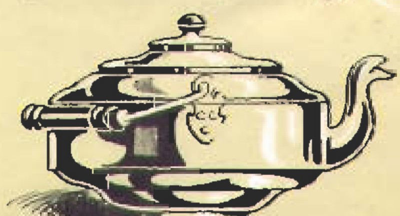
MOLINE SYSTEM OF HEATING

HEATING
by the MOLINE SYSTEM

A system of noiseless heating by vapor, designed to operate naturally without pumps, traps, or automatic radiator valves. Requires as little attention and has far greater efficiency than any hot water system.



There is no more pressure in the MOLINE SYSTEM than there is in your teakettle

MOLINE VACUUM VAPOR HEATING COMPANY.
MOLINE ILLINOIS.

DESIGNED AND EXECUTED BY THE CRAMER-KRASSELT CO., CHICAGO-MILWAUKEE

Introduction and Guarantee

The Moline System of circulation and all Moline Apparatus is absolutely guaranteed.

We do not manufacture or sell boilers, radiators, pipe or fittings and have no interest in any concerns that do. We do not figure or contract for the installation of heating plants.

Neither are we architects, and assume none of the architect's duties or responsibility for the proper arrangement, superintendency or installation.

This heating proposition is a co-operative one.

The owner needs the architect's and contractor's services as much as he needs ours. In most buildings an architect's services are required to harmonize the placing of the radiators with the ultimate purpose of the various rooms. Then the piping must be properly designed to supply the radiators.

We manufacture and sell Specialties and Valves to be used in connection with

The Moline System of Vacuum-Vapor Heating

of which we are the patentees and sole owners in the United States and Foreign Countries.

We design complete heating plants, furnishing working plans and specifications and co-operate with contractors, solely to insure the perfect operation of our product.

There are so many vital factors in the successful operation of heating apparatus which the designer cannot control, that our guarantee is necessarily limited to our own manufactured product and the operation of the Moline System of circulation.

No system ever brought forth or that ever will be invented will in itself make up any lack of capacity in boiler, piping or radiating surfaces or poor workmanship in erection.

To render every possible assistance to owners to secure the heating results they pay for, we design Moline Systems. All this must be considered in connection with our guarantee.

No customer who has used our judgment has ever had occasion to regret it.

Our record is open for inspection.

Results are what count.

We have delivered them for years in thousands of installations all over the United States and Canada.

This fact makes a stronger appeal to experienced buyers than the longest guarantee that can be written.

Moline Systems are Better than Ordinary Steam Heating

Moline Systems are noiseless.

Moline Systems have no air valves on the radiators to leak, sputter or require frequent expert attention.

The radiators on Moline Systems can be regulated at will by adjusting the supply valve.

Moline radiator supply valves are smaller than ordinary steam radiator valves, and are set at the tops of the radiators, where they are easy to handle.

Moline Systems heat quicker than ordinary steam heating.

Before ordinary steam radiators will heat, the air must be expelled through a tiny pin hole in the air valve on each radiator. This requires energy. **The air discharge opening in Moline Systems is so large that to expel the air requires no more pressure than to boil water in a tea kettle.**

Ordinary steam radiators cool as soon as there is no pressure at the boiler. **Moline System radiators heat long after the pressure drops.**

Ordinary steam radiators must either be all hot or all cold—there is no intermediate state. The atmosphere of steam heated rooms has a disagreeable harsh feel.

Moline Systems are more responsive than either hot water or steam systems and as low temperatures can be carried in Moline System radiators as in hot water radiators. The atmosphere of Moline System rooms is more pleasant than in steam heated rooms.

Moline Systems are Better than Hot Water

If radiation is figured on the proper basis, 60 per cent more will be required to do the same work with a hot water system than with the Moline System.

Moline Systems heat quicker than hot water. They are as speedy as hot air. Each radiator on a Moline System can be regulated at your pleasure. You don't have to wait all morning for the radiator to heat up, nor all afternoon for it to cool. They are more responsive.

