GORTON

HEATING EQUIPMENT

Catalogue
No. 92

GORTON & LIDGERWOOD CO.

GORTON PRODUCTS

Gorton & Lidgerwood Co.

Manufacturers High Grade
Heating Equipment

ESTABLISHED 1887

General Offices
96 Liberty Street
New York, N. Y.

Represented in

Baltimore, Md.
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Compiled by Geo. D. Chadeayne

Foreword

GORTON Heating Equipment has always been of the highest quality and has led the field since 1887 in research and development.

It is the intent of this catalogue to set forth the Gorton Products to whomsoever is interested; together with the data necessary to enable the industry to plan and install these specialties, each article of which is the latest *proven* development in the science of heating.

Contents

Section One

THE GORTON SINGLE PIPE VAPOR HEATING SYSTEM

IT IS singularly appropriate that this Company with its long standing reputation for making the most efficient and the highest grade heating equipment known to science, should invent and develop the *single pipe vapor system of heating.*

The development of this system of heating is without a doubt the most important development in the science of heating that has taken place since the original idea of utilizing the heat carrying properties of evaporated water was conceived.

Coming as it does at a time when building costs are very high and heating systems tend to grow more complex and expensive, it ushers in an era of efficient and economical heating which will gladden the hearts of those in the building industry who have long despaired of ever being able to furnish their clients with the best at a price that they could pay.

Installation

THE SIMPLICITY of the installation of this system is astonishing; since it is the only bona fide vapor heating system yet devised that requires no more piping than the well-known one pipe steam job.

Either steam or hot water radiation can be used and the number of sq. ft. of radiation required is no more than is required for ordinary steam.

Some piping systems are shown elsewhere in this Section which indicate the various methods of running the piping according to the size and conditions surrounding the job.

A table of pipe sizes for the supply mains, branches, risers, return mains and drips will be found in Section Three.

The GORTON VAPOR SPECIALTIES attached, as shown in the informative layouts, to a single pipe system of piping, whether it is an old job or a new installation, makes the job a real coal saving vapor system.

To each radiator is connected a GORTON QUARTER TURN PACKING LOCK RADIATOR SUPPLY VALVE and a GORTON VAPOR AIR RELIEF VALVE.

At the end of each main is placed a GORTON VAPOR AIR ELIMINATOR, which has a 3/8″ vertical connection.

On the boiler is placed the GORTON VAPOR RETARD PRESSURE GAUGE and the GORTON VAPOR DRAFT REGULATOR.

Regulation and Operation

How to *Control the Heat* and *Save Fuel*

THE GORTON SINGLE PIPE VAPOR SYSTEM provides the means for controlling both the fire and the temperature in each room. This fact makes it possible to save an immense amount of coal because it is well known that every good heating plant is installed to warm the building properly in the coldest weather and that the average weather is very much warmer than that for which the plant is designed; so, the heating plant is much too large for the work the majority of the time. The plant will, however, burn as much coal all the time unless it is controlled.

The GORTON VAPOR DRAFT REGULATOR has a ¾″ vertical connection which screws into the top of the boiler. The chains should be attached to the ends of the cross-bar and to the base draft door and the check draft door respectively. The chains should then be so adjusted that the base draft door is open somewhat when there is no pressure on and a bit of slack in the check draft chain; so that when the pressure which it is desired to carry has been obtained both draft doors are closed and if the pressure goes beyond this then the check draft opens.

Your particular attention is called to the fact that the total movement obtainable at the ends of the Vapor Draft Regulator Lever, when it is centered at the fulcrum, is only

two inches, therefore, it is very necessary that you give this matter close attention.

Whenever the base draft door and the check draft door are open at the same time a condition similar to a poor draft arises which results in the consumption of fuel without results; therefore, *both drafts must be closed at the operating pressure.*

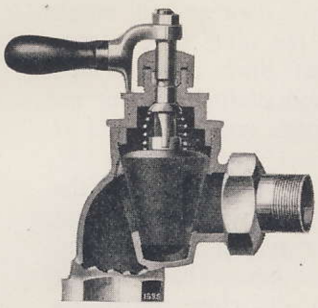
After the regulator is connected to the drafts as advised there is no need to attend the boiler for any other reason than to coal it up and take out the ashes. The regulator will automatically open and close the drafts as vapor is desired in the various radiators.

When a Thermostat is used, it must be connected to the back end of the Draft Regulator Lever *only,* so that it will lift the lever to check the fire, or release the lever to allow the Regulator to work automatically when more heat is required.

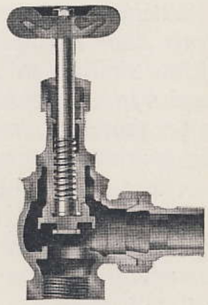
The temperature in each room is controlled by *fully* opening and *fully* closing the Gorton Quarter Turn Radiator Valve. This is the only logical way to control the room temperature since, by closing the valve when the room is getting too warm, it saves the fuel.

The operation of the Gorton Quarter Turn Radiator Valve for the purpose of controlling the room temperature and the fuel consumption is exactly analogous to the operation of the switch to control the light in the room and the consumption of electricity; since, as one twist of the wrist puts out the light, one twist of the wrist shuts off the heat.

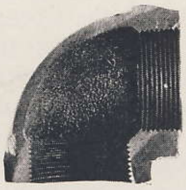
No other valve has this feature.



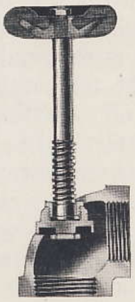
SECTION VIEW,
GORTON VALVE



SECTION VIEW,
ORDINARY VALVE



ELBOW



ELBOW WITH VALVE
AND STEM

The Gorton Vapor Specialties

The Gorton Quarter Turn Packing Lock Radiator Supply Valve

THE GORTON QUARTER TURN RADIATOR VALVE is the heart of the Single Pipe Vapor System. Without it, or a supply valve incorporating the same features, a real single pipe vapor system is impossible.

On the opposite page is pictured the ordinary radiator valve and the Gorton Valve. Below the Gorton Valve is shown an ordinary cast iron elbow while below the ordinary valve is shown the same elbow with a stem and valve imposed, to show in a forcible manner the relative amount of resistance offered by the two different valves and the two different elbows.

Would you use cast iron elbows with such friction-making obstruction in them? This is why the ordinary radiator valve cannot be used for single pipe vapor. The packless type of radiator valve is still worse because the valve does not lift from its seat as far as the ordinary radiator valve.

The result in operation of these types of valves is that when the radiator is vented as fast and easy as a vapor system must be vented, the velocity of the incoming vapor is much higher than the ordinary valve can handle. In more technical terms, the velocity exceeds the critical point, which is that point at which the incoming vapor will not allow the water of condensation to flow back against it.

This probably explains for the first time to many the phenomena that occurs on a steam job where the ordinary or packless radiator valve is used, when the air valve is removed from the radiator and the supply valve is opened to let the steam in, the steam rushes in, condenses, and the condensate is pushed out of the air valve tapping because it cannot flow back through the valve on account of the velocity of the incoming vapor which is too high for a valve of this type to handle.

The GORTON VALVE on the other hand allows the use of much higher velocity, which in turn allows the radiator to be vented *eight times faster* without holding up the returning condensate.

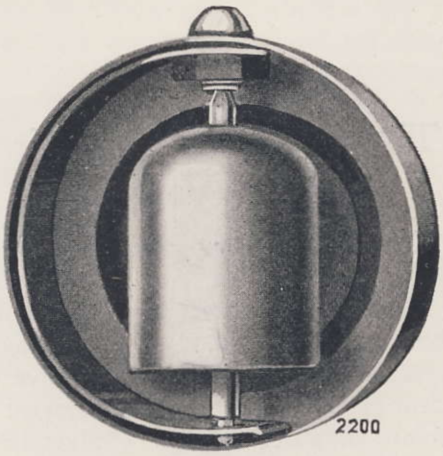
The construction of the GORTON QUARTER TURN PACKING LOCK RADIATOR SUPPLY VALVE is explained in Section Two.

The Gorton Vapor Air Relief Valve

WHILE the component parts of the GORTON VAPOR AIR RELIEF VALVE shown on the next page are not novel in themselves, the method of assembling the parts is decidedly new; making a valve with sufficient open space to positively prevent any possibility of water-logging. (Valves having small spaces between the parts water-log by reason of molecular attraction and surface tension.)

The large movement of the valve proper to and from the seat insures the effective venting of the air and the equally effective prevention of the escape of vapor.

This movement is made positive by the inherent strength of the compound thermostatic element that is used and the life of all the parts of the valve is assured by the best of all assurances—*past experience.*



INTERNAL VIEW

EXTERNAL VIEW
GORTON VAPOR AIR RELIEF VALVE

THE ILLUSTRATION shows the attractive appearance of the Gorton Vapor Air Relief Valve. It is full nickel-plated and has ⅛″ standard connection with clean cut thread and is attached to regular tapping in steam radiator.

On hot water type of radiator it is to be located two-thirds of the way down from the top of the radiator.

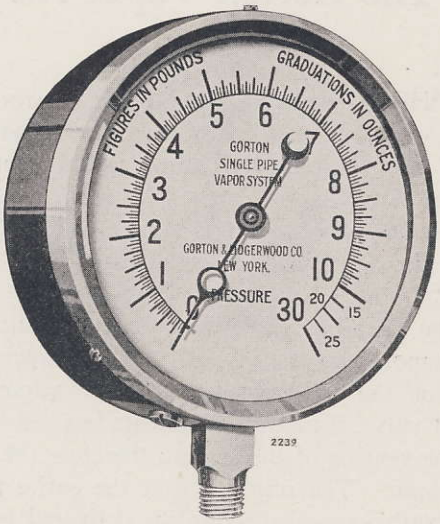
The free and unobstructed passage for the escape of the air through this valve is eight times larger than the ordinary air valve. For this reason the Gorton vapor air relief valve cannot be used with the ordinary or packless type radiator supply valve.

GORTON
VAPOR AIR ELIMINATOR

The Gorton Vapor Air Eliminator

THE GORTON VAPOR AIR ELIMINATOR which is used on the end of the main is built exactly the same as the GORTON VAPOR AIR RELIEF VALVE with the exceptions of the connection which is vertical and 3/8″ and the air outlet which is about three times larger.

The Eliminator is a large factor in successful vapor heating. Having a much larger outlet for the air than the radiator vapor air relief valve, it naturally presents less resistance to the venting of the air and therefore the flow of vapor. The result is that the entire main fills with vapor before any is delivered to the radiators. The main then acts as a reservoir from which the radiators are all fed evenly. This action very practically achieves what has long been desired—*even distribution.*



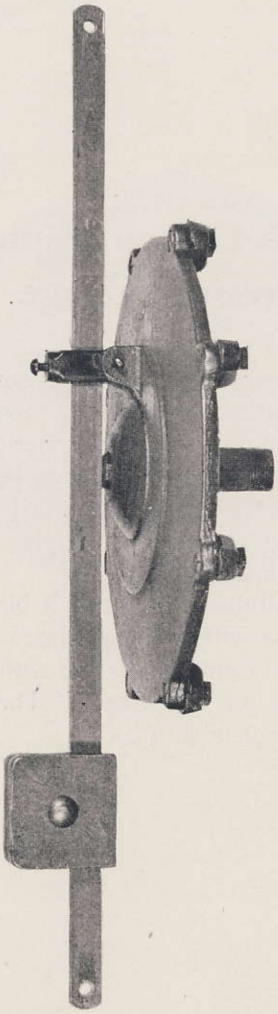
GORTON
VAPOR PRESSURE GAUGE

The Gorton Vapor Pressure Gauge

THE GORTON VAPOR PRESSURE GAUGE indicates accurately on its clean cut dial the slightest variations in pressure from 2 ounces to 10 pounds with a free and unrestricted movement of the sensitive spring; then with protected and retarded travel of spring, correct registration for pressures from 10 to 30 pounds.

It is beautifully enclosed in a black enameled steel case with a nickel-plated face ring.

The vertical connection is ¼″ with an ample square shank for the wrench. The gauge is furnished complete with cock.



