system operating under pressure. It has a *safe* and *positive* means of relieving excess pressure *with absolute certainty*.

The Thrush Differential Pressure Relief Valve is assembled in a way that will not permit dirt or sediment to accumulate around the seat and will therefore always close tight against the leakage of water when the pressure in the system has been reduced to the proper working condition. The valve really seats upward against the ceiling.

It is set to open at approximately 26 pounds pressure or an equivalent of about 60 feet altitude, which is suitable pressure for 1, 2 and 3 story buildings. Special adjustments can be made at our factory to meet the requirements of higher buildings when ordered.

It cannot fail to operate when the pressure has reached the maximum for which it is set because the differential ratio between the valve disc and the diaphragm which operates it is ample. *This provides a tremendous safety factor* and insures positive overflow of excess water in the heating system when needed. This certain control makes it possible to maintain higher pressure with safety and thus insure better and quicker circulation. The Relief Valve is connected to the water supply line and there is no circulation of water through the device except at such times as excessive expansion takes place. It is therefore filled with the coolest water in the system which preserves the elements from deterioration.

If the system is drained during the winter on account of closing up of building for any reason, the Differential Relief Valve should be disconnected and all of the water poured out of it, then reconnected to the system.

How It Works

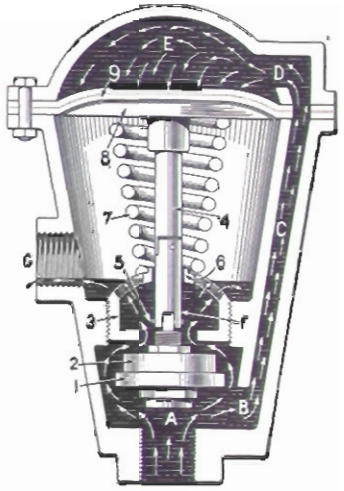


Fig. No. 6

The water enters the Differential Pressure Relief Valve at A, passes through opening B into By-Pass C, to opening D into top Chamber E. (See Figure 6). The Valve Member is closed tight when not under pressure by means of the tension of Coil Spring 7

As pressure accumulates from the system, Diaphragm 9 is forced against Adjustable Plate 8, which pushes down upon Valve Stem 4. When pressure has become sufficient to counteract the tension of Coil Spring 7, the Valve unseats and allows the water from Chamber A to pass out through Middle Chamber of opening G. As pressure recedes coil spring pulls Valve Disc against seat and overflow ceases.

Not only is the safety factor of the Thrush Differential Pressure Relief Valve *ample to eliminate all possible danger*, but even if the spring should break the only result would be immediate relieving of the pressure. Breakage of a spring does not put the boiler in danger of bursting but merely allows the excess pressure to escape at an even lower pressure than it would under normal working conditions. This is due to the fact that the Thrush valve seats on the ceiling, leaving no pocket where dirt can accumulate to prevent proper seating.

When installing a Thrush Differential Pressure Relief Valve always cause the system to overflow when you first fill it so that water will pass above the valve seat and submerge the valve disc. This prevents all possibility of corrosion. The ordinary type of relief valve is open to the atmosphere on one side and the action of air on the valve with the slight amount of water which may seep through encourages corrosion. The Thrush valve on the other hand is insulated from the air by water above valve seat and corrosion prevented.

A Vital Part of Any Hot Water Heating System

DIMENSIONS AND CAPACITIES OF TANKS

Size No. 0—12"x36"
350 sq. ft. radiation
Size No. 1—12"x48"
750 sq. ft. radiation
Size No. 2—12"x60"
1250 sq. ft. radiation
Size No. 3—14"x60"
2000 sq. ft. radiation

Fig. No. 7

Thrush Air Tight Pressure Tanks

The Thrush Pressure Tank conserves hot water. When ever water is heated, it expands and some water is forced out of the system. In the ordinary open gravity or the "tankless" system it overflows out into the air, and is wasted. It takes coal to raise the temperature of water, and every time hot water is wasted, coal is wasted, for when the water in the system cools and contracts, fresh water from the mains must be taken in, and that calls for more heat immediately.

In Thrush System this water that is forced out of the system goes into the Thrush Pressure Tank where it is saved, and it returns to the system immediately when the water in the system has contracted again.

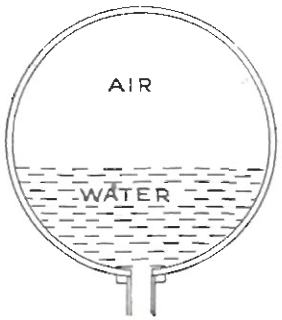


Fig. No. 8

Every time *fresh* water is let into a boiler it deposits lime, magnesia and other insulating substances on the boiler plates. This gradually reduces the heating efficiency of the plant. By keeping the same water in the system for a long time, the Thrush Pressure Tank not only prevents waste of fuel but helps to *cut down this deposit of mineral to a minimum.*

Why Thrush Tanks Won't Water-Log

The Thrush Pressure Tank is made of copper bearing steel. It is air tight and every one is tested under high pressure before shipment. It is never completely filled with water. More than half of it is filled with air.

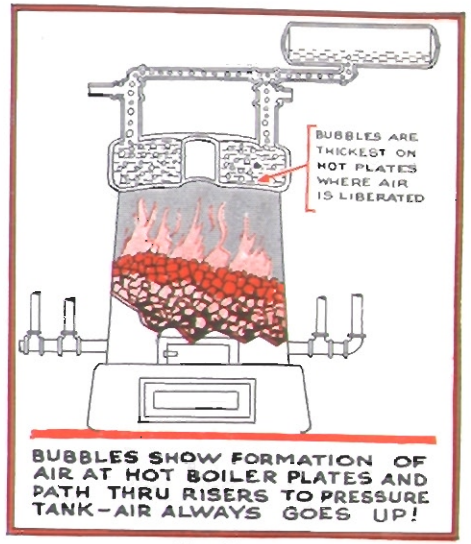


Fig. No. 9

The same air which gets into radiators and causes trouble in the ordinary system is here put to work. By the Thrush method of piping, all the air which gets into the system through the water mains or which is liberated at the hot boiler plates naturally rises to the highest point immediately above, which is the tank. The illustration above shows the path which the air takes direct from the boiler to the Pressure Tank. Thus not only is air kept from the radiators but the needed supply of air in the Pressure Tank is constantly maintained.

When installing a system requiring more than 2000 square feet of radiation, simply use more than one tank. For instance a job carrying 2750 square feet of radiation requires one No. 3 Tank and one No. 1 Tank as shown in the illustration below.

Two tanks are used because a tank larger than our No. 3 would be too large to go between joists, and a tank that is set on the basement floor is apt to waterlog. Fig. 10 shows the proper arrangement.

When buildings are higher than three-story be sure to indicate it in ordering so that proper equipment can be supplied.