The heat from Moline Systems can be better controlled from the fire than the best hot water job. In the early fall and late spring buildings can be quickly warmed without overheating them.

Changes can be made in the heating plant, radiators moved, etc., during building alterations without the necessity of draining a ton or two of water.

Moline Radiators do not require as much space as hot water radiators.

A hot water job in a two-story residence has at least 12 lbs. pressure on the boiler, due to the weight of the water. If a heat generator or similar device is used, 10 lbs. more pressure is carried on the boiler. The Moline System delivers heat with practically no pressure.

Moline Systems save fuel, because **they permit quick regulation of the delivery** of heat from **the radiators** to suit weather requirements, in the simplest, **easiest manner.**

A Moline System will deliver more heat with less fuel than a hot water job. When you know that at least 10 lbs. of water must be circulated over each square foot of radiation every hour, you will appreciate one of the reasons why Moline Systems save fuel.

Any radiator in a Moline System can be shut off without danger from freezing.

Moline Systems are better than hot water heating in every way.

Why the Moline System is Superior to All Others

Moline Systems have no automatic return valves or retarders on the radiators. Such apparatus causes no end of trouble, is high in first cost and very expensive to maintain in repair.

Moline Systems are designed to operate without pressure, but pressure may be carried in the radiators if it is desired to do so. If pressure is carried on any purely vapor heating system, steam is wasted into the atmosphere or chimney.

Moline Systems have the radiators as open to the atmosphere as any vapor system, but it is impossible to waste steam through this opening, because the opening is protected with a Moline air trap that won't let the steam escape.

Some vacuum systems expel the air from the radiators through pin holes in valves or retarders on the radiators. Much energy is required to do this. **Moline Systems are two pipe systems, not a one pipe steam appliance with an air line hooked on to the radiators.** The air and water are freely and noiselessly carried away from Moline System radiators by the return line.

No pumps are used with the Moline System. The cost of operating pumps is known only by those who have paid the bills for running them. **Moline Systems save this cost and perform more and better work than any pump.**

Radiators on any vapor system cool immediately when there is no pressure at the boiler. The Moline System radiators stay hot long after pressure drops in boiler, because the Moline Vacuum Valve keeps the air out of the System.

Drexel Apartments, Philadelphia, Pa.

Owner and Contractor Pleased

Philadelphia, Pa., May 2, 1911.
Moline Vacuum Vapor Heating Co.,
Moline, Ill.

Gentlemen: We installed a Moline System of Heating in the Drexel Apartments at Overbrook, Philadelphia, in the latter part of the winter of 1909, and it has proven entirely satisfactory.

It has never been necessary to carry pressure; in fact, the job is generally running on 10 inches of vacuum.

The owner is very well pleased and will forward you a testimonial.

Yours very truly,
WEST END HEATING & ENGINEERING CO.,
Per Jos. W. Breen.

Gets a Surprise

Dubuque, Iowa, Jan. 11, 1911.
Reilihan & Mullen, Dubuque, Iowa.

Gentlemen: I at first questioned your statements relative to heating my apartment building of 3,200 square feet radiation with less than a pound of pressure, but I find in operating the plant that you are entirely right about it.

To date we have used about 50 tons of Pocahontas coal and at this rate the coal consumption will be entirely within my expectations.

Respectfully yours,
OTTO M. SCHMID,
Schmid Manufacturing Co.

Schmid Apartment Buildings, Dubuque, Iowa

Home of E. C. Matthews, Moose Jaw, Sask.

Canadians Know What "Weather" is

Moose Jaw, Sask., Feb. 1, 1912.

The Moose Jaw Hardware Co., Ltd.,
Moose Jaw, Sask.

Gentlemen: I have much pleasure saying that since you installed the Moline system of Heating in my home I have had excellent satisfaction and have much pleasure recommending same to any person wanting a good system of heating.