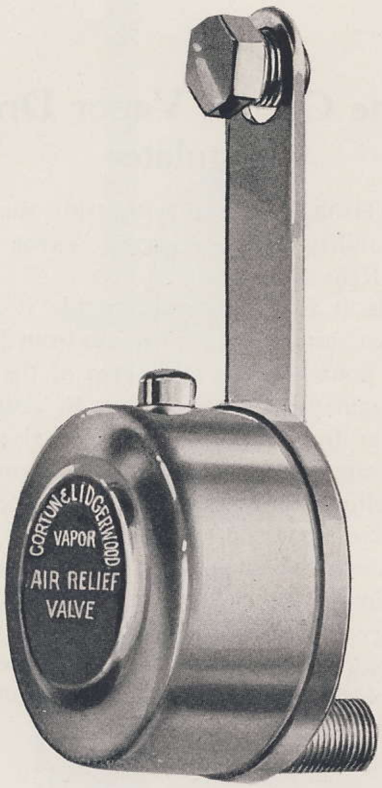
GORTON VAPOR DRAFT REGULATOR

The Gorton Vapor Draft Regulator

A THING endowed with truly marvelous ability is the GORTON VAPOR DRAFT REGULATOR.

While it is strong and durable it is very sensitive, responding to pressures from 2 ounces to five pounds. The large area of the bronze diaphragm provides the power to actuate the cross-bar by concentrating the total pressure of the vapor under the large diaphragm on the small sliding pin which transmits the power to the cross-bar.

The sensitive diaphragm is protected in a very simple yet effective manner by placing bearing stops above and below the diaphragm for it to rest on and prevent it from becoming strained, that is, preventing its movement beyond its safe limit of endurance.



SCHOOL TYPE
Gorton Vapor Air Relief Valve

Gorton Vapor System

School Type

Gorton Vapor Air Relief Valve

THIS TYPE of air relief valve was developed at the request of the Chief Engineer of the Board of Education, City of New York.

The commercial instinct appears in children at an early age, it would appear, and one of its manifestations is the removing of air valves from the radiators to sell to the junk man.

This design of the Gorton Vapor Air Relief Valve renders it quite a task to remove, since a solid piece of strap brass is double rivetted to the valve body. This strap brass is then drilled at the top to allow for the insertion of a hexagon headed screw with 1/8″ male pipe thread. The radiators for school work are drilled and tapped (3-1/2″ C to C of valve tapping and screw tapping) to receive this screw.

The simpleness of this preventative measure has been widely appreciated, except by the small boy who finds it an extremely hard task to remove after a husky fitter has inserted it with a 12″ monkey wrench.

About Old Steam Jobs

THIS SYSTEM is unique in its adaptability to old steam jobs.

All that is necessary to be done, providing the piping is properly graded, is to attach the Gorton Vapor Specialties in place of the old steam valves.

Since the measurement "B" of the Gorton Quarter Turn Radiator Supply Valve is approximately ¾″ more than the ordinary radiator valve, it is necessary to raise the radiator in order to install the valve without cutting the nipple.

On old jobs of course the old valves are larger than the Schedule of Sizes of the Gorton Valves, but it is the consensus of opinion among the many contractors doing this change-over work that it is much cheaper and easier to install a Gorton Valve the same size as the old valve than it is to remove the pipe coming through the floor and install a new piece conforming with the Gorton Valve Schedule.

A number of contractors tell us that when installing the air eliminator on the end of the main, it is sometimes easier to tap in on the side than the top. In this case a ⅜″ street elbow is screwed into the tapping and the ⅜″ vertical male connection screwed into the elbow.

There is much jobbing and fixing of heating systems going on all the time, more or less

of which is unsatisfactory, but when the Gorton Vapor Specialties are attached to an old heating system, thus changing it to a Gorton Single Pipe Vapor System, the result is permanent and to everyone's satisfaction.

Gorton Radiator Supply Valve Sizes

For Use with
The Gorton Single Pipe Vapor System

½"—For Radiators up to 12 sq. feet.
¾"—For Radiators from 12 to 25 sq. ft.
1" —For Radiators from 25 to 60 sq. ft.
1¼"—For Radiators from 60 to 100 sq. ft.
1½"—For Radiators from 100 to 200 sq. ft.

Note—Roughing-in Dimensions on Pages 54-55.

Special Note

The five Specialties which have just been described comprise the GORTON VAPOR SYSTEM. In order to obtain the many benefits that it is possible to derive with the System as a whole, the whole system must be installed.

Hypothetical Heating Lay-Out

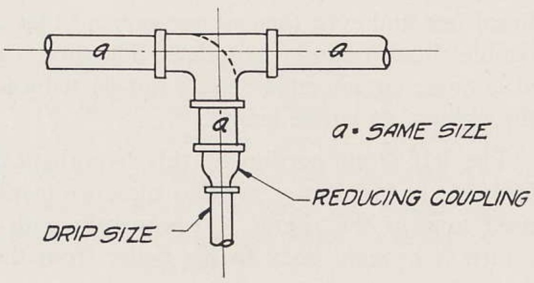
WE SHOW a piping lay-out for different applications of the Gorton Single Pipe Vapor System but the lay-out shown on page 29 is designed to show at a glance all the possible ways of installing a single pipe system of piping for all of the ordinary conditions encountered in practice.

Imagine a building where the rear part is only one story high and not very large in area. The single circuit main is used for that part. A single circuit main should never be used where the total length of the main exceeds 50 lineal feet and even then we recommend that a double circuit main be installed. The pipe size of a single circuit main should not be reduced throughout its entire length.

The left front portion of this hypothetical building is two stories high so there isn't any need to drip the risers. Consequently a dry return is brought back to the boiler from the end of this main which is one half of a double circuit main supplying the whole front portion of the building.

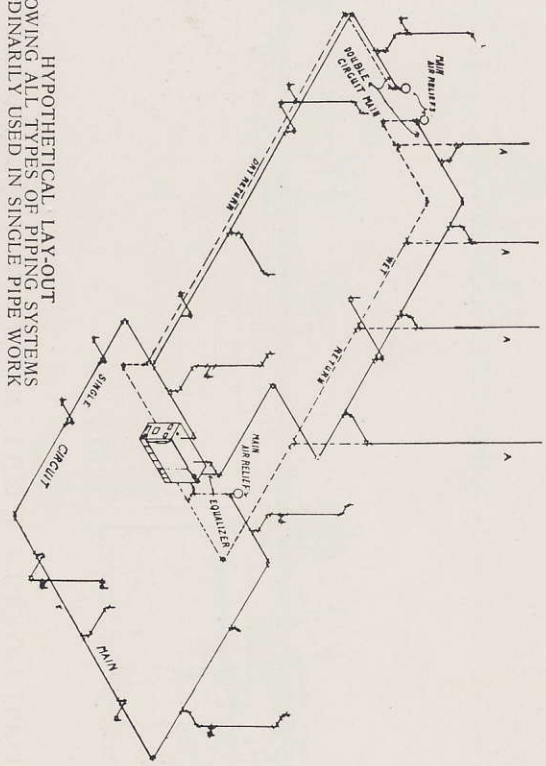
The right front portion of the building is six stories high. Consequently each riser (A) is dripped into a wet return back to the boiler.

It is advisable to make as many circuits as possible on a job because each division cuts down the length of the individual mains thus making the heating up faster and the distribution of the vapor more even. The pipe size of any main should never be reduced unless an eccentric fitting is used or the main is dripped at the point of reduction. When dripping a main for any reason the drip opening of the fitting used should be the full size of the line dripped and a full sized nipple carried down to a reducing coupling, where a reduction is made to the size of pipe capable of carrying the condensation to the return.

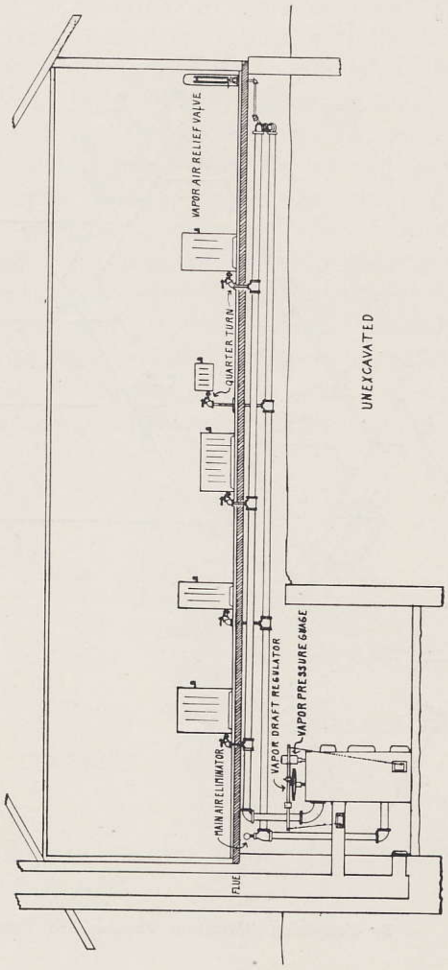


DETAIL OF ALL DRIP CONSTRUCTION

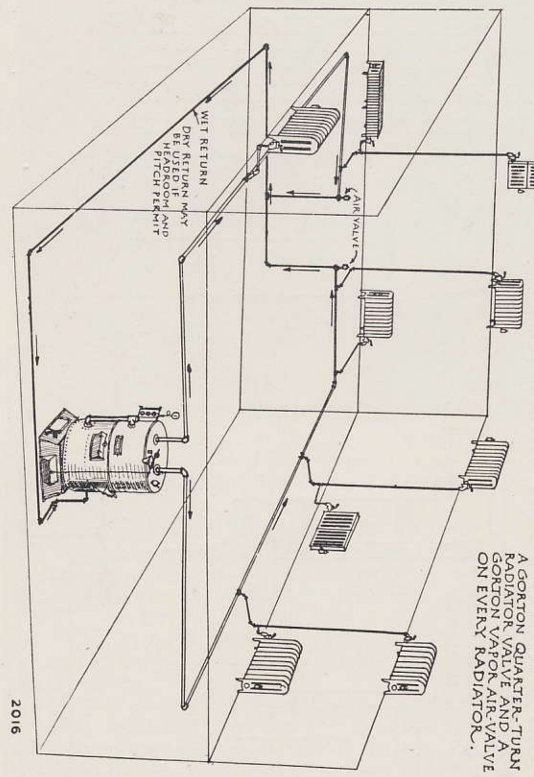
HYPOTHETICAL LAY-OUT
SHOWING ALL TYPES OF PIPING SYSTEMS
ORDINARILY USED IN SINGLE PIPE WORK



By Permission "Merchant Plumber and Fitter"



CIRCUIT LAY-OUT FOR COTTAGE WITH VERY SMALL BOILER



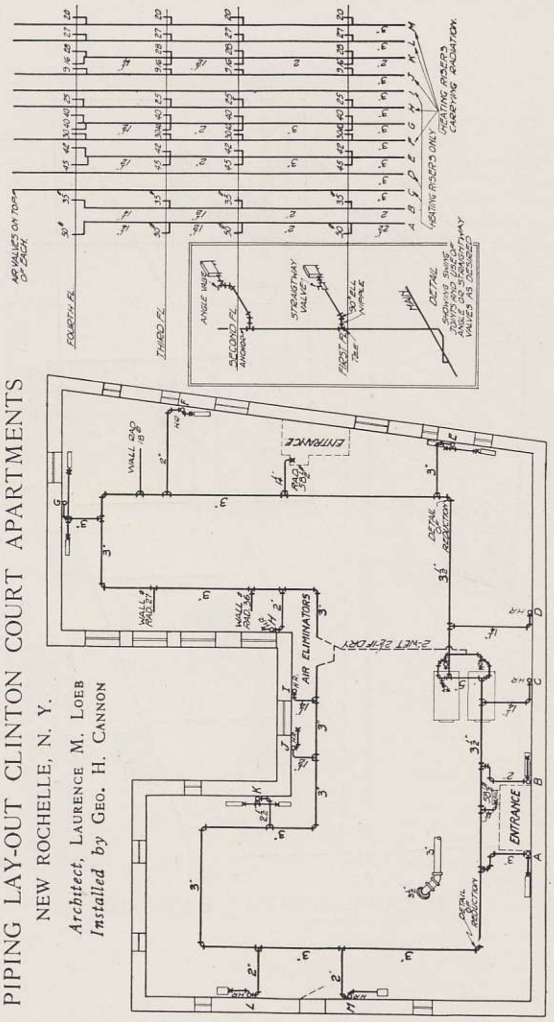
DOUBLE CIRCUIT LAY-OUT

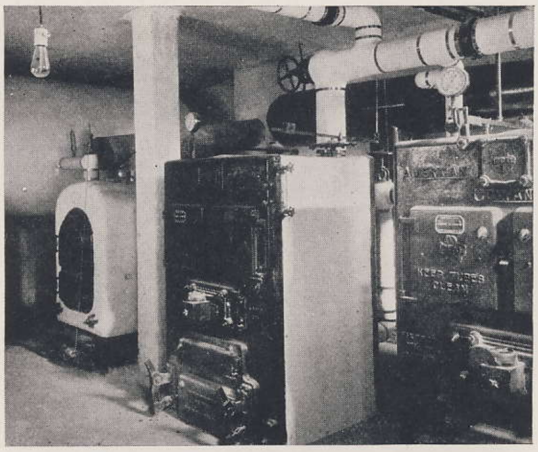
PIPING LAY-OUT CLINTON COURT APARTMENTS

NEW ROCHELLE, N. Y.