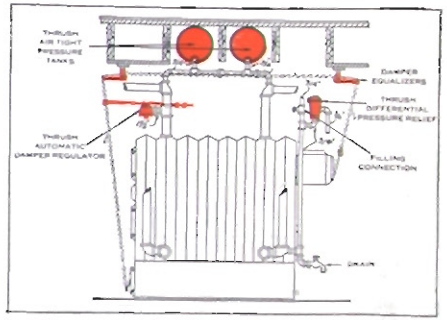


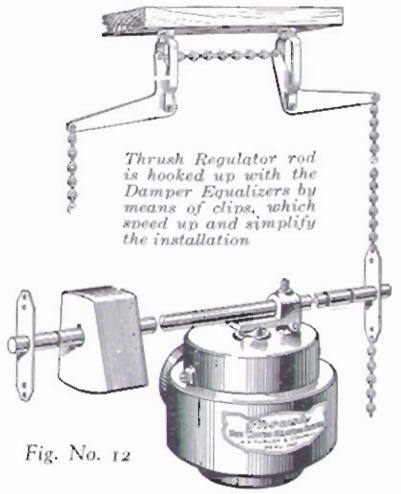
Fig. No. 10

Fig. No. 11

Thrush Damper Equalizers

With the Thrush System of Hot Water Heating all pulleys are dispensed with and in their stead Thrush Damper Equalizers are furnished. These Damper Equalizers can be delicately balanced for extremely sensitive operation and they will continue to function in this delicately sensitive manner for an indefinite period. They will not stick or bind at any time. Therefore, the full power from Thermostat lever is applied to the opening of the dampers. Practically none is lost in transmission. It requires comparatively few degrees of temperature change between the opening and the closing of the Dampers—consequently more uniform house temperatures are maintained.

There is no way for Thrush Equalizers to "jump the track" or get out of order, like the ordinary pulley and chain arrangement. They will work right at first and keep on doing it for years.



Thrush Regulator rod is hooked up with the Damper Equalizers by means of clips, which speed up and simplify the installation

Fig. No. 12

Thrush Damper Equalizers are sturdy in construction. They are made of heavy gauge steel and plated to prevent rusting.

Each one is complete with a screw held in the top making it a simple matter to install. No loose screws or screw driver bother with.

A Simplified Gauge on Thrush System

Copyrighted

Fig. No. 13

The original dial design of this gauge makes it very easy for the most inexperienced person to operate Thrush System at maximum efficiency. Instead of the usual altitude dial, this dial bears markings *both in pressure and in feet*. The number of feet from boiler to highest point in the system indicates point at which boiler should be filled with water so the proper pressure will be registered. Red Arrows plainly labeled point to place where indicator should stand for one or two story building, for three story building, and four story building.

Thrush Thermometer

Fig. No. 14

Thrush System includes a delicately responsive thermometer which indicates the water temperature in the boiler. This enables the operator to adjust the regulator with full knowledge of conditions within the boiler, and weights can be set to provide just the proper degree of water temperature according to the table of temperatures which is on the instruction sheet furnished with Thrush System. It is also reproduced below.

Table of Temperatures

This shows the approximate boiler temperatures which should be maintained to meet varying outdoor temperatures. They will vary of course in proportion to the condition or construction of the building.

Outside Temperature	Boiler Temp.
60 degrees above	120 degrees
50 degrees above	130 degrees
40 degrees above	145 degrees
30 degrees above	160 degrees
20 degrees above	170 degrees
10 degrees above	180 degrees
0 Zero	190 degrees
10 degrees below	200 degrees
20 degrees below	210 degrees
30 degrees below	225 degrees

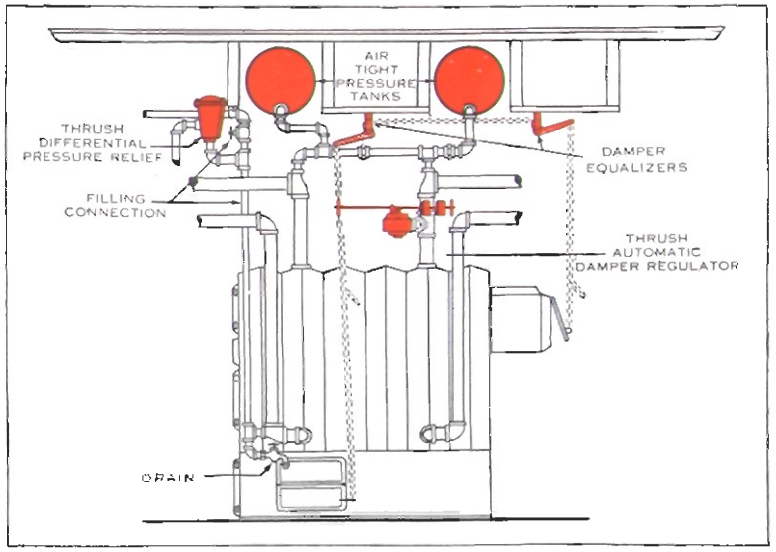


Fig. No. 15

Thrush System With Sectional Boiler

One of the advantages of Thrush System is that it can be applied to a heating plant of any kind or size. It is adapted to large as well as small installations. The above illustration shows the proper method of installing with sectional cast iron or steel boilers.

The same method of trapping the air into the expansion tank can be applied to installations on sectional boilers and in fact to installations on boilers of every kind.

The use of Thrush Damper Equalizers in place of pulleys here offers a big advantage also. As the installation above shows, Thrush Damper Equalizers may be separated and placed at any point desired to obtain maximum efficiency of operation.

With each Thrush System we pack an instruction sheet which gives complete diagrams for installation on each popular type of boiler.

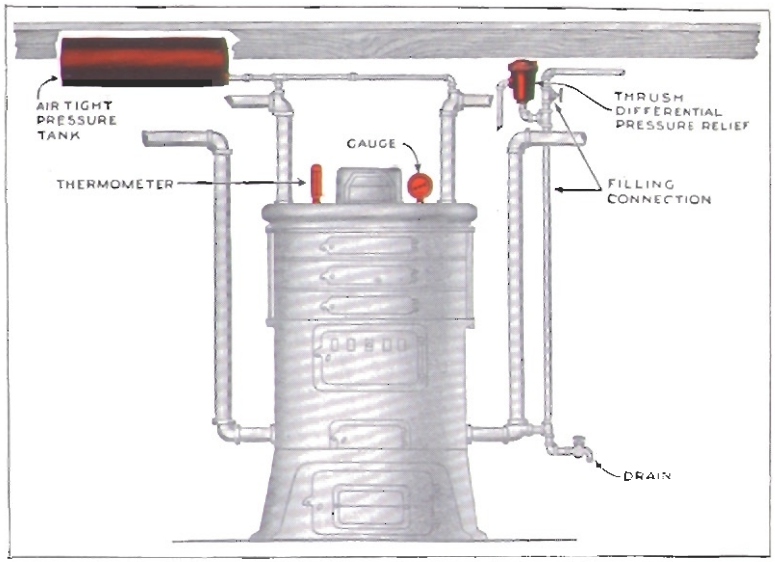


Fig. No. 16

Thrush System of Hot Water Heating

Class "B" Equipment

While we recommend that a complete Thrush System be installed wherever possible, there are cases in which the Regulator may not be required.