EDW. C. MATHEWS.

Cuts Fuel Bill in Half

Cottonwood Falls, Kas., Aug. 31, 1909.

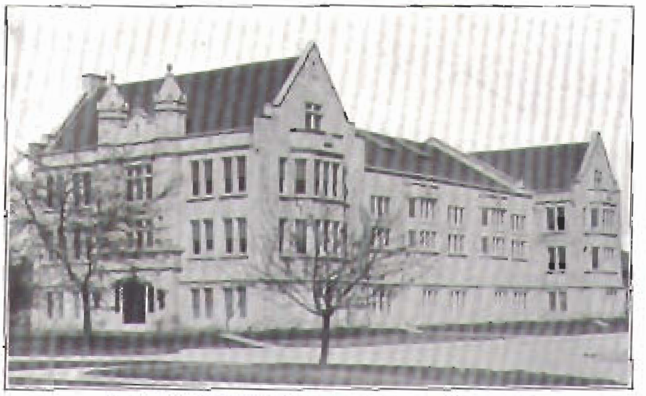
Burnap Bros., Emporia, Kas.

Gentlemen: The Moline Vacuum Vapor Heating System installed by you in the Chase County Court House is giving entire satisfaction; heating all the rooms and corridors in the coldest weather evenly; our fuel bill for last winter was less than half of the winter before, when we were using the individual stoves for each office.

It is very rapid, our offices being comfortable by 6:30 in the morning.

Yours truly,
W. B. PENNY, County Clerk.

Chase County Court House, Cottonwood Falls, Kas.



Bradley Polytechnic Institute (Gymnasium) Peoria, Ill.

Solves Engineering Problem

Peoria, Ill., March 25, 1911.

Mr. J. M. Robb.

Dear Sir: The MOLINE SYSTEM in the new gymnasium building at Bradley Institute has given good satisfaction.

Our engineering department vouches that this building will clear itself of air, although 500 feet away, from 20 to 25 minutes sooner than Bradley Hall, which contains the heating plant.

This system has solved a great question for our heating department.

Very truly yours,

(Signed) G. R. MacCLYMENT.
Office Bradley Polytechnic Institute,
419 Observatory Building.

Cuts Fuel Bill—Stops Irritating Noises

Moose Jaw, Sask., Feb. 1, 1912.

The Moose Jaw Hardware Co., Ltd.,
Moose Jaw, Sask.

Dear Sirs: The Moline System in two of our blocks has given good satisfaction. It takes less coal than the old steam system. It has also eliminated all irritating noises.

During the extreme cold weather of the past month our new block has been comfortably heated although the storm windows have not been placed on the block.

J. W. GRAYSON.

J. W. Grayson's New Block, Moose Jaw, Sask.

The Moline System Briefly Explained

Vapor heating is heat furnished from the vapor of heated water where the pressure is measured in ounces as compared with pounds in ordinary steam heating.

In Moline Systems there is no more pressure generated than by a teakettle. Compare this with the pressure of fifteen pounds or more that is always on the boiler of a hot water heating job due to the weight of the water.

Vapor heating is not new. Forty years ago vapor systems were in use in the United States and the European engineers use practically no other method of heating their important buildings.

A Combination System

The Moline Vacuum-Vapor System is **vapor heating** with a vacuum attachment. This means that in it are combined *all* the advantages of ordinary *steam-heating*, vapor-heating, vacuum-heating and hot-water heating. With the Moline System the radiators heat far quicker than with ordinary steam or hot water and retain their heat when the radiators on the ordinary steam job or vapor job are stone cold.

Moline Systems consist of any good steam boiler, equipped with a good, sensitive damper regulator, with a double system of piping to carry the vapor to the radiators and the water and air away from them, together with Moline special radiator supply and return valves on the radiators to give positive control of their heat delivery and Moline air trap and vacuum valve to quickly discharge air from the piping and radiators and to keep it out.