Architect, Laurence M. Loeb

Installed by Geo. H. Cannon





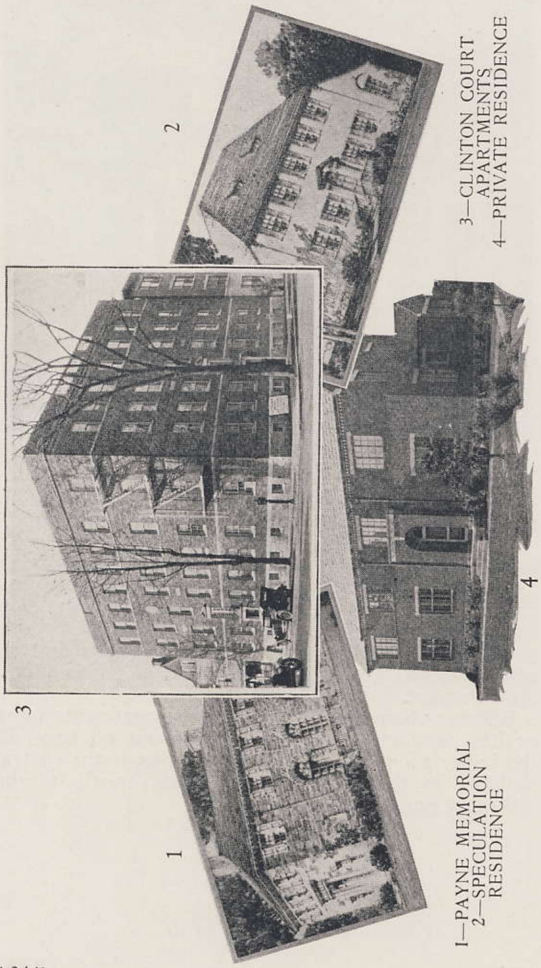
BOILER ROOM

CLINTON COURT APARTMENTS, NEW ROCHELLE, N. Y.

Laurence M. Loeb, Architect, New Rochelle, N. Y., has specified and had the Gorton Single Pipe Vapor System installed in over forty imposing residences, apartments, etc., in wealthy Westchester County, New York. We have a written report from Mr. Loeb giving his experience with the Gorton Vapor System, which we will gladly send, with list of installations, upon request.

We show here the Clinton Court Apartments more or less completely; that is, the lay-out on page 32, the boiler room above and the exterior is the central building in the group of Mr. Loeb's work on the following page.

First page of series of Gorton System Installations

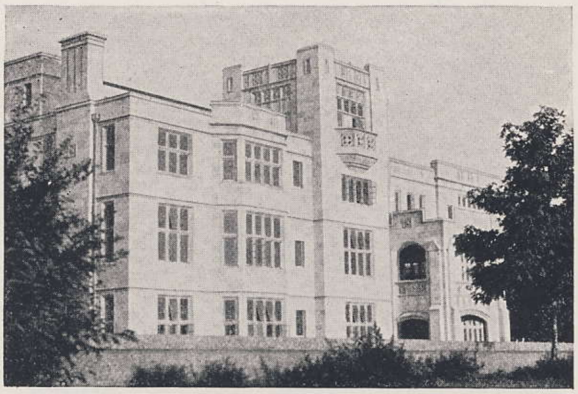


3—CLINTON COURT APARTMENTS
4—PRIVATE RESIDENCE

1—PAYNE MEMORIAL
2—SPECULATION RESIDENCE

APARTMENTS
Lynn, Mass.
Society of Friends, *Owners*
M. F. Burk Company, *Architects*

BRENTWOOD COURT APARTMENTS
High St., West Medford, Mass.
Whitten and Gore, *Architects*
Robert A. LaCentra & Co., Boston, *Heating Contractors*



LEGATION BUILDING
15TH AND CHAPIN STS., WASHINGTON, D. C.
MRS. J. B. HENDERSON
GEO. OAKLEY TOTTEN, JR., *Architect*
E. J. FEBREY & CO., *Heating Contractors*

RESIDENCE OF MR. EDWARD L. MORELAND
WELLESLEY FARMS, MASS.
THOMAS BYRD EPPS, *Architect*

37th PRECINCT POLICE STATION
CITY OF NEW YORK, BOROUGH OF BROOKLYN
THOMAS E. O'BRIEN, *Architect*

NAY AUG PARK ZOO
SCRANTON, PA.

Two boilers and two systems are here installed. Zoos are always hard to heat and exacting in requirements. Tropical animals—birds, beasts and fishes—require steady and unfailing heat at all times except during the few hot summer months. The Gorton System fulfills all desires and needs.

RESIDENCE OF MR. WILLIAM LA FONTAINE
Heating Engineer and Contractor, SCRANTON, PA.

My observations and comparative experiments leads me to the conclusion that the Gorton Single Pipe Vapor System will fill a cold system about three times as fast as any vacuum Air Valve System and the heated radiators will remain hot very nearly as long.

Wm. La Fontaine

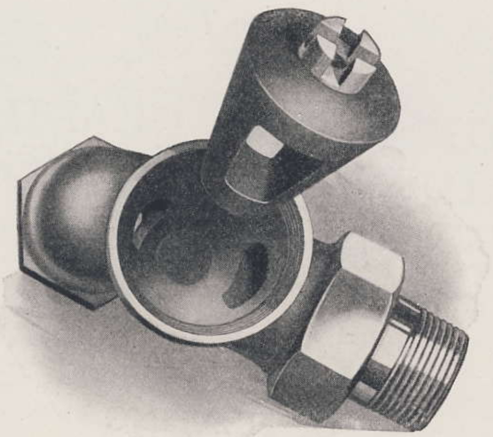
IN CONCLUSION
The Gorton System Provides

(1) A 25% saving in installation over other good vapor heating systems.
(2) A 25% saving in coal consumption possible over steam heating.
(3) Automatic regulation of the boiler.
(4) Room temperature easy to control with the Gorton Quarter Turn Valve.
(5) Quick heating up at all times.
(6) High grade specialties which will last as long as the building.

Section Two

THE GORTON QUARTER TURN PACKING LOCK RADIATOR SUPPLY VALVES

FOR ALL SYSTEMS OF HEATING



THE HEART
OF THE
VALVE

Construction Details

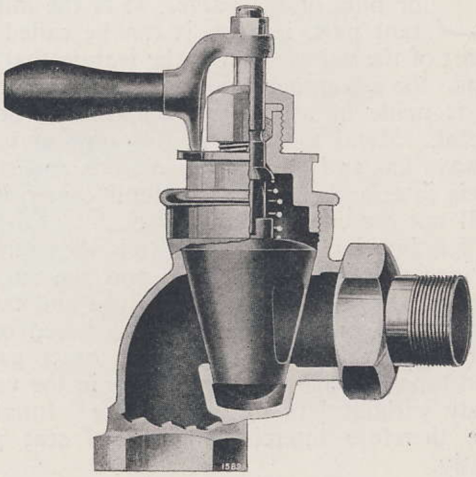
of

The Gorton Quarter Turn Packing Lock Supply Valve

CUT on opposite page shows the interior or plug of the valve. It is the important part, in fact, it can be called the heart of the valve, for it is the feature that has made the advantages of the valve practicable. It is made of a mineral composition, not a metal. Metal to metal in this type of valve always has and always will corrode and stick. This interior being of a mineral composition will not corrode, soften or stick.

The interior is moulded. It is then put on a special grinding machine, and the surface ground smooth and to exact gauge and taper. The inside of the valve body is bored on a special machine and reamed to exact gauge and taper, so that the interior fits in the valve body without lapping or grinding. Interiors are therefore interchangeable and seat perfectly.

The wear of the interior is imperceptibly small for the interior is of different material than the valve body. A wearing test given, equal to 90 years of heating service, based on two hundred heating days a year and the opening and closing of the valve fifteen times a day, showed that the surface of the interior had a very high polish. The inside of the valve body was also highly polished but so far as could be determined there was no wear either of the interior or of the valve body. There is therefore, under ordinary working



SECTIONAL VIEW

GORTON QUARTER TURN PACKING LOCK RADIATOR VALVE

conditions, no reason why the interior will not last as long as the valve body.

The interior and stem are connected by a loose joint which makes it impossible to throw the interior out of its seat. A hole is drilled in the valve body to allow the steam or water to come on top of the interior, keeping it seated when in operation, the area of the down-thrust being greater than the area of uplift, so that neither grit nor dirt can get in between the interior and the seat. The light bronze spring shown is used *only* to keep the interior seated during transportation.

The packing device used is simple and effective. The stem has a groove just above the bottom of the packing box. Special asbestos packing rings are forced into this groove by screwing down the packing box nut, which makes a "Packing Lock." The stem also has a ball shoulder which seats on the underside of the bonnet. This ball shoulder seat and "Packing Lock" make a packing device that eliminates all possibility of a leak. The "Packing Lock" is a patented device used exclusively by us.

The Gorton Quarter Turn Packing Lock Valve is not a variation of an ordinary valve. It is distinctly something better. Its ease of operation is obviously desirable. One turn of the wrist, which gives a quarter turn of the handle, is all that is required to fully open or close the valve. If you have been turning ordinary radiator valves you will fully appreciate the "Quarter Turn" Valve.

Valve Area *vs.* Free Passageway

IF YOU will examine the ordinary radiator valve you will find that while it has full area, yet the disc and holder make an obstruction in the valve body which prevents the free flow of steam and water through the valve.

The effect of this obstruction in single pipe work is shown in the data on critical velocity in the Miscellaneous Data Section. When one of these valves is attached the full capacity of the pipe cannot be used.

On the other hand, the Gorton Quarter Turn Packing Lock Valve, in single pipe work, because of its unobstructed passageway, allows the full capacity of the pipe to be used when a Gorton Valve, the same size as the pipe, is attached to the pipe.

Furthermore, a Gorton Valve one size smaller than the pipe to which it is attached will supply the full amount of radiation which the particular size of pipe used is rated to carry.

To make this clear we will give an example in both cases. In the first case, the full capacity of 1¼" pipe used as a branch to a radiator with a pitch of 6" in 10 ft., according to tests made by the State College of Washington (Table 14, Page 84, Section Three), is 182.5 sq. ft.* If an ordinary 1¼" radiator valve is attached, the capacity of the pipe is reduced 27% because the valve becomes the limiting factor. However, if a 1¼" Gorton Valve is attached to this same pipe, the full capacity of the pipe is still available. This fact is the thing that allowed Mr. Lewis to do what he did. (See Page 57.)

In the second case, the working capacity of a 1¼" pipe used as a branch, as given in the Guide of the American Society of Heating and Ventilating Engineers, is 60 sq. ft. The ordinary 1¼" radiator valve will supply this 60 sq. ft., but a 1" GORTON VALVE will supply this 60 sq. ft. This fact accounts for our valve size schedule for single pipe work on pages 26 and 53. This fact also lowers the cost of a job, since the smaller size valves cost less.