The advantages of the Thrush Closed System with the water under pressure, producing an accelerated circulation and increased heat transmission, are so well known that many installations where other forms of regulation are furnished with the boiler, are made with Class "B" Equipment added. An oil burner for instance usually has its own regulator, but the addition of Thrush Class "B" Equipment will greatly increase the heating efficiency of the job.

Class "B" Equipment consists of the Thrush Air Tight Steel Pressure Tank, Thrush Differential Pressure Relief, Thrush Thermometer and Thrush Special Gauge. It is listed separately in our price list.

Thrush System of Hot Water Heating

The Thrush Air Tight Pressure Tank. It is made of copper bearing steel, thoroughly tested before shipping.

Thrush Damper Equalizers. Provide delicately sensitive balanced operation of Dampers. Much better than pulleys.

Thrush method of piping. Traps air from Flow risers and leads it into the tank where it serves a useful purpose. Keeps it out of the system.

Uniform temperatures maintained. Adjustment made by merely sliding weights forward or backward on lever.

Thrush Thermometer Sets in boiler. Indicates temperature of water within boiler enabling operator to maintain desired room temperatures.

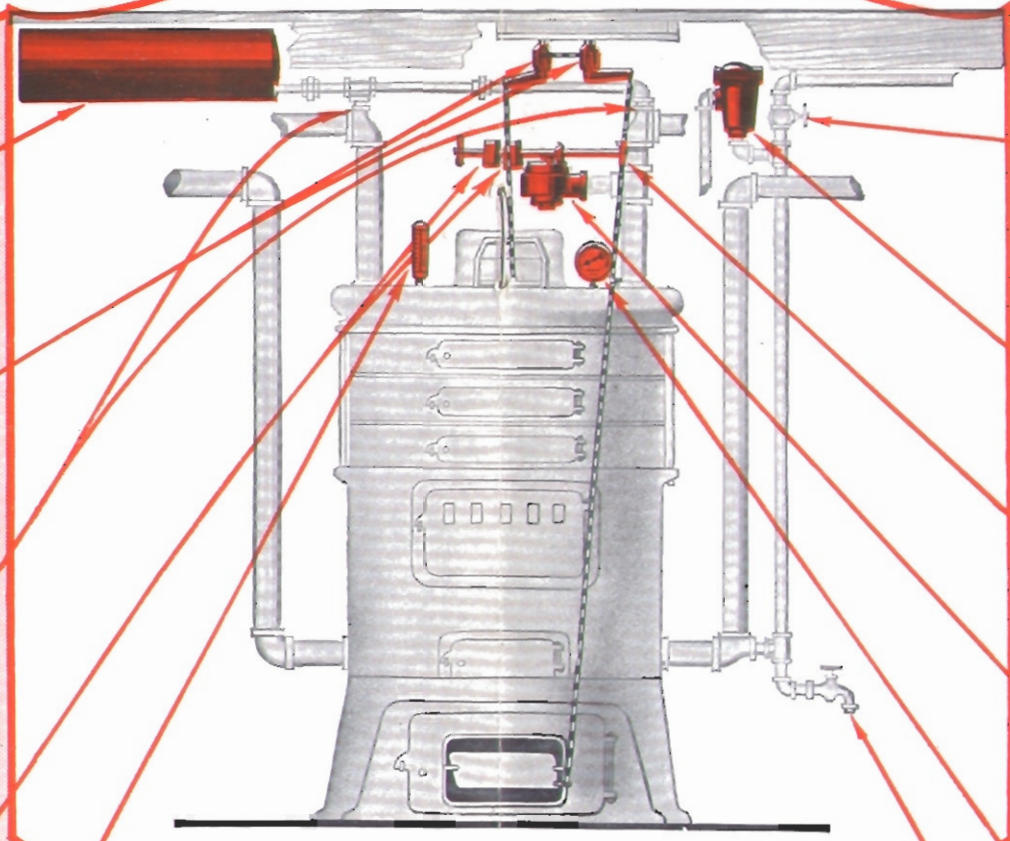


Fig. No. 17

Thrush
HOT WATER
HEATING SYSTEM

Makes a Closed System, automatically regulated.
Only six feet of pipe and eight fittings needed.

Filling Connection. Thrush method of installation takes only six feet of pipe and eight connections. Quick and easy.

Thrush Differential Pressure Relief. Provides positive safe overflow. Maintains additional pressure on system, relieving excess pressure instantly.

Clip for easy hook-up of rod to damper chains. Clip on opposite end of Regulator rod prevents weights from slipping off.

Thrush Automatic Damper regulator. Maintains temperature of water in radiators and thus uniform room temperatures.

Thrush Gauge. Has a simplified dial with markings both in pressure and in feet. Easy to understand.

Drain Valve. To drain, open air vents on radiators. Remove drain plug in pressure tank.

Easy to Install-Economical in Operation

Thrush Differential Pressure Relief Valve and Air Tight Pressure Tank

For Arcolas, or similar installations where overhead piping system is used and where radiators set on same floor level as the heater, the illustration at bottom of this page shows how to apply the Thrush method of harnessing the system. *We guarantee the circulation in any Arcola or similar installation where our instructions for the use of the Thrush Differential Pressure Relief Valve and Pressure Tank are adhered to.*

Instructions

Connect Thrush Differential Pressure Relief Valve to the return pipe, near heater, as shown, and extend it above top of heater. Locate it so that it will be at least 12" away from smoke pipe. Overflow pipe may be dropped through floor below.

Vent pipe must be located under expansion tank as shown. It should be about ¼" size, with pet cock located within easy reach from first floor. Altitude pressure gauge should always be used and set to indicate about 20' altitude. When the system is filled with water at start, vent air through ¼" vent pipe and fill until altitude gauge shows 20'.