In addition to all this there are many little devices and methods that Moline engineers have discovered in their practice of planning thousands of successful heating jobs, that improve the Moline System to a point where it does its work as naturally and easily as the sun shines and the rain falls. The strongest feature about the Moline System and the one that should most appeal to the prospective purchaser is the entire absence of complicated apparatus.

A Moline System once installed is done forever. There is nothing to wear out, requiring expensive repairs, and there is no chance for noise or drips or leaks of any description.

The only opening on a Moline System is on the air trap usually installed at the basement ceiling.

The air trap does its work so efficiently that there is a rare possibility of its ever leaking, but even if by some remote chance this should occur no damage could result.

The Moline System is a source of wonder to experienced heating engineers, because of its simplicity and its highly efficient operation.

In the following pages a short description of its operation and the functions of its principal parts is given.

Equipment Described in Detail

Boiler

The kind of fuel to be used determines the type of boiler to be selected.

Any good steam boiler can be used with a Moline System. Some boilers are better than others and prospective purchasers of heating apparatus will save money by using the experience we have gained through observing the operation of hundreds of heating jobs, in selecting the boiler best fitted for their needs. We have no boilers to sell nor any connection with any boiler manufacturer. Our only aim is to design heating systems that will satisfy the purchasers, so you can count on disinterested advice. The boiler capacity is as important, too, as the type of boiler, and we are especially fitted to advise the proper size boiler to use.

Piping

As stated, the two pipe method is used with Moline Systems.

One pipe carries the vapor from the boiler to the radiators, and the other takes the air and water from the radiators, returning the water to the boiler and discharging the air from the radiators to the condenser.

The question of designing the piping is most important.

In Moline Systems, skilled engineers lay out the piping after a careful study of all the conditions to be met on the building to be heated. An accurate plan is then made to guide the man installing the work. On this plan, the size and pitch of every pipe is given. **Don't you think this method of planning heating work is an improvement on the hit or miss plan followed by the average mechanic?**

We know that Moline plans save enough for purchasers of heating apparatus to be worth to them all the cost of all the Moline apparatus used to heat their buildings.

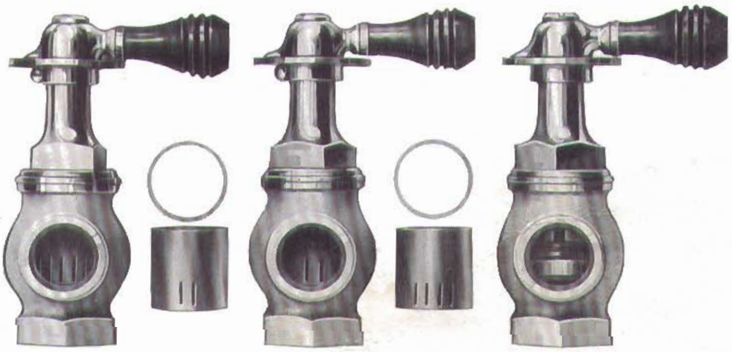
Radiators

Hot water radiators are used on all new Moline Systems. Hundreds of old steam jobs have, however, been remodeled into successful Moline Systems, and on these the old steam radiators have been used.

The question of the amount of radiation to use and where to place it to do the most effective work is a matter requiring nice judgment. No rule taken from a book can be relied upon. Moline engineers are trained by long experience to properly proportion radiation. Their judgment can be relied upon with the assurance that the desire to land a contract will not tempt them to figure it short. Hot water radiators are best for Moline Systems because the vapor is admitted to them at the top; cooling, it condenses to water, which drips down the walls of the radiator and gives up all its heat through them. This means as low temperature in the radiators as can be secured with hot water heating. Low radiator temperature means pleasant room atmosphere. It is pleasanter than the atmosphere of a building heated by any other method.