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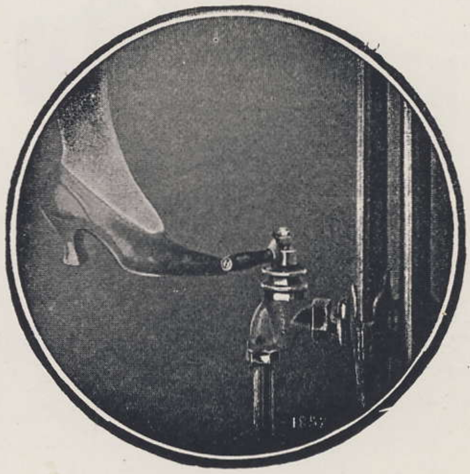
*It should be borne in mind that this figure is for steady operation and only supplying 240 B. T. U. per hour per square foot of radiation. Your attention is called to the graph, Fig. 1, page 64, which illustrates the reason for using 1¼" pipe to supply only 60 sq. ft. of radiation on the job.

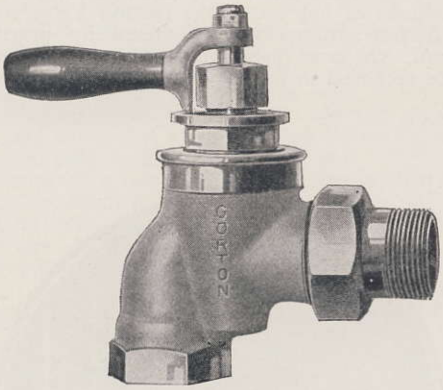
In two-pipe work the unobstructed passageway which is an exclusive feature with the Gorton Valve allows the perfectly safe use of the schedule on page 53.

We can easily guarantee this schedule, since, by actual and practical tests, we have found the valves capable of carrying more than this schedule.

In hot water heating, although it is necessary to use a valve the same size as the piping in order to get the volume of hot water, the Gorton Valve reduces the friction ordinarily encountered by practically one-half. On large installations this saving of energy can be reckoned in horse power.



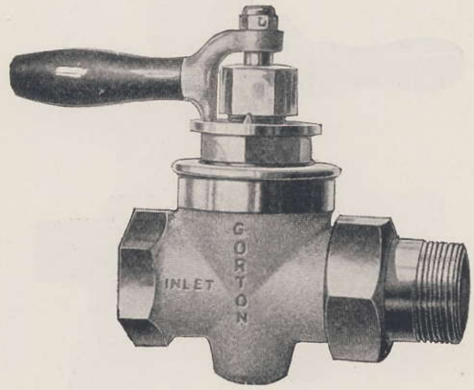
EASE OF OPERATION



GORTON QUARTER TURN PACKING LOCK RADIATOR VALVE

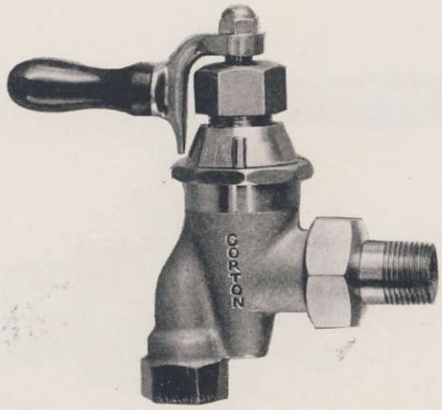
ANGLE TYPE WITH UNION

No. 1—Plain brass.
No. 2—Rough body, nickel-plated, polished trimmings.
Sizes: ½", ¾", 1", 1¼", 1½".
See Schedule Page 53.



GORTON QUARTER TURN PACKING LOCK STRAIGHTWAY VALVE (WITH UNION)

No. 5—Plain brass.
No. 6—Rough body, nickel-plated, polished trimmings.
Also made without union (Nos. 3 and 4).
Sizes: ½", ¾", 1", 1¼", 1½".
See Schedule Page 53.



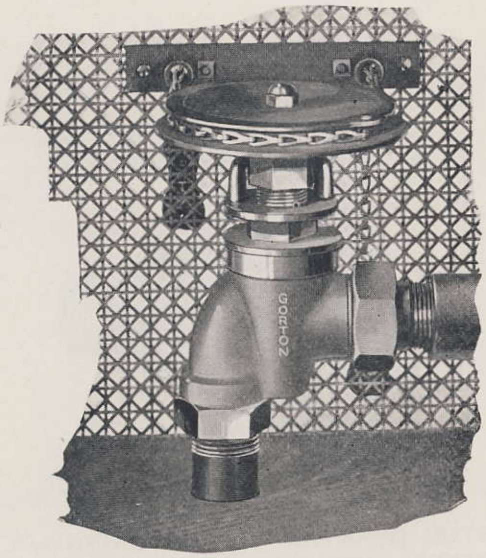
GORTON QUARTER TURN PACKING LOCK MODULATING VALVE NO. 7

For Two-Pipe Vapor and Vacuum Heating

No. 7—Rough body, nickel-plated, polished trimmings
Sizes: ½", ¾". (For larger sizes use No. 2 Valve.)
See Schedule Page 53.

GORTON QUARTER TURN PACKING LOCK RADIATOR VALVE (ANGLE TYPE) WITH LOCK SHIELD

Straightway Valves (with and without Union) Can be Furnished with Lock Shields.
Key Handle Furnished.
See Schedule Page 53.



THE GORTON QUARTER TURN CHAIN PULL VALVE

For Operation of Concealed Valves and Overhead Valves on Wall and Ceiling Radiators

See Schedule Page 53.

The Gorton Quarter Turn Chain Pull Valve

THE GORTON CHAIN PULL VALVE is another triumph of the engineering ability identified with this Company.

There may be other chain- and wheel-operated valves, but here is one comparable to your chain-pull electric light socket.

This is due to the basic fact that we are making the only plug type of valve which never sticks. The operation of this Chain Pull Valve is as easy as the operation of your chain pull electric light socket.

This valve needs to be turned only a quarter of a circle in order to fully open or close it. This fact makes it apparent that the amount of pulling necessary to open or close the valve is very little.

The same size wheel is mounted on all sizes of valves, and the actual lineal length of movement of the chain in fully opening or closing the valve is only three and one-half inches.

The principal use of this Chain Pull Valve is on radiators placed behind grilles. When attaching the chain guide to the grille, be sure that it is never lower than the wheel. It must be either level or a trifle higher.

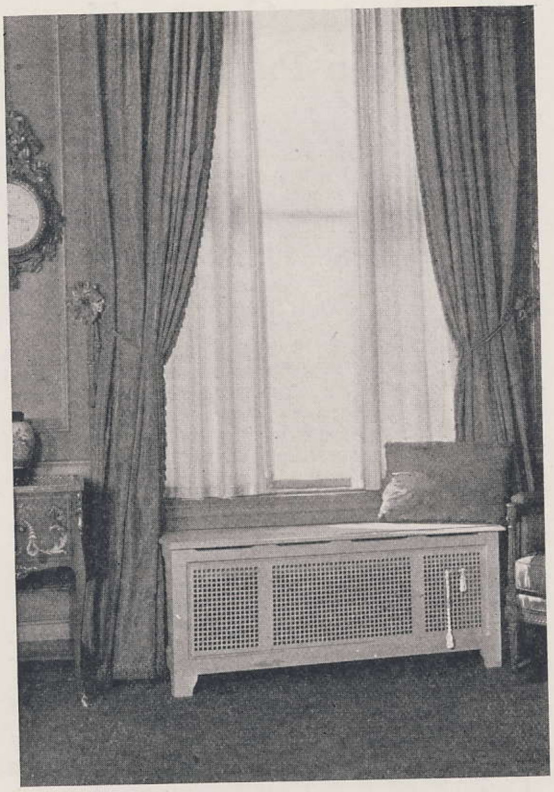
All previous methods of controlling radiators in difficult locations, such as extension stems, hinged sections in the grille, etc., caused a great deal of trouble.

With the advent of this Chain Pull Valve all former methods become obsolete.

The neat-appearing handles which are outside of the grille are marked *Open* and *Shut*, so there is never any doubt as to the position of the valve.

Another use for this Chain Pull Valve is to control radiators or heating units hung from the ceiling or high on the wall.

The operation is just as easy on these high units as when the valve is behind a grille. The only difference is in the length of the chain which can easily be adjusted.



Application of Gorton Quarter Turn Chain Pull Valve with Tuttle & Bailey Radiator Screen or Grille

Guaranteed Schedule

Sizes of Gorton Quarter Turn Packing Lock Valves to Be Used for Various Heating Systems

THE regular size of pipe used for the system being installed should be run to the elbow below the Radiator Valve, where reduction is made to valve size as follows:

Steam Heating, Single-Pipe Connection

Radiators up to 12 sq. ft....	½ inch valve
From 12 to 25 sq. ft.......	¾ " "
From 25 to 60 sq. ft.......	1 " "
From 60 to 100 sq. ft.......	1¼ " "
From 100 to 200 sq. ft.......	1½ " "

Vapor and Vacuum Heating, Two-Pipe Connections

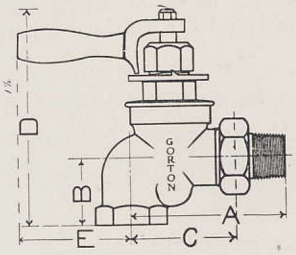
Radiators up to 90 sq. ft....	½ inch valve
From 90 to 180 sq. ft.......	¾ " "
From 180 to 360 sq. ft.......	1 " "
From 360 to 540 sq. ft.......	1¼ " "
From 540 to 720 sq. ft.......	1½ " "

Hot Water Heating

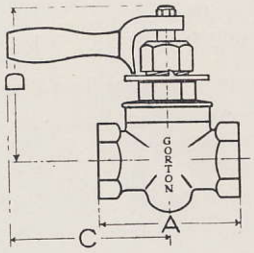
Use the regular size of valves needed for the particular system installed.

The above schedule of Gorton Valve Sizes is based on direct cast-iron radiation condensing ¼ lb. of steam per hour, or the equal in other types. It has been used for over 10 years and no case has yet arisen where a Gorton Quarter Turn Packing Lock Valve would not supply the radiation according to this Guaranteed Schedule.

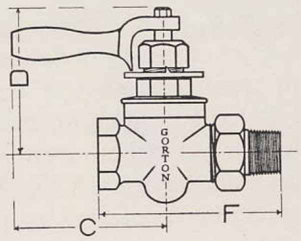
RADIATOR ANGLE VALVE (WITH UNION)
Nos. 1, 2 and 7



STRAIGHTWAY VALVE
Nos. 3 and 4



STRAIGHTWAY VALVE WITH UNION
Nos. 5 and 6

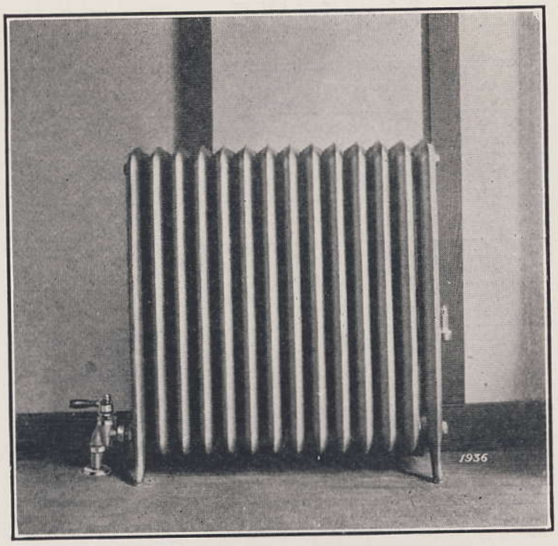


Roughing-in Measurements

Size....	½″	¾″	1″	1¼″	1½″
A	3⅜	3⅞	4⅜	5	5¾
B	1⅝	2	2⅛	2⅜	2⅝
C	2¼	2⅝	3	3½	4
D	5⅝	6	6⅝	7⅛	7½
E	2¼	2⅞	3¼	3⅛	2⅞

Size....	½″	¾″	1″	1¼″	1½″
A	2⅞	3⅜	3¾	4¼	4⅝
C	3⅛	3⅝	4⅜	4⅜	4⅜
D	4	4¼	4¾	4⅞	5⅛

Size....	½″	¾″	1″	1¼″	1½″
F	4	4⅝	5¼	5⅞	6⅝
C	3⅛	3⅝	4⅜	4⅜	4⅜
D	4	4¼	4¾	4⅞	5⅛



70 SQ. FT. RADIATOR

Connected by a ONE INCH GORTON VALVE to a one pipe steam system

THE photograph above, together with the letter of Mr. Lewis on next page, indicate the value of the unobstructed passageway (See page 44) which is an exclusive feature of the Gorton Quarter Turn Valve.