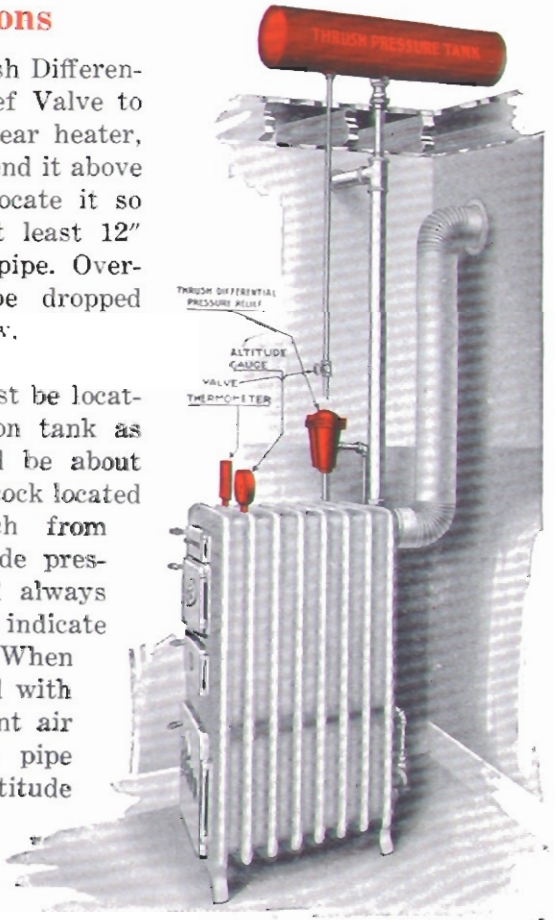


Fig. No. 18

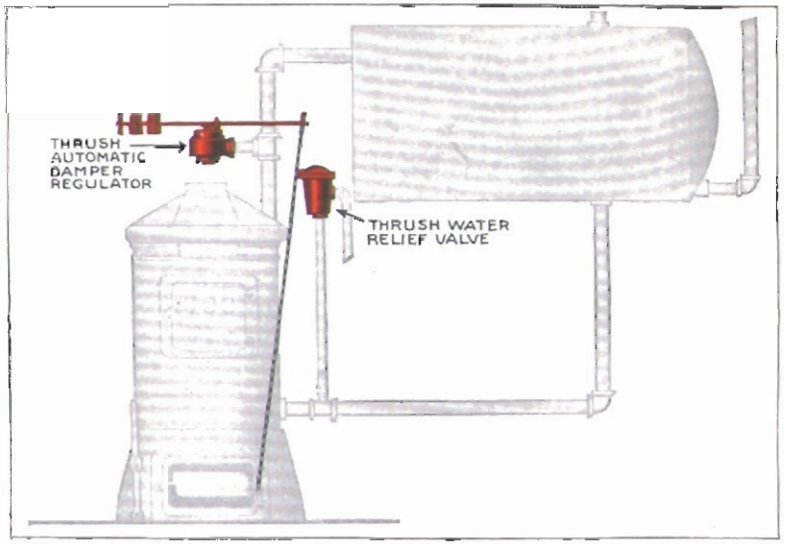


Fig. No. 19

Thrush Domestic Water Relief Valve And Automatic Temperature Control

For controlling the water temperature in Domestic Water Heater and storage tank. The Thrush Automatic Temperature Damper Regulator is very sensitive in its operation and *will maintain uniform water temperatures without attention.*

Safety

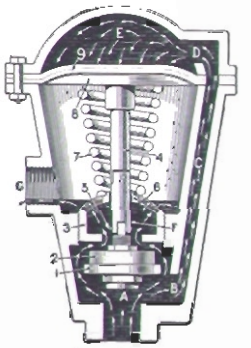


Fig. No. 20

Patented

The Thrush Domestic Water Relief Valve is a Differential Pressure Relief Valve similar to the larger Thrush valve on standard Thrush Hot Water Heating Systems. It is made for operation on higher pressures however, and is the first entirely satisfactory relief valve for the purpose. The valve seats on the ceiling and cannot stick, corrode or become clogged with dirt. It is positively safe and certain in its action.

Our Engineering Department

Thrush engineers design piping plans for the trade and for architects who are using and specifying Thrush Hot Water Heating Systems in every part of the country. This valuable service is available to the legitimate trade only.

It doesn't make any difference whether your problems have to do with the largest apartment building or the smallest bungalow, they will be handled in a most practical and efficient manner.

A well designed piping plan showing in detail the Thrush self-controlled Hot Water System, together with all of the various pipe sizes and connections and, in fact every part of the heating equipment, enables you to do your work better and quicker.

Where Thrush plans are used and faithfully followed, there is every assurance that the job will give the utmost satisfaction to the customer.

Our supervising engineers are men who have spent many years specializing in hot water heating installations. Don't wait till you have the order, to ask for plans. Let us help you get the job. The right plan may help you win the bid by reducing costs.

When Submitting Plans

1st—Indicate location of boiler and chimney flue. State whether round or square boiler is to be used.

2nd—Show exact location and footage of radiators.

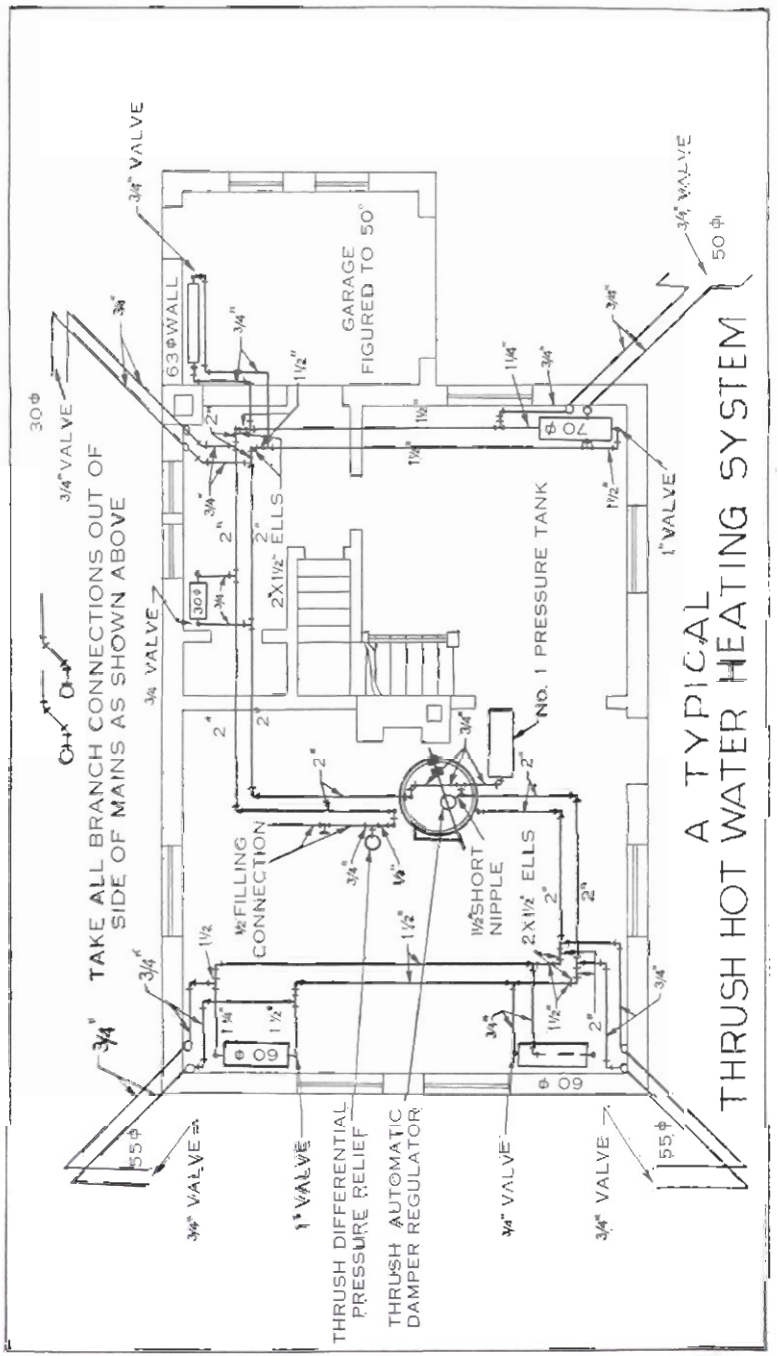
3rd—Be sure to show location of stairway in basement.