With hot water radiators, the supply valve is placed at the top. This makes it most convenient to operate.

Radiator Valves



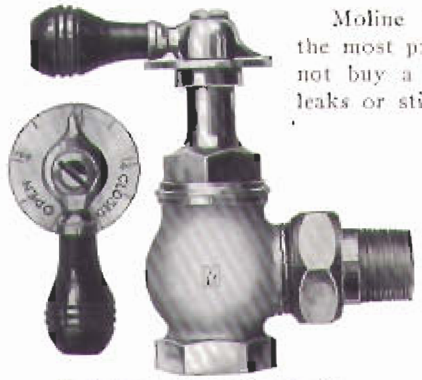
Supply Valves

The supply valves used with Moline Systems are but half the size used on ordinary steam or hot water systems. This makes them so easy to operate that a small child can manipulate them.

A patented restrictor sleeve is used in the radiator supply valves of Moline Systems to equalize the distribution of heat to the various radiators.

Proper distribution of steam to the radiators, at low pressure, is most essential to economy and even heating. It has taken many years of careful experimenting to determine this, and the Moline patented restrictor sleeves are the outcome of this experience. Complete instructions are given on Moline plans to guide the mechanics in applying these restrictor sleeves.

The supply valves used on Moline Systems never leak and require no packing. They have lever handles and graduating indicator dial.

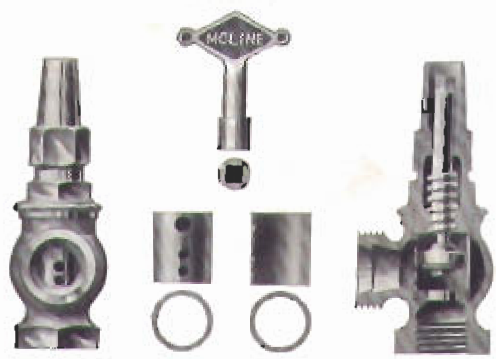


Packless Graduated Supply Valve

Moline Valves have Jenkins' discs, the most practical valve for steam. Do not buy a plug type valve that either leaks or sticks.

The return valves used with Moline Systems are one-half inch valves, fitted with patented sleeves to permit the removal of water and air from the radiator, and to prevent the escape of an excessive amount of steam into the return lines.

The return valves are fitted with keys so that any radiator may be cut off from the system when necessary. The air vent



Return Valves

openings on the radiators of Moline Systems of heating are plugged permanently.

There are no **automatic** valves or apparatus of any description on the radiators of Moline Systems.

Ejector

The removal of air from Moline Systems is effected by the combined operation of the Moline ejector, condenser and air trap.

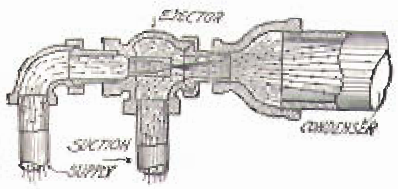
The ejector is really a steam jet pump, but it has no moving parts, nor anything to wear out. It is set at the end of the main steam pipe. When the system is cold and being heated up the ejector provides an immense opening at the end of the steam main that permits the air in it to flow out without friction. When the main is freed from air, steam passes through the ejector. Now, steam passing through an opening under the conditions that prevail in a Moline Ejector travels at a velocity of many hundred feet per second. The peculiar construction of the Moline Ejector utilizes this tremendous velocity to make a suction or pull on the air line. This drops the pressure in the return line and promotes a positive flow of vapor to all the radiators.

Please bear in mind that the pump action produced by the Moline Ejector is secured without the use of energy from any source, outside of the heating system itself.

Condenser

Note the simplicity of the Moline Ejector. It exhausts the air from the piping and radiators freely, quickly and without the loss of any energy.

The Moline condenser condenses the steam from the ejector and so utilizes the heat from this steam.



The condenser can be placed where this heat can be utilized to good advantage. In most cases a pipe coil hung on the basement ceiling is used for a condenser.