The letter indicates a method of curing some jobs and saving the expense of repiping.

M. E. LEWIS
HEATING ENGINEER AND CONTRACTOR
BINGHAMTON, N. Y.

March 12th, 1920.

Gorton & Lidgerwood Co.,
96 Liberty St.,
New York, N. Y.

Gentlemen:

In reply to your letter of Feb. 21st, requesting my experience and opinion of the Gorton Quarter Turn Packing Lock Valve, I wish to say:

About four years ago I installed in my office a seventy-foot, three-column radiator thirty-eight inches high, using a one-inch Gorton Valve connected to a one-pipe steam system as an experiment. The radiator has been working perfectly and, as far as I can determine, is as efficient as it was when connected with an inch and one-half ordinary angle radiator valve.

About this time I was called in to overhaul a one-pipe steam plant in a six-family apartment that had been in only a short time, but was not heating properly. I found that the corner rooms required fifty-foot radiators, and only twenty-five-foot radiators were used, with one-inch valves and pipe size according.

I told the owner about your valve and my experience with it in my office, and was instructed to enlarge the radiators using your one-inch valves. The job has been working three winters and is as satisfactory and efficient as any one-pipe steam job could be, and he was saved the expense of repiping.

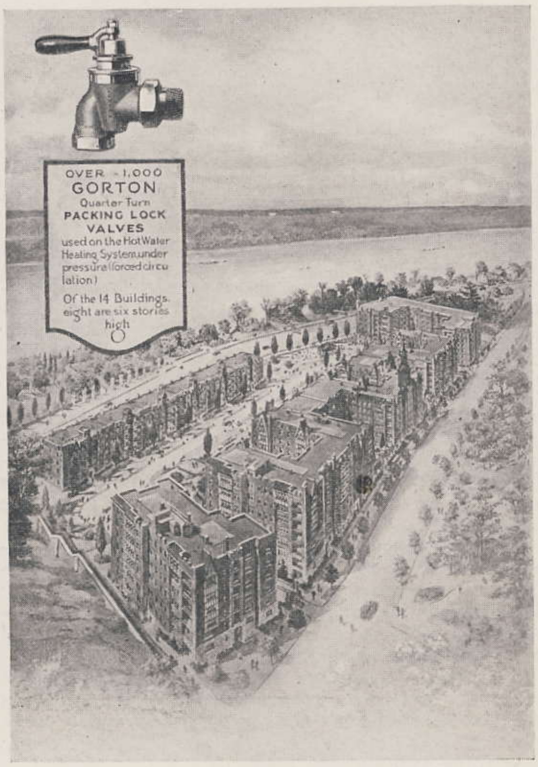
Since then I have used a great many of your valves on similar work with excellent results, and I am using them on nearly all my new work; and for vapor work there is none better.

Wishing you success, I am,

Yours very truly,

(Signed) M. E. Lewis.

First Page of Series of Gorton Valve Installations



HUDSON VIEW GARDENS
182ND TO 186TH STREETS, PINEHURST AND NORTHERN AVENUES, NEW YORK

GEORGE FRED PELHAM, INC., *Architect*
GEORGE F. MUSSELMAN, *Consulting Engineer*
J. L. MURPHY, INC., *Heating Contractor*
PATERNO CONSTRUCTION COMPANY, *Builder*

THE MATSON BUILDING, SAN FRANCISCO, CALIF.

THE MATSON NAVIGATION COMPANY, *Owners*
BLISS & FAVILLE, *Architects*
THOMAS NORRIN, *Engineer*

PACIFIC TELEPHONE & TELEGRAPH BUILDING
SAN FRANCISCO, CALIF.

TALLEST BUILDING WEST OF THE MISSISSIPPI
J. R. MILLER AND T. L. PFLUEGER, A. A. CANTIN, *Architects*
ATKINS & PARKER, *Consulting Engineers*
J. E. O'MARA COMPANY, *Heating Contractors*

AMERICA FORE BUILDING
CHICAGO, ILL.

McCORMICK BUILDING
BALTIMORE, MD.
McCORMICK & Co., *Owners*

Section Three

MISCELLANEOUS DATA

Appreciation

We wish to acknowledge our indebtedness for a large part of the following data to—

American Society of Heating and Ventilating Engineers

Heating and Ventilating Magazine

Hoffman Specialty Co., Inc.

State College of Washington

NOTE. *We would like to express our appreciation of the work of The American Society of Heating And Ventilating Engineers in compiling The Guide and to recommend its being purchased and used as a reference book by all of our friends and customers.*

Radiating Surface

The Gorton Single Pipe Vapor System requires the same amount of radiation as is used for ordinary steam.

Warming the Radiator

It is often very important to know the maximum condensation that occurs in a radiator when steam is turned on. Fig. 1 shows the condensation rate in pounds per hour for the time elapsing after steam is turned into the radiator. It will be noticed that the maximum condensation occurs 10 min. after steam is turned on, and in that case it amounts to

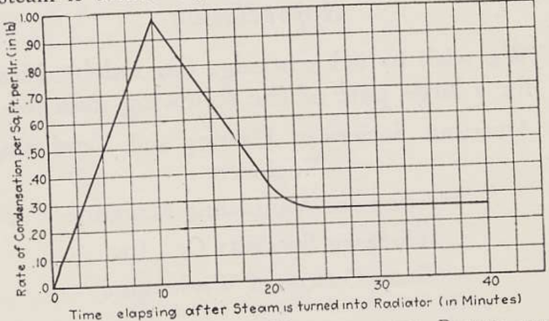


FIG. 1. CHART SHOWS DEMAND UPON BOILER FOR HEATING-UP PLANT

about three and one-half times normal condensation. After the end of 25 min., the radiator had reached a normal rate of condensation. This curve was made from observations at intervals of 10 min. so that the intermediate points between the 10 min. points are not known, and the form of the curve is not exact. It shows, however, that in starting a plant, the demand made upon the boiler may be very much higher than the normal demand.

TABLE 1. EFFECT OF PAINTING ON TWO-COLUMN 38-IN. RADIATOR, STEAM TEMPERATURE 215 DEG., ROOM TEMPERATURE 70 DEG. FAHR.

Condition of Surface	Per Cent
Cast iron bare	240
Painted with aluminum bronze	200
" " gold bronze	205
" " white enamel	242
" " maroon Japan	240
" " white zinc paint	242
" " no-lustre green enamel	230

The effect of painting radiators is only to change the amount of heat radiated by the radiator and does not change the amount of heat absorbed by the air circulating thru the radiator.

WHEN a hot water type of radiator is used for single pipe steam or vapor, the air valve should be placed from two-thirds to one-half way down from the top of the last section opposite the supply end of the radiator.

Effect of Enclosing the Radiator

It is very often desirable to partly enclose or conceal a radiator by means of screens or grills. All such enclosures in general reduce the heat transmission from the radiator, the effect being both to reduce the radiant heat and the convected heat. As in most radiators, the convected heat is at least two-thirds of the heat transmission, these enclosures or screens largely affect the convected heat. It is therefore very desirable that the current of air passing over and through the radiator should be restricted as little as possible. There has been some experimental work done, particularly abroad, with reference to these screens. There are, however, so many different cases that may arise that it will not be possible to discuss all of them but only to take up typical ones.

Case No. 1.—In this case, Fig. 2, the radiator is enclosed in a box with a screen in front and at the bottom, and a screen at the top, these screens extending the full length of the radiator. This arrangement reduces the heat transmission of the radiator from 7 to 10 per cent and in all cases, the spaces between the radiator and the wall and the spaces between the casing and the radiator should be at least 2½ in. The reduction of heat transmission will be more in narrow radiators than in wide radiators. Experiments show that the best results are obtained when the opening at the top has twice the width of the opening at the bottom, and for radiators of ordinary type the width of opening at the bottom should be 5 in. and the opening at the top, 10 in.

Case No. 2.—It is sometimes desirable to place a screen in front of the radiator, leaving the top entirely open with an opening at the bottom in front for the cold air to enter the radiator as in Fig. 3. In a case of this kind the effect of the screen is to produce a strong current of air and if this screen is high enough it may even produce a chimney effect which will increase heat transmission from the radiator due to increased circulation. The effect of such screens depends entirely upon their height. Professor Brabbee states that, with a screen 72 in. high and a 49-in. radiator, the heat transmission will be increased 12 per cent.

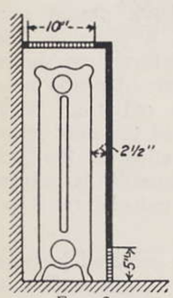


FIG. 2

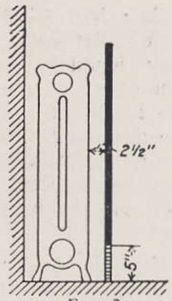


FIG. 3

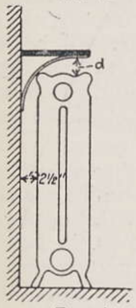


FIG. 4

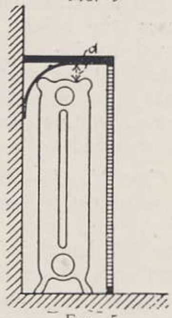


FIG. 5

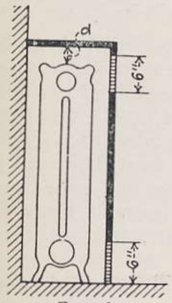


FIG. 6

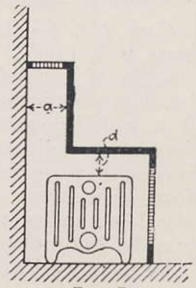


FIG. 7

DIFFERENT ARRANGEMENTS OF RADIATOR ENCLOSURES

Case No. 3.—Radiators often have placed over them a flat shelf, as shown in Fig. 4. In such case, they should be provided with a deflector as shown. The effect of the shelf very largely depends upon the height of the shelf above the radiator. When the distance *D*—that is the height of the shelf above the radiator—is 5 in. or over, the effect of the shelf may be neglected. When the distance *D* is reduced to 4 in., the heat effect may be reduced by 4 per cent.

Case No. 4.—Radiators are often enclosed in boxes with a grill in front or recessed in the wall with a gril placed in front of them as in Fig. 5. In such cases, the height, *D*, is very important. With *D* equal to 2½ in., the heat transmission will be reduced 20 per cent, and with *D* equal to 6 in., the heat transmission is reduced 10 per cent. It is assumed in this case that the entire front of the box is provided with an open grill.

Case No. 5.—Sometimes a grill, as shown in Case 4, is partly replaced by a solid panel with openings above and below as in Fig. 6. With the openings the full length of the radiator and 6 in. in height and with *D* not less than 4 in., the heat transmission will be reduced 25 per cent. As *D* is reduced in height, the heat transmission will also be reduced and with *D*, 2½ in., the reduction will be 40 per cent.

Case No. 6.—Radiators are often placed under seats as in Fig 7. In this case the distance between the top of the radiator and the bottom of the seat becomes very important and should not be less than 3 in. and if possible it should be made 6 in. Under favorable conditions, when *D* is at least 3 in. and *A* is equal to 6 in., the heat transmission will be reduced from 15 to 20 per cent. When *D* is small, however, say 2 in., and *A* is reduced to 4 in., this reduction may be 35 or 40 per cent.

In tests[1] by Prof. K. Brabbee will be found other cases than those cited above.

[1]Reported by George Stumpf, Jr., in *Heating and Ventilating Magazine*, May 1914, p. 23.