4th—Indicate clearly the size of each room.

5th—Closets should be shown.

Give as much information as possible concerning the building to be heated. It is always better for the heating contractor to figure the radiation, but if this is not done, be sure to show the exact size of each room, size and location of windows and doors, also the height of ceiling. All outside walls are figured as exposed wall unless it is indicated otherwise.

Remember that our engineers are not on the ground and must have the information submitted as completely as possible. While it is impossible for us to guarantee the radiation footages shown on plans, yet with the proper information furnished with your plans, you can depend upon our estimates with reasonable assurance of accuracy. You should indicate whether building is of frame, brick or other form of construction.



Instructions for Proper Designing

The Thrush piping system has attained the limit of simplicity and economy in both quantity and size of pipe and fittings, the installation of which is so safe and easy that the following simple instructions should enable any steam fitter to secure perfect results in every instance.

THE CHIMNEY of the building to be heated should have sufficient height and area to supply ample volume and velocity of draft for the boiler attached to it. This permits the boiler to attain its full efficiency and is an aid to fuel economy.

THE BOILER capacity rating should be estimated on a basis of at least eight hour firing periods, and on the average of 100% more rating capacity than the total square feet of direct radiation to be heated.

RADIATORS should be located on outside walls whenever possible, because that is where the cold air is entering.

RADIATORS in which the mains terminate should have one size larger valves. This serves as a distinct aid to circulation, because the radiators in which the mains terminate serve as a link to join together the flow and return mains.

NO REDUCTION should be made in flow main consisting of 1½" pipe and under unless the reduction can be made where mains turn at right angles, then use reducing ells, one size reduction only. If mains run straight to end radiator they should extend full size to the end and look up to the radiator valve with reducing ells. Return mains should be graduated in size according to valve areas.

THE PIPING SYSTEM should be laid in with the idea of extending the mains in the most direct and convenient way, so as to terminate in a first floor radiator furthest from the boiler, and utilize as much as possible short branch pipes between mains and radiators. Avoid terminating mains in risers extending to a second floor radiator.

SIZE OF MAINS to use for a given amount of radiation is ascertained by determining the size and area of valve to be used for each radiator connected to a main. The combined valve areas will be the area of main to use. The same principle applies to risers when one or more radiators are to be connected to them.

Data for Figuring Radiation

1. Simple Method—There is a simple rule for figuring hot water radiation that gives approximate results and may be used with a reasonable degree of dependability for residence heating where the temperature required is 70 degrees.

Simple Table

Divide square feet of opening by 2.
Divide square feet of Exposed Wall by 10.
Divide the cubic contents by 60.

The sum of the figures obtained by these divisions is the approximate amount of radiation required. This rule, however, does not take into account the various conditions which the heating contractor must meet and results are approximate.

2. Accurate Method—For the purpose of accurately figuring radiation under all conditions, we give you the two tables shown on pages 26 and 27. These tables give standard heat losses as compiled by recognized authorities. Radiation can be definitely computed for buildings of any construction and for any desired temperature by using the data given in these tables.

For example let us figure the radiation required to maintain 70 degrees temperature in the large living room of a well built frame residence when the weather is zero outside. The room is 14 feet wide, 28 feet long, with nine foot ceiling, medium tight windows and one door, half of which is glass.

Residence Example No. 1

		Sq. Ft. of Exposure	Factor		B. T. U. Loss
(1)	Sq. ft. Windows (medium)	81	× 94.5	=	7654.5
(2)	Sq. ft. door	21	× 48.3	=	1014.3
(3)	Sq. ft. exposure	784	× 23.1	=	18110.4
(4)	Cubical contents	3528	× 1.27	=	4480.5
	Total B. T. U. Loss				31259.7

For hot water radiation, divide total B. T. U. Loss 31,259.7 by 170=184 sq. ft. radiation. (See bottom of table No. 2).

As another example, say you have a Garage with 8" brick walls to be heated to 50 degrees temperature with zero outside. Size, 40 ft. x 80 ft. exposed on one side and both ends, with average ceiling 12 ft. high, composition roof, wood sheathing, with 14 single glass windows, (loose) and 1 solid wood door.

Garage Example No. 2

		Sq. Ft. of Exposure	Factor	B. T. U. Loss
(1)	Sq. ft. of windows	336	× 75.	= 25200
(2)	Solid wood door	81	× 24.	= 1944
(3)	Exposure Walls, openings deducted	1503	× 21.	= 31563
(4)	Cement floor	3200	× 15.5	= 49600
(5)	Roof exposure	3200	× 22.	= 70400
(6)	Cubical contents	38400	× .9	= 34560
	Total B. T. U. Loss			213267

For hot water radiation, divide 213,267 by 170=1255 sq. ft. radiation. (See bottom of table No. 2).

By studying the above problems and studying the table also you will get a good idea of the correct method of figuring radiation for any desired temperature and for almost every type of construction by the use of these tables. For instance, factors for Example No. 1 are found under the 70 degree column and factors shown by Example No. 2 are found under the 50 degree column in the tables.

When measuring building to be heated, it is advisable to make a rough outline of the various rooms, showing closets, offsets, and stairways. Windows and doors should be marked on sketch. When measuring for sizes include entire opening and not glass only. Be careful to ascertain as nearly as possible how the building is constructed. You cannot exercise too much care in learning all you can about the building to be heated.

RADIATOR VALVE SIZES
For the Thrush Hot Water Heating System

FIRST FLOOR.	
Up to 70 sq. ft.	¾" valve
Up to 125 sq. ft.	1" valve
Over 125 sq. ft.	1¼" valve
SECOND FLOOR.	
Up to 25 sq. ft.	½" valve
Up to 90 sq. ft.	¾" valve
Over 90 sq. ft.	1" valve
THIRD FLOOR.	
Up to 40 sq. ft.	½" valve
Up to 120 sq. ft	¾" valve
Over 120 sq. ft.	1" valve

PIPE SIZES and AREAS
Ordinarily Used for Hot Water Heating

½" pipe and valve area	.30 sq. in.
¾" pipe and valve area	.50 sq. in.
1" pipe and valve area	.85 sq. in.
1¼" pipe and valve area	1.50 sq. in.
1½" pipe and valve area	2.00 sq. in.
2" pipe and valve area	3.36 sq. in.
2½" pipe and valve area	4.80 sq. in.
3" pipe and valve area	7.40 sq. in.
3½" pipe and valve area	9.80 sq. in.
4" pipe and valve area	12.70 sq. in.
4½" pipe and valve area	15.90 sq. in.
5" pipe and valve area	20.00 sq. in.
6" pipe and valve area	28.80 sq. in.

PITCH MAINS about one-half inch for each ten lineal feet of pipe. Short branch pipes should have about one inch pitch to three feet of pipe. Ream the burr from all pipe ends.