The condenser serves another purpose, that is, to store the air that leaks into the piping and radiators during the vacuum periods or times when the pressure in the system is less than the atmosphere. The air remains stored in the condenser until enough pressure is raised to expel it through its air trap.

The Moline Air Trap

Vacuum Valve

Air Trap

The function of the Moline air trap is to discharge the air from the piping and radiators without friction and to prevent the escape of steam.

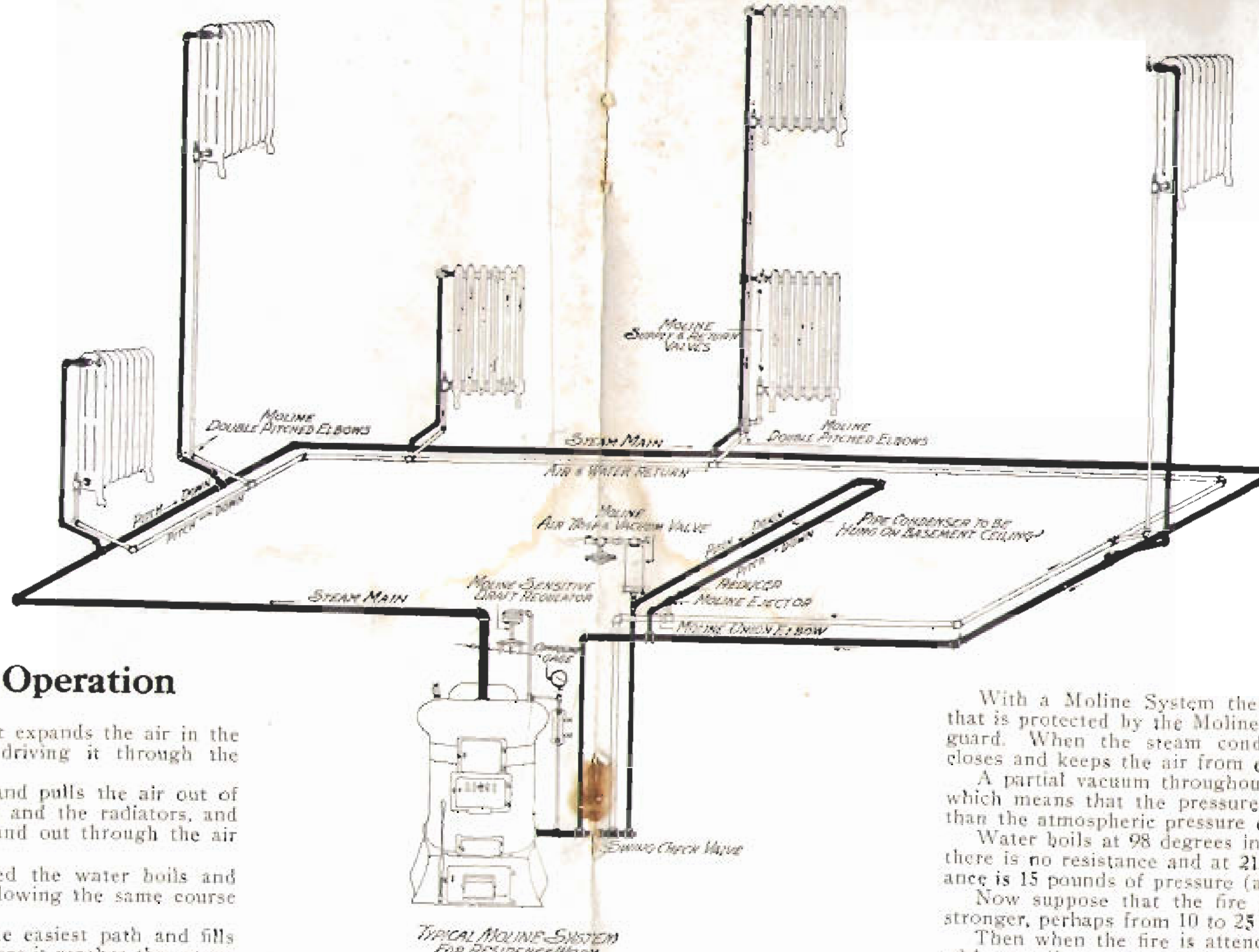
It is simply a big heat valve. The opening through it for the air to escape is many hundred times the combined area of all the pin holes in the automatic air valves on the ordinary steam job. This is one reason why air leaves a Moline System with so little friction that starting with a cold system, the air can all be expelled from the piping and radiators without any pressure showing on the boiler gauge. The Moline air trap is the most efficient device of its kind that has ever been built. Its operating principle is the expansion and contraction of a small quantity of air contained in an open bottomed float. There are no expansion posts or volatile liquids confined in sealed chambers under enormous pressure. Moline air traps are properly designed, have been used years enough to demonstrate that the principle underlying them is correct, and are built to wear forever.