TABLE 2

CLIMATIC CONDITIONS
COMPILED FROM U.S. WEATHER BUREAU RECORDS

COL. A	COL. B.	COL. C.	COL. D	COL. E	COL. F
STATE	CITY	AVERAGE TEMP. OCT. 1ST-MAY 1ST	LOWEST TEMPERATURE	AVERAGE WIND VELOCITY DEC., JAN., FEB., MILES PER HR.	DIRECTION OF PREVALING WIND DEC., JAN., FEB.
ALA	MOBILE	57.7	- 1	8.3	N
	BIRMINGHAM	53.9	-10	8.6	N
ARIZ.	PHOENIX	59.5	16	3.9	E
	FLAGSTAFF	34.9	-25	6.7	SW
ARK.	FORT SMITH	49.5	-15	8.0	E
	LITTLE ROCK	51.6	-12	9.9	NW
CALIF.	SAN FRANCISCO	54.3	29		N
	LOS ANGELES	58.6	28		NE
COL.	DENVER	39.3	-29	7.4	S
	GRAND JCT.	39.2	-16	5.6	SE
CONN.	NEW HAVEN	38.0	-14	9.3	N
D. C.	WASHINGTON	43.2	-15	7.3	NW
FLA.	JACKSONVILLE	61.9	10	8.2	NE
GA.	ATLANTA	51.4	- 8	11.8	NW
	SAVANNAH	58.4	8	8.3	NW
IDAHO	LEWISTON	42.5	-13	4.7	E
	POCATELLO	36.4	-20	9.3	SE
ILL.	CHICAGO	36.4	-23	17	SW
	SPRINGFIELD	39.9	-24	10.2	NW
IND.	INDIANAPOLIS	40.2	-25	11.8	S
	EVANSVILLE	44.1	-15	8.4	S
IOWA	DUBUQUE	33.9	-32	6.1	NW
	SIOUX CITY	32.1	-35	12.2	NW
KAN.	CONCORDIA	38.9	-25	7.3	N
	DODGE CITY	40.2	-26	10.4	NW
KY.	LOUISVILLE	45.2	-20	9.3	SW
LA.	NEW ORLEANS	61.5	7	9.6	N
	SHREVEPORT	56.2	- 5	7.7	SE
ME.	EASTPORT	31.1	-23	13.8	W
	PORTLAND	33.6	-17	10.1	NW
MD.	BALTIMORE	43.6	- 7	7.2	NW
MASS.	BOSTON	37.6	-13	11.7	W
MICH.	ALPENA	29.1	-27	11.3	W
	DETROIT	35.4	-24	13.1	SW
	MARQUETTE	27.6	-27	11.4	NW
MINN.	DULUTH	25.1	-41	11.1	SW

TABLE 3

CLIMATIC CONDITIONS
COMPILED FROM U.S. WEATHER BUREAU RECORDS

COL. A	COL. B	COL. C	COL. D	COL. E	COL. F
STATE	CITY	AVERAGE TEMP. OCT. 1ST – MAY 1ST	LOWEST TEMPERATURE	AVERAGE WIND VELOCITY DEC., JAN., FEB., MILES PER HR.	DIRECTION OF PREVALING WIND DEC., JAN., FEB.
MINN.	MINNEAPOLIS	29.6	−33	11.5	NW
MISS.	VICKSBURG	56.0	− 1	7.6	SE
MO.	ST. JOSEPH	40.3	−24	9.1	NW
	SPRINGFIELD	43.0	−29	11.3	SE
MONT.	BILLINGS	34.7	−49		W
	HAVRE	27.7	−57	8.7	SW
NEB.	LINCOLN	37.0	−29	10.9	N
	NORTH PLATTE	34.6	−35	9.0	W
NEV.	TONOPAH	39.6	− 7	9.9	SE
	WINNEMUCCA	37.9	−28	9.5	NE
N.H.	CONCORD	33.4	−35	6.0	NW
N.J.	ATLANTIC CITY	41.6	− 7	10.6	NW
N.Y.	ALBANY	35.1	−24	7.9	S
	BUFFALO	34.7	−14	17.7	W
	NEW YORK	40.3	− 6	13.3	NW
N.M.	SANTA FE	38.0	−13	7.3	NE
N.C.	RALEIGH	49.7	− 2	7.3	SW
	WILMINGTON	53.1	5	8.9	SW
N.D.	BISMARK	24.5	−45		NW
	DEVIL'S LAKE	18.9	−44	11.4	W
OHIO	CLEVELAND	36.9	−17	14.5	SW
	COLUMBUS	39.9	−20	9.3	SW
OKLA.	OKLAHOMA CITY	48.0	−17	12.0	N
ORE.	BAKER	34.1	−20	6.0	SE
	PORTLAND	45.9	− 2	6.5	S
PA.	PHILADELPHIA	41.9	− 6	11.0	NW
	PITTSBURGH	40.8	−20	13.7	NW
R.I.	PROVIDENCE	37.6	− 9	14.6	NW
S.C.	CHARLESTON	56.9	7	11.0	N
	COLUMBIA	53.7	− 2	8.0	NE
S.D.	HURON	28.1	−43	11.5	NW
	RAPID CITY	32.3	−34	7.5	W
TENN.	KNOXVILLE	47.0	−16	6.5	SW
	MEMPHIS	50.9	− 9	9.6	NW
TEX.	EL PASO	53.0	− 2	10.5	NW
	FORTH WORTH	54.7	− 8	11.0	NW

TABLE 4

CLIMATIC CONDITIONS
COMPILED FROM U.S. WEATHER BUREAU RECORDS

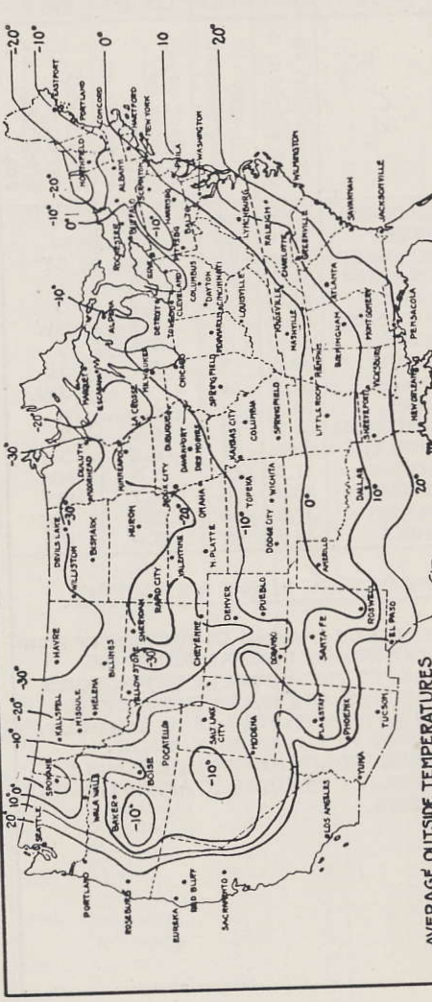
COL. A	COL. B	COL. C	COL. D	COL. E	COL. F
STATE	CITY	AVERAGE TEMP. OCT. 1ST – MAY 1ST	LOWEST TEMPERATURE	AVERAGE WIND VELOCITY DEC., JAN., FEB., MILES PER HR.	DIRECTION OF PREVALING WIND DEC., JAN., FEB.
TEX.	SAN ANTONIO	60.7	4	8.2	N
UTAH	MODENA	38.1	−24	8.9	W
	SALT LAKE CITY	40.0	−20	4.9	SE
VT.	BURLINGTON	29.3	−27	12.9	S
VA.	NORFOLK	49.1	2	9.0	N
	LYNCHBURG	45.2	− 7	5.2	NW
	RICHMOND	47.4	− 3	7.4	S
WASH.	SEATTLE	45.3	3	9.1	SE
	SPOKANE	37.5	−30		SW
W. VA.	ELKINS	38.8	−21	4.8	W
	PARKERSBURG	41.9	−27	6.6	S
WIS.	GREEN BAY	28.6	−36	12.8	SW
	LA CROSSE	31.2	−43	5.6	NW
	MILWAUKEE	33.0	−25	11.7	W
WYO.	SHERIDAN	31.0	−45	5.3	NW
	LANDER	28.9	−36	3.0	NE

EFFECT OF WIND VELOCITY.

THE VELOCITY AND DIRECTION OF WIND HAS A BEARING ON THE AMOUNT OF RADIATION TO BE INSTALLED. FACTORS FOR EXPOSURES ARE BASED ON ZERO WEATHER WITH AN AVERAGE WIND VELOCITY OF 10 TO 15 MILES PER HOUR.

DROP IN TEMPERATURE PER MILE WIND VELOCITY IS EQUAL TO APPROXIMATELY 1½ DEGREES.

TEMPERATURE CHART



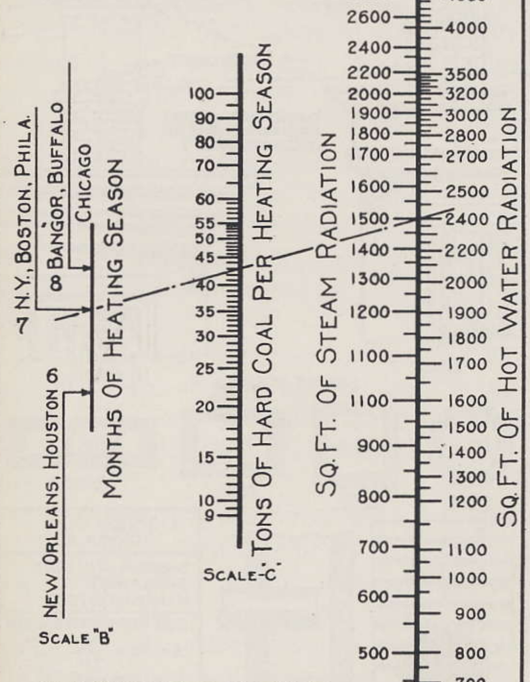
AVERAGE OUTSIDE TEMPERATURES AS USED BY ENGINEERS IN FIGURING RADIATION.
EXAMPLE — KNOXVILLE, TENN. USUALLY FIGURES 0° TO DESIRED INSIDE TEMP.
PORTLAND, ME. -10° TO DESIRED INSIDE TEMP.

COMPUTED FROM U.S. WEATHER BUREAU CHART.

LOW PRESSURE HEATING-FUEL CHART

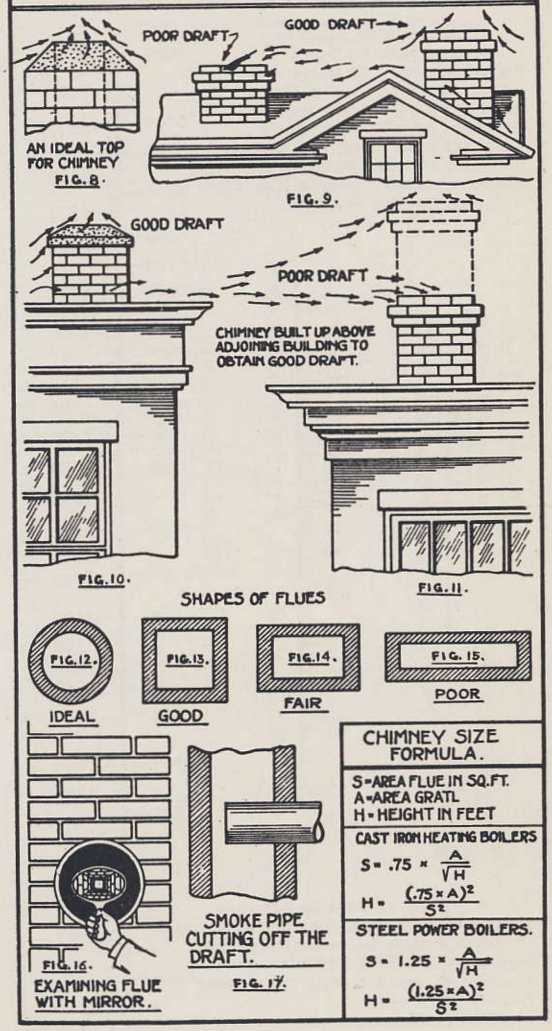
HOW TO USE CHART

SELECT POINT ON SCALE "A" SHOWING AMOUNT OF RADIATION INSTALLED & ON SCALE "B" SELECT POINT SHOWING CORRECT HEATING SEASON—FROM THE TWO POINTS SELECTED DRAW A LINE AND WHERE THIS LINE CROSSES SCALE "C" READ ESTIMATED NUMBER TONS OF HARD COAL REQUIRED FOR THE SEASON.



NOTE:—CHART IS BASED ON STEAM OR VAPOR RADIATION CONDENSING 1/4 LB. OF STEAM PER HOUR AND WATER RADIATION GIVING OFF 150 B.T.U. PER HOUR OR IT'S EQUIVALENT AND INCLUDES THE AVERAGE AMOUNT OF PIPING.

CHIMNEY DATA



Cleaning Chimneys

THE U. S. Fuel Administration has strongly advocated the use of salt. The fire should be put in good condition with a substantial body of hot fuel. Well dried common salt is then scattered over the incandescent fuel in quantity depending upon the size of the furnace. For a household furnace, a pound at a time is ample. The dampers should be kept open to maintain the furnace temperature until the fumes entirely disappear. This usually takes about half an hour. The soot is disintegrated by the action of the salt fumes. Repeat the application as necessary.