Table for Figuring AMOUNT of RADIATION for Any BUILDING at Any DESIRED TEMPERATURE

FLOORS, AND CEILINGS.		B.T.U. PER 1° DIFF.	DIFFERENCE IN TEMP BETWEEN ROOM AND OUTSIDE 50°	55°	60°	65°	70°	75°	80°	85°	90°
			FACTORS.								
CEMENT FLOOR.		.31	15.5	17.05	18.6	20.1	21.7	23.2	24.8	26.3	27.9
WOOD FLOOR AIR BELOW.	COEFFICIENTS	.32	16.0	17.6	19.2	20.8	22.4	24.0	25.6	27.2	28.8
WOOD FLOOR PLASTER BENEATH		.24	12.0	13.2	14.4	15.6	16.8	18.0	19.2	20.4	21.6
DOUBLE FLOOR. PLASTER BENEATH		.16	8.0	8.8	9.6	10.4	11.2	12.0	12.8	13.6	14.4
PLASTERED CEILING NO FLOOR ABOVE		.50	25.0	27.5	30.0	32.5	35.0	37.5	40.0	42.5	45.0
PLASTERED CEILING FLOOR ABOVE.		.28	14.0	15.4	16.8	18.2	19.6	21.0	22.4	23.8	26.1
STEEL CEILING FLOOR ABOVE		.35	17.5	19.25	21.0	22.7	24.5	26.2	28.0	29.7	31.5
ROOFS.											
4" CONCRETE TARRED		.60	30.0	33.0	36.0	39.0	42.0	45.0	48.0	51.0	54.0
6" " "	COEFFICIENTS.	.54	27.4	29.7	32.4	35.1	37.8	40.5	43.2	45.9	48.6
1" TILE ON BOARDS		.40	20.0	22.0	24.0	26.0	28.0	30.0	32.0	34.0	36.0
SHEET IRON.		1.30	65.0	71.5	78.0	84.5	91.0	97.5	104.0	110.5	117.0
SLATE ON LATH		.85	42.5	46.75	51.0	55.2	59.5	63.7	68.0	72.2	76.5
" SHEATHING		.38	19.0	20.9	22.8	24.7	26.6	28.5	30.4	32.3	34.2
WOOD SHINGLES		.63	31.5	34.65	37.8	40.9	44.1	47.2	50.4	53.5	56.7
COMB ROOF & SHEATHG		.44	22.0	24.2	26.4	28.6	30.8	33.0	35.2	37.4	39.6
NUMBER OF AIR CHANGES.			**~CUBICAL CONTENTS.~**								
½ CHANGE PER HR	COEFFICIENTS	.009	.45	.495	.54	.59	.64	.68	.73	.77	.82
1 " "		.018	.90	.990	1.08	1.18	1.27	1.36	1.45	1.55	1.66
1½ " "		.027	1.35	1.485	1.62	1.77	1.91	2.05	2.18	2.32	2.45
2 " "		.036	1.80	1.98	2.16	2.36	2.55	2.73	2.91	3.09	3.27
3 " "		.055	2.75	3.025	3.30	3.57	3.82	4.09	4.36	4.64	4.91
4 " "		.073	3.65	4.015	4.38	4.73	5.09	5.45	5.82	6.18	6.55

NOTE--FOR AVERAGE CONSTRUCTED BUILDING USE ONE AIR CHANGE, PER HOUR.

NOTE.--MULTIPLY OPENINGS, EXPOSURES, AND CUBICAL CONTENTS BY FACTORS CORRESPONDING TO DESIRED DIF. IN TEMP. AND DIVIDE BY 170 FOR HOT WATER. 280 FOR LOW PRESSURE STEAM. 200 FOR VAPOR OR ATMOSPHERIC STEAM.

Table for Figuring AMOUNT of RADIATION for Any BUILDING at Any DESIRED TEMPERATURE

DOORS WINDOWS AND SKYLIGHTS		B.T.U. PER 1° DIFF.	DIFFERENCE IN TEMP BETWEEN ROOM AND OUTSIDE 50°	55°	60°	65°	70°	75°	80°	85°	90°
			FACTORS.								
SINGLE GLASS LOOSE		1.50	75	82.5	90.0	97.5	105.0	112.5	120.0	127.5	135.0
" " MEDIUM.		1.35	67.5	74.25	81.0	87.8	94.5	101.3	108.0	114.8	121.5
" " TIGHT.	COEFFICIENTS	1.20	60.0	66.00	72.0	78.0	84.0	90.0	96.0	102.0	108.0
DOUBLE GLASS (STORM)		.60	30.0	33.00	36.0	39.0	42.0	45.0	48.0	51.0	54.0
VAULT GLASS SIDEWALK		1.50	75.0	82.5	90.0	97.5	105.0	112.5	120.0	127.5	135.0
SINGLE SKY-LIGHTS		1.08	54.0	59.4	64.8	70.2	75.6	81.0	86.4	91.8	97.2
DOUBLE " "		.60	30.0	33.00	36.0	39.0	42.0	45.0	48.0	51.0	54.0
GOOD DOORS ½ GLASS		.69	34.5	37.95	41.4	44.9	48.3	51.2	55.2	58.7	62.1
" " SOLID.		.48	24.0	26.4	28.8	31.2	33.6	36.0	38.4	40.8	43.2
WALLS.											
POOR FRAME N.W.		.45	22.5	24.75	28.0	29.3	31.5	33.8	36.0	38.3	40.5
GOOD FRAME PAPERED		.33	16.5	18.15	19.8	21.5	23.1	24.5	26.4	28.0	29.7
STUCCO.		.33	16.5	18.15	19.8	21.5	23.1	24.5	26.4	28.0	29.7
4" BRICK PLAIN		.64	32.0	35.2	38.4	41.6	46.8	48.0	51.2	54.4	57.6
8" " "		.42	21.0	23.1	25.2	27.3	29.4	31.5	33.6	35.7	37.8
12" " "		.31	15.50	17.05	18.6	20.1	21.7	23.2	24.8	26.3	27.9
16" " "	COEFFICIENTS.	.26	13.0	14.3	15.6	17.1	18.2	19.5	20.8	22.1	23.4
8" BRICK PLASTERED		.39	19.5	21.45	23.4	25.3	27.3	29.2	31.2	33.1	35.1
12" " "		.33	16.5	18.15	19.8	21.5	23.1	24.8	26.4	28.0	29.7
16" " "		.24	12.0	13.2	14.4	15.6	16.8	18.0	19.2	20.4	21.6
8" CEMENT BLOCKS		.63	31.5	34.65	37.8	40.9	44.1	47.2	50.4	53.5	56.7
8" DO FR'D & PLASTERED.		.40	20.0	22.0	24.0	26.0	28.0	30.0	32.0	34.0	36.0
4" TILE STUCCOED		.57	28.5	31.35	34.2	37.0	39.9	42.7	45.6	48.4	51.3
8" " "		.42	21.0	23.1	25.2	27.3	29.4	31.5	33.6	35.7	37.8
12" " "		.38	19.0	20.9	22.8	24.7	26.6	28.5	30.4	32.3	34.2
8" TILE FUR'D & PL'TD.		.28	14.0	15.4	16.8	18.2	19.6	21.0	22.4	23.8	25.2
12" " "		.25	12.5	13.75	15.0	16.2	17.5	18.7	20.0	21.2	22.5
16" " "		.22	11.0	12.1	13.2	14.3	15.1	16.5	17.6	18.7	19.8
PARTITIONS PLASTERED		.20	10.0	13.0	12.0	13.0	14.0	15.0	16.0	17.0	18.0