This method is highly endorsed for cleaning boiler tubes and furnace passages. It does not interfere with the operation of the plant and neither brickwork nor metal is deteriorated.

It is known that a layer of tarry soot 1/16 in. thick on boiler tubes or furnace passages will decrease their heating efficiency 20 per cent, hence the necessity of keeping them clean. It is claimed that an occasional use of salt as described will keep both heating apparatus and flue free from soot.

TABLE 5

Circumferences and Areas of Circles

Diameter	Circumference	Area	Diameter	Circumference	Area	Diameter	Circumference	Area
1/64	0.0491	0.0002	2	6.2832	3.1416	5	15.7080	19.635
1/32	0.0982	0.0008	1/16	6.4795	3.3410	1/16	15.9043	20.129
1/16	0.1964	0.0031	1/8	6.6759	3.5466	1/8	16.1007	20.629
3/32	0.2945	0.0069	3/16	6.8722	3.7583	3/16	16.2970	21.135
1/8	0.3927	0.0123	1/4	7.0686	3.9761	1/4	16.4934	21.648
5/32	0.4909	0.0192	5/16	7.2649	4.2000	5/16	16.6897	22.166
3/16	0.5890	0.0276	3/8	7.4613	4.4301	3/8	16.8861	22.691
7/32	0.6872	0.0376	7/16	7.6576	4.6664	7/16	17.0824	23.221
1/4	0.7854	0.0491	1/2	7.8540	4.9087	1/2	17.2788	23.758
9/32	0.8836	0.0621	9/16	8.0503	5.1572	9/16	17.4751	24.301
5/16	0.9817	0.0767	5/8	8.2467	5.4119	5/8	17.6715	24.850
11/32	1.0799	0.0928	11/16	8.4430	5.6727	11/16	17.8678	25.406
3/8	1.1781	0.1105	3/4	8.6394	5.9396	3/4	18.0642	25.967
13/32	1.2763	0.1296	13/16	8.8357	6.2126	13/16	18.2605	26.535
7/16	1.3745	0.1503	7/8	9.0321	6.4918	7/8	18.4569	27.109
15/32	1.4726	0.1726	15/16	9.2284	6.7771	15/16	18.6532	27.688
1/2	1.5708	0.1964	3	9.4248	7.0686	6	18.8496	28.274
17/32	1.6690	0.2217	1/16	9.6211	7.3662	1/8	19.2423	29.465
9/16	1.7672	0.2485	1/8	9.8175	7.6699	1/4	19.6350	30.680
19/32	1.8653	0.2769	3/16	10.0138	7.9798	3/8	20.0277	31.919
5/8	1.9635	0.3068	1/4	10.2102	8.2958	1/2	20.4204	33.183
21/32	2.0617	0.3382	5/16	10.4065	8.6179	5/8	20.8131	34.472
11/16	2.1598	0.3712	3/8	10.6029	8.9462	3/4	21.2058	35.785
23/32	2.2580	0.4057	7/16	10.7992	9.2806	7/8	21.5984	37.122
3/4	2.3562	0.4418	1/2	10.9956	9.6211	7	21.9911	38.485
25/32	2.4544	0.4794	9/16	11.1919	9.9678	1/8	22.3838	39.871
13/16	2.5525	0.5185	5/8	11.3883	10.321	1/4	22.7765	41.282
27/32	2.6507	0.5591	11/16	11.5846	10.680	3/8	23.1692	42.718
7/8	2.7489	0.6013	3/4	11.7810	11.045	1/2	23.5619	44.179
29/32	2.8471	0.6450	13/16	11.9773	11.416	5/8	23.9546	45.664
15/16	2.9452	0.6903	7/8	12.1737	11.793	3/4	24.3473	47.173
31/32	3.0434	0.7371	15/16	12.3700	12.177	7/8	24.7400	48.707
1	3.1416	0.7854	4	12.5664	12.566	8	25.1327	50.265
1/16	3.3379	0.8866	1/16	12.7627	12.962	1/8	25.5254	51.849
1/8	3.5343	0.9940	1/8	12.9591	13.364	1/4	25.9181	53.456
3/16	3.7306	1.1075	3/16	13.1554	13.772	3/8	26.3108	55.088
1/4	3.9270	1.2272	1/4	13.3518	14.186	1/2	26.7035	56.745
5/16	4.1233	1.3530	5/16	13.5481	14.607	5/8	27.0962	58.426
3/8	4.3197	1.4849	3/8	13.7445	15.033	3/4	27.4889	60.132
7/16	4.5160	1.6230	7/16	13.9408	15.466	7/8	27.8816	61.862
1/2	4.7124	1.7671	1/2	14.1372	15.904	9	28.2743	63.617
9/16	4.9087	1.9175	9/16	14.3335	16.349	1/8	28.6670	65.397
5/8	5.1051	2.0739	5/8	14.5299	16.800	1/4	29.0597	67.201
11/16	5.3014	2.2365	11/16	14.7262	17.257	3/8	29.4524	69.029
3/4	5.4978	2.4053	3/4	14.9226	17.721	1/2	29.8451	70.882
13/16	5.6941	2.5802	13/16	15.1189	18.190	5/8	30.2378	72.760
7/8	5.8905	2.7612	7/8	15.3153	18.665	3/4	30.6305	74.662
15/16	6.0868	2.9483	15/16	15.5116	19.147	7/8	31.0232	76.589

TABLE 6

Circumferences and Areas of Circles

Diameter	Circumference	Area	Diameter	Circumference	Area	Diameter	Circumference	Area
10	31.4159	78.540	16	50.2655	201.06	22	69.1150	380.13
1/8	31.8086	80.516	1/8	50.6582	204.22	1/8	69.5077	384.46
1/4	32.2013	82.516	1/4	51.0509	207.39	1/4	69.9004	388.82
3/8	32.5940	84.541	3/8	51.4436	210.60	3/8	70.2931	393.20
1/2	32.9867	86.590	1/2	51.8363	213.82	1/2	70.6858	397.61
5/8	33.3794	88.664	5/8	52.2290	217.08	5/8	71.0785	402.04
3/4	33.7721	90.763	3/4	52.6217	220.35	3/4	71.4712	406.49
7/8	34.1648	92.886	7/8	53.0144	223.65	7/8	71.8639	410.97
11	34.5575	95.033	17	53.4071	226.98	23	72.2566	415.48
1/8	34.9502	97.205	1/8	53.7998	230.33	1/8	72.6493	420.00
1/4	35.3429	99.402	1/4	54.1925	233.71	1/4	73.0420	424.56
3/8	35.7356	101.62	3/8	54.5852	237.10	3/8	73.4347	429.13
1/2	36.1283	103.87	1/2	54.9779	240.53	1/2	73.8274	433.74
5/8	36.5210	106.14	5/8	55.3706	243.98	5/8	74.2201	438.36
3/4	36.9137	108.43	3/4	55.7633	247.45	3/4	74.6128	443.01
7/8	37.3064	110.75	7/8	56.1560	250.95	7/8	75.0055	447.69
12	37.6991	113.10	18	56.5487	254.47	24	75.3982	452.39
1/8	38.0918	115.47	1/8	56.9414	258.02	1/8	75.7909	457.11
1/4	38.4845	117.86	1/4	57.3341	261.59	1/4	76.1836	461.86
3/8	38.8772	120.28	3/8	57.7268	265.18	3/8	76.5763	466.64
1/2	39.2699	122.72	1/2	58.1195	268.80	1/2	76.9690	471.44
5/8	39.6626	125.19	5/8	58.5122	272.45	5/8	77.3617	476.26
3/4	40.0553	127.68	3/4	58.9049	276.12	3/4	77.7544	481.11
7/8	40.4480	130.19	7/8	59.2976	279.81	7/8	78.1471	485.98
13	40.8407	132.73	19	59.6903	283.53	25	78.5398	490.87
1/8	41.2334	135.30	1/8	60.0830	287.27	1/8	78.9325	495.79
1/4	41.6261	137.89	1/4	60.4757	291.04	1/4	79.3252	500.74
3/8	42.0188	140.50	3/8	60.8684	294.83	3/8	79.7179	505.71
1/2	42.4115	143.14	1/2	61.2611	298.65	1/2	80.1106	510.71
5/8	42.8042	145.80	5/8	61.6538	302.49	5/8	80.5033	515.72
3/4	43.1969	148.49	3/4	62.0465	306.35	3/4	80.8960	520.77
7/8	43.5896	151.20	7/8	62.4392	310.24	7/8	81.2887	525.84
14	43.9823	153.94	20	62.8319	314.16	26	81.6814	530.93
1/8	44.3750	156.70	1/8	63.2246	318.10	1/8	82.0741	536.05
1/4	44.7677	159.48	1/4	63.6173	322.06	1/4	82.4668	541.19
3/8	45.1604	162.30	3/8	64.0100	326.05	3/8	82.8595	546.35
1/2	45.5531	165.13	1/2	64.4026	330.06	1/2	83.2522	551.55
5/8	45.9458	167.99	5/8	64.7953	334.10	5/8	83.6449	556.76
3/4	46.3385	170.87	3/4	65.1880	338.16	3/4	84.0376	562.00
7/8	46.7312	173.78	7/8	65.5807	342.25	7/8	84.4303	567.27
15	47.1239	176.71	21	65.9734	346.36	27	84.8230	572.56
1/8	47.5166	179.67	1/8	66.3661	350.50	1/8	85.2157	577.87
1/4	47.9093	182.65	1/4	66.7588	354.66	1/4	85.6084	583.21
3/8	48.3020	185.66	3/8	67.1515	358.84	3/8	86.0011	588.57
1/2	48.6947	188.69	1/2	67.5442	363.05	1/2	86.3938	593.96
5/8	49.0874	191.75	5/8	67.9369	367.28	5/8	86.7865	599.37
3/4	49.4801	194.83	3/4	68.3296	371.54	3/4	87.1792	604.81
7/8	49.8728	197.93	7/8	68.7223	375.83	7/8	87.5719	610.27

TABLE 7

PROPERTIES OF SATURATED STEAM

Vacuum in Ins. of Mercury or Gage Pres. in Lbs.	Absolute Pressure in Lbs. per Sq. In.	Temp. in Deg. Fahr.	Total Heat Above 32° Fahr. B.T.U. in the Water	Total Heat Above 32° Fahr. B.T.U. in the Steam	Latent Heat of Steam in B.T.U.	Volume in Cu. Ft. of 1 Lb. of Steam
27.88	1.	101.83	69.8	1104.4	1034.6	333.0
25.85	2.	126.15	94.0	1115.0	1021.0	173.5
23.81	3.	141.52	109.4	1121.6	1012.3	118.5
21.78	4.	153.01	120.9	1126.5	1005.7	90.5
19.74	5.	162.28	130.1	1130.5	1000.3	73.33
17.70	6.	170.06	137.9	1133.7	995.8	61.89
15.67	7.	176.85	144.7	1136.5	991.8	53.56
13.63	8.	182.86	150.8	1139.0	988.2	47.27
11.60	9.	188.27	156.2	1141.1	985.0	42.36
9.56	10.	193.22	161.1	1143.1	982.0	38.38
7.52	11.	197.75	165.7	1144.9	979.2	35.10
5.49	12.	201.96	169.9	1146.5	976.6	32.36
3.45	13.	205.87	173.8	1148.0	974.2	30.03
1.42	14.	209.55	177.5	1149.0	971.9	28.02
0.00	14.70	212.00	180.0	1150.4	970.4	26.79
0.3	15.	213.00	181.0	1150.7	969.7	26.27
1.3	16.	216.3	184.4	1152.0	967.6	24.79
2.3	17.	219.4	187.5	1153.1	965.6	23.38
3.3	18.	222.4	190.5	1154.2	963.7	22.16
4.3	19.	225.2	193.4	1155.2	961.8	21.07
5.3	20.	228.0	196.1	1156.2	960.0	20.08
6.3	21.	230.6	198.8	1157.1	958.3	19.18
7.3	22.	233.1	201.3	1158.0	956.7	18.37
8.3	23.	235.5	203.8	1158.8	955.1	17.62
9.3	24.	237.8	206.1	1159.6	953.5	16.93
10.3	25.	240.1	208.4	1160.4	952.0	16.30
15.3	30.	250.3	218.8	1163.9	945.1	13.74
20.3	35.	259.3	227.3	1166.8	938.9	11.89
25.3	40.	267.3	236.1	1169.4	933.3	10.49
31.3	46.	275.8	244.8	1172.0	927.2	9.20
35.3	50.	281.0	250.1	1173.6	923.5	8.51
41.3	56.	288.2	257.5	1175.7	918.2	7.65
45.3	60.	292.7	262.1	1177.0	914.9	7.17
51.3	66.	299.0	268.5	1178.8	910.2	6.56
61.3	76.	308.5	278.3	1181.4	903.0	5.74
71.3	86.	317.1	287.2	1183.6	896.4	5.10
81.3	96.	324.9	295.3	1185.6	890.3	4.60
90.3	105.	331.4	302.0	1187.2	885.2	4.23
100.3	115.	338.1	309.0	1188.8	879.8	3.88
125.3	140.	353.1	324.6	1192.2	867.6	3.219
140.3	155.	361.1	332.9	1194.0	861.0	2.920
150.3	165.	366.1	338.2	1195.0	856.8	2.753
165.3	180.	373.1	345.6	1196.4	850.8	2.533
175.3	190.	377.6	350.4	1197.3	846.9	2.406
200.3	215.	388.0	361.4	1199.2	837.9	2.138