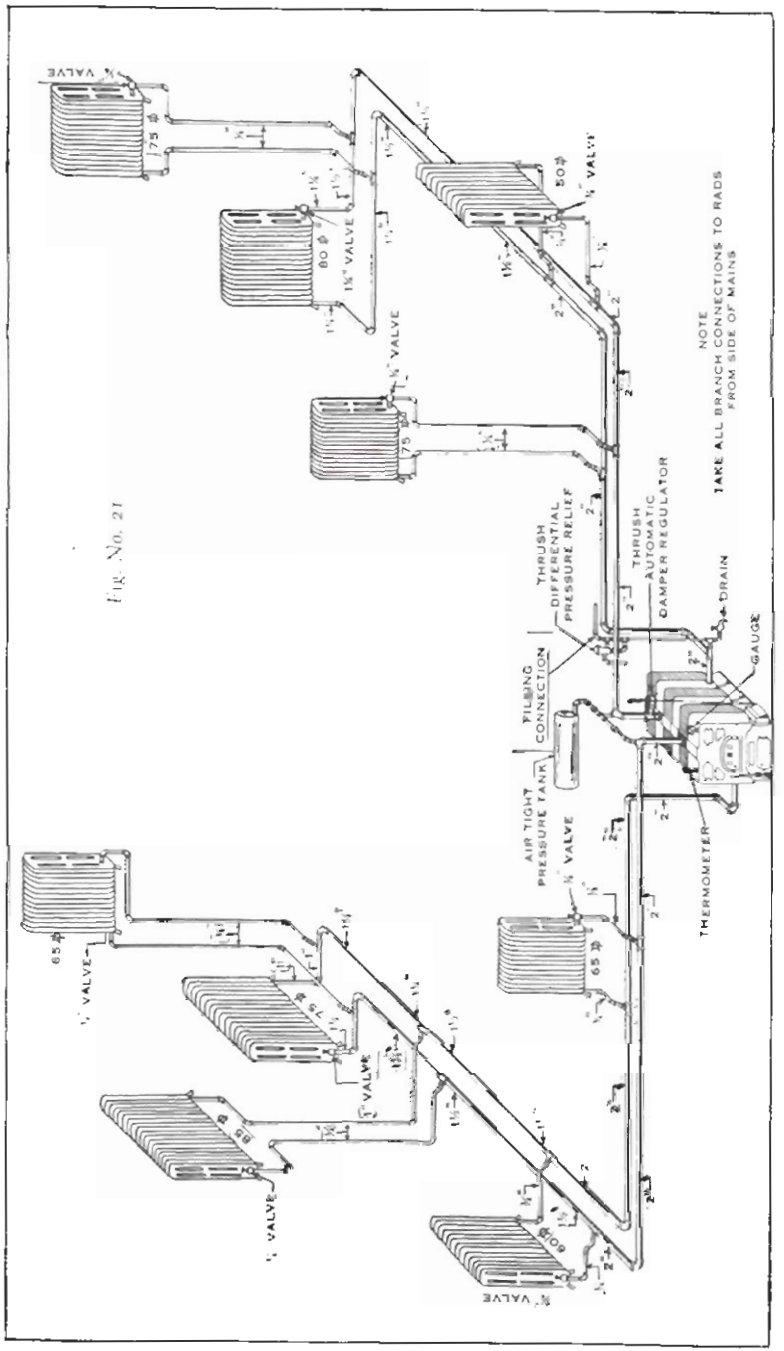


Fig. No. 21
NOTE
TAKE ALL BRANCH CONNECTIONS TO RADS
FROM SIDE OF MAINS
THRUSH
DIFFERENTIAL
PRESSURE RELIEF
THRUSH
AUTOMATIC
DAMPER REGULATOR
DRAIN
GAUGE
FILLING
CONNECTION
AIR TIGHT
PRESSURE TANK
THERMOMETER
175 #
80 #
50 #
75
65 #
60 #
70 #
1" VALVE
¾" VALVE
½" VALVE

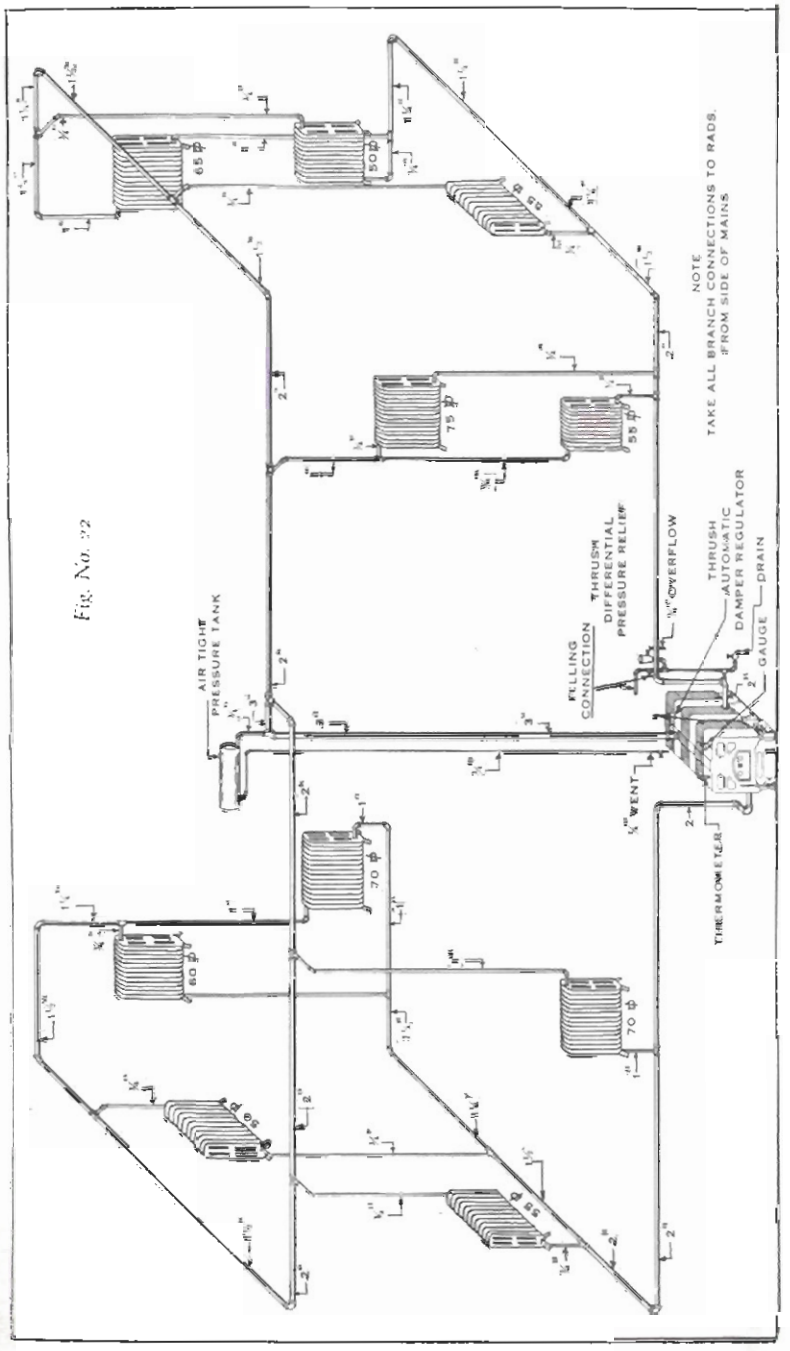


Fig. No. 22
NOTE
TAKE ALL BRANCH CONNECTIONS TO RADS.
FROM SIDE OF MAINS
THRUSH
DIFFERENTIAL
PRESSURE RELIEF
THRUSH
AUTOMATIC
DAMPER REGULATOR
DRAIN
GAUGE
FILLING
CONNECTION
AIR TIGHT
PRESSURE TANK
¾" OVERFLOW
¾" VENT
THERMOMETER
65 #
50 #
75 #
55 #
70 #
60 #
70 #

Connections Recommended

Fig. 23 shows cross section of mains with branch connections out of side of mains to radiators. Side connections are recommended because the circulating water will be more uniformly distributed throughout the various radiators.

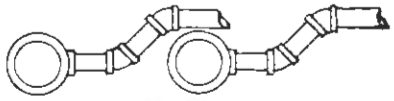


Fig. No. 23

Fig. 24 shows method of connecting two radiators on one set of risers. Note the largest radiator is always supplied from the top of riser.

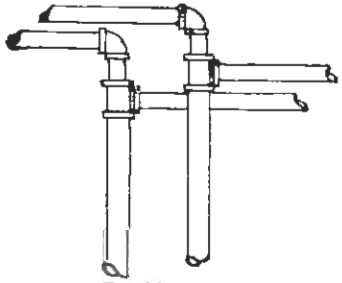


Fig. No. 24

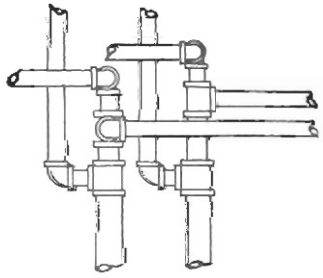


Fig. No. 25

Fig. 25 illustrates method of connecting branches to upper floors. The largest radiator should be taken from the connections at top of risers.

Figure 26 shows the Thrush method of constructing pipe coils for hot water heating. This provides uniform distribution of water supply to each coil and completely eliminates short circuits so commonly found in pipe coils.

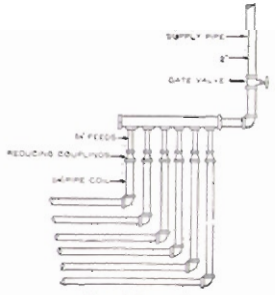


Fig. No. 26

GREENHOUSE HEATING

Thrush Equipment is particularly satisfactory for Greenhouse Heating Plants. It produces a mild *uniform temperature without fluctuations and is entirely dependable.*

In figuring radiation for a Greenhouse, the problem is one concerned almost entirely with exposed surfaces. Cubic contents is rarely, if ever taken into account. The entire area of glass should be determined, counting every 5 feet of exposed side wall of glass by the following coefficients as shown in the table to secure the different temperatures required at zero outside.

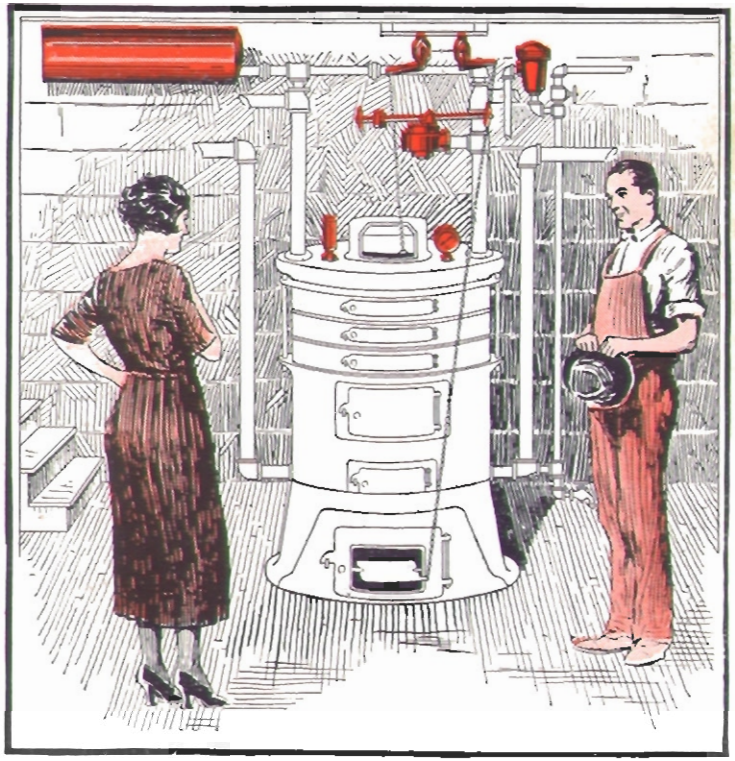
To heat Greenhouse to	40	divide	No.	sq. ft.	of	glass	by			6
" " " "	45	"	No.	"	"	"	"			5
" " " "	50	"	No.	"	"	"	"			4
" " " "	55	"	No.	"	"	"	"			3.75
" " " "	60	"	No.	"	"	"	"			3.5
" " " "	65	"	No.	"	"	"	"			3.25
" " " "	70	"	No.	"	"	"	"			3

In localities where the temperature falls below zero, add to the result obtained by the above table, 1% for every degree below zero.

To find the square feet of radiation in pipe, use the table below. Multiply the length of the pipe by the coefficient shown in the table corresponding to the diameter of pipe being used.

¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"
.275	.346	.434	.494	.622	.753	.916	1.045	1.175	1.455	1.739

In connection with designing pipe coils for greenhouse work note Fig. No. 25 on opposite page. Reducing the supply to each pipe as shown results in uniform temperatures in all pipes in coil. Area of main supply should equal combined areas of supplies to coils.



Thrush System brings satisfaction to the home owner—that makes it a good product for the man who takes pride in his work, to handle. Thrush System is neat and compact, takes very little labor to install and its popularity with both home owners and heating contractors is increasing tremendously each year because it makes any hot water job work better!

H. A. Thrush & Co.

Peru, Indiana

All items listed in this catalog are covered by our price list

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