TABLE 8

PIPE DATA

Nominal Size	Actual Outside Dia.	Area-Sq. In. Inside	Area-Sq. Ft. Inside	3600 x Area in Sq. Ft. for Computing Velocity	Lineal Ft. per Sq. Ft. of External Surface	Sq. Ft. of Heating Surface per Lineal Ft.	Gals of Water per 100 Ft. Length	Safe Velocity in Ft. per Second
1/8"	.41	.06			9.43		.3	
1/4	.54	.10			7.08		.5	
3/8	.68	.19			5.66		1.0	
1/2	.84	.30			4.55		1.6	
3/4	1.05	.53			3.64	.275	2.7	
1	1.32	.86	.006	21.60	2.90	.346	4.5	16
1 1/4	1.66	1.50	.010+	37.08	2.30	.434	7.7	20
1 1/2	1.90	2.04	.014-	50.04	2.01	.494	10.6	23
2	2.38	3.36	.023+	84.24	1.61	.622	17.4	29
2 1/2	2.88	4.78	.033+	119.52	1.33	.753	24.8	35
3	3.50	7.38	.051+	185.40	1.09	.916	38.4	40
3 1/2	4.00	9.89	.068+	246.60	.96	1.041	51.3	44
4	4.50	12.73	.088-	318.24	.85	1.175	66.1	49
4 1/2	5.00	15.96	.110	396.00	.76	1.316	82.9	55
5	5.56	19.99	.138	496.80	.69	1.455	103.8	58
6	6.63	28.89	.200	720.00	.58	1.739	150.0	66
7	7.63	38.74	.270	972.00	.50	2.000	202.0	75
8	8.63	50.02	.347	1249.20	.44	2.272	260.0	80
9	9.63	62.73	.435	1566.00	.40	2.500	326.0	90
10	10.75	78.82	.550	1980.00	.36	2.778	410.0	95

VELOCITY OF STEAM

To Find The Approximate Velocity Of Low Pressure Steam Multiply The Condensation In Pounds By The Volume In Cu. Ft. Corresponding To The Pressure, Which Gives Volume Of Steam Passing Thru The Pipe Per Hour. Dividing This Product By 3600 Times The Area Of The Pipe In Sq. Ft. Gives Velocity In Ft. Per Second.

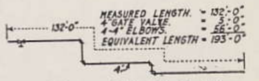
SAFETY VALVE SIZES. LOW PRESSURE BOILERS. A.S.M.E STD.

Up To 3.25 ɸ Grate	= 1 1/4"	12.51 To 17.75 ɸ Grate	= 3"
3.26 " 4.50 ɸ "	= 1 1/2"	17.76 " 24.00 ɸ "	= 3 1/2"
4.51 " 8.00 ɸ "	= 2"	Over 24 ɸ "	Use 2 Or More
8.01 " 12.50 ɸ "	= 2 1/2"		

TABLE 9. Length in feet of pipe to be added tc actual length of run to obtain equivalent length.

Size of Pipe	St'd. Elbow	Side Outlet Tee	Gate Valve	Globe Valve	Angle Valve
	Length in Feet to be Added in Run				
2"	5	16	2	18	9
2½"	7	20	3	25	12
3"	10	26	3	33	16
3½"	12	31	4	39	19
4"	14	35	5	45	22
5"	18	44	7	57	28
6"	22	50	9	70	32
7"	26	55	10	82	37
8"	31	63	12	94	42
9"	35	69	13	105	47
10"	39	76	15	118	52
12"	47	90	18	140	63
14"	53	105	20	160	72

Example of length in feet of pipe to be added to actual length of run.



Effect of Reaming Pipe—TABLE 10

	Per Cent Decrease in Capacity
Reamed Entrances	0.0
Rounded "	3.2
Squared "	10.1
Three Wheel Cutter	22.2
Single Wheel "	28.7

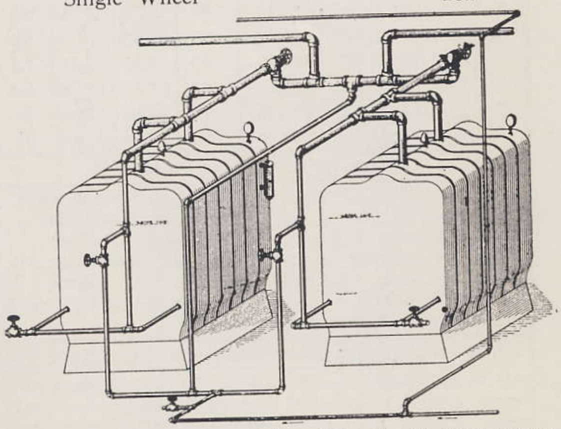


FIG. 18. Connecting Two Boilers Using the Hartford Return Loop

Heating Water

Since 1 B.T.U. will raise 1 lb. of water 1 degree, and since 1 U. S. gal. of water weighs 8.345 lbs., then 8.345 B.T.U. is required to raise 1 gal. of water 1 degree. It is customary to heat ⅓ the total capacity of a storage tank 100 degrees per hour. Therefore, a 100 gal. tank would require 34 x 8.345 x 100 equals 28,373 B.T.U. per hour, or, dividing this by 240 B.T.U., a boiler capable of supplying 120 sq. ft. of cast-iron radiation.

TABLE 11

Size of Drills for Pipe Taps

Pipe tap size	Drill size
⅛"	21/64"
¼"	29/64"
⅜"	19/32"
½"	23/32"
¾"	15/16"
1"	1 3/16"
1¼"	1 15/32"
1½"	1 23/32"
2"	2 3/16"
2½"	2⅝"
3"	3¼"
3½"	3¾"
4"	4½"

TO CLEAN BOILERS acid vinegar is recommended; 3 gallons for boilers up to 1,000 sq. ft. capacity and an additional gallon for each additional 1,000 sq. ft. The plant should be operated at least 30 hours and then blown off top and bottom thoroughly.

THE HARTFORD RETURN LOOP shown opposite in Fig. 18 is a most excellent method of connecting the return to the boiler where either one or two boilers are used. It eliminates the use of check valves which oftentimes stick and insures the boilers against loss of water through the return and consequent cracking.

When only one boiler is used the loop consists of an equalizing pipe running from the steam header or main to the return tapping in the boiler. The return is then connected into the equalizing pipe at the waterline. *We strongly advise the use of this loop with every boiler installation.*

Table 12. PIPE SIZES—FOR THE GORTON SYSTEM

Capacity in Sq. Ft. of Radiation

	With steam and water flowing in the same direction, as in mains and branches that are *dripped*	With steam and water flowing in opposite direction, as in branches *not dripped* and upfeed risers	Branches to Radiators: 5 ft. in length or less	Branches to Radiators: 5 ft. to 10 ft. in length	Wet Return Main	Dry Return Main, Grade in inches: Vertical or 1 in. in 5 ft.	Dry Return Main, Grade in inches: 1 in in 10 ft.	Dry Return Main, Grade in inches: 1 in. in 20 ft.	GORTON Radiator Valve Sizes	Ordinary Radiator Valve Sizes	Drips for Risers: Riser Size	Drips for Risers: Drip Size to Returns
½"									12		1"	¾"
¾"									25		1¼"	¾"
1"	30	30	25						60	24	1½"	1"
1¼"	70	60	60	25	1000	700	450	375	100	60	2"	1"
1½"	125	90	100	60	2500	1300	800	600	200	100	2½"	1¼"
2"	200	150	200	100	5000	2500	1800	1200		200	3"	1¼"
2½"	400	200		200	9000	4500	3000	2000			3½"	1½"
3"	700	320			17000	8000	6000	4000			4"	1½"
3½"	1200	430			25000		9000	6000				
4"	1600	550			35000		12000	9000				
4½"	2500											
5"	3200											
6"	5500											
7"	8400											
8"	12,000											
10"	20,000											
12"	32,000											

Note: See detail page 28 for all drip construction.

TABLE 13—Slope 6 Inches in Ten Feet

Nominal Size	Actual Size	Actual Area	Lbs. Per Minute	Volume in Cu. Feet Per Minute	Velocity Feet Per Minute	B T U Per Minute
Velocity in ¾ inch pipe, using 1 inch valve						
¾ inch	13-16 in.	.5184	.1687	3.80	1052.	164.
Velocity in ¾ inch valve fed by ¾ inch pipe						
¾ inch	¾ -in.	.44	.1448	3.26	1056.	141.
Velocity in ¾ inch valve fed by 1 inch pipe						
¾ inch	¾ -in.	.44	.1687	3.78	1231.	164.
Velocity in ¾ inch orifice set in 1 inch pipe						
¾ inch	-.781 in.	.48	.200	4.5	1350.	194.5

The first line in table 13 shows the capacity of a ¾" pipe using a 1" valve. The third line shows the capacity of a ¾" valve fed by a 1" pipe. The first and third line capacities are the same even with conditions reversed; while the last line shows the capacity of a ¾" orifice in a 1" pipe to be more efficient than either.

It is our contention that the Gorton Valve can be compared most nearly with the last line since the Gorton Valve and the orifice are alike in that there is no obstruction in the path of the incoming steam and outgoing water.

In a test of this kind a ¾" Gorton Valve fed by a 1" pipe would probably deliver about 180 B. T. U. per min. as against 194.5 for the orifice.

This delivery of 180 B. T. U. per min. by the Gorton Valve is considerably more than either conditions in lines one and three and far more than line two.

Note: The Graph (Fig. 1) must be kept in mind when calculating capacities for practical work.

TABLE 14—Critical Velocity in Pipe. Slope 6 Inches in Ten Feet

Nominal Size	Actual Size	Actual Area	Lbs. Per Minute	Volume in Cu. Feet Per Minute	Velocity Feet Per Minute	B. T. U Per Minute
¾ inch	13-16 in.	.5184	.1687	3.80	1052.	164
1 inch	1 3-64 in	860	4000	9 02	1505.	389
1¼ inch	1 3-8 in.	1.485	.7500	16.88	1640.	730.
1½ inch	1 39-64 in.	2.04	1.025	23 10	1630.	1000.
2 inch	2 1-16 in.	3.341	1.568	35.3	1520.	1519.

* Using a valve one size larger than pipe

TABLE 15

Slope 1½ Inches in 10 Feet or More.

Standard Pipe With the Same Size Valve	Maximum B. T. U Per Minute	Standard Pipe With One Size Larger Valve	Maximum B. T. U Per Minute	Gain By Larger Valve
¾"	136	¾"	164	20.6%
1 "	330	1 "	389	17.9%
1¼"	575	1¼"	730	27.0%*
1½"	836	1½"	1000	19.6%
2 "	1485	2" pipe	1519	2.3%
"		no valve		

TABLE 16

Comparison of Effect of Slope on Capacity of 1¼ Inch Pipe

Slope in 10 Feet	Maximum B. T. U. Per Min.
½ inch	448
1½ inch	575
6 inch	566
12 inch	584
Vertical	528