Moline air traps will operate after ten years of service as efficiently as the day they were installed.

The combined action of the Moline ejector, condenser and air trap on a Moline System will give better heating results than does the most elaborate vacuum pump that can be built. It does it, too, without any expense for energy or for maintenance.

Moline Vacuum Valve

The Moline vacuum-valve seals the piping and radiators against the return of the air expelled by the ejector, condenser and air trap. It is the only apparatus of its kind on the market.



TYPICAL MOLINE SYSTEM FOR RESIDENCE WORK

Moline System Operation

When a fire is started the heat expands the air in the supply pipes (shown in black) driving it through the ejector.

The ejector causes a suction and pulls the air out of the return lines (shown in white) and the radiators, and discharges it into the condenser and out through the air trap and vacuum valve.

Before all the air is discharged the water boils and steam is generated; the steam following the same course as the air before it.

The steam naturally follows the easiest path and fills the supply mains and radiators before it reaches the return lines.

When all of the radiators are heated through, any surplus steam that may be generated fills the condenser.

The air trap remains open while air is passing out, but it closes the moment steam comes in contact with it.

The entire system is now filled with steam.

The next event which takes place is the condensing of the steam in the radiators as they cool.

Steam which occupies an entire radiator, is condensed into water which occupies about a thimble full, and when this condensing action takes place air is either pulled into a radiator or a partial vacuum is produced.

With a straight steam system the air would be pulled in through the automatic air vents.

With a Moline System there is only one outlet, and that is protected by the Moline Vacuum Valve, always on guard. When the steam condenses the Vacuum Valve closes and keeps the air from entering at that point.

A partial vacuum throughout the system is the result, which means that the pressure within the system is less than the atmospheric pressure on the outside.

Water boils at 98 degrees in a perfect vacuum because there is no resistance and at 212 degrees when the resistance is 15 pounds of pressure (absolute).

Now suppose that the fire gets low and the vacuum stronger, perhaps from 10 to 25 inches.

Then when the fire is attended to it will be seen that with very little atmospheric pressure there is little resistance and the vapor or steam is distributed almost immediately.

Remember, however, that vacuum is not heat. You couldn't heat a building with it in a thousand years.

Vacuum is pressure, lower than the pressure in the atmosphere and these natural laws are taken advantage of. That's all, but it means rapid circulation, fuel economy, etc. A more complete explanation is given on the following pages.

Construction of Moline Systems

Study the center page diagram. This illustrates a typical Moline System. The pipe that leads from the top of the boiler and carries the vapor to the various radiators is called the steam main.

The pipe that removes the air and water from the radiators is called the air main.

The pipe coil that is run at the end of the steam main is the condenser. The ejector is shown at the supply of the condenser with pipes leading to it from the steam and air mains. The condenser terminates at the Air Trap (which is usually set between the joists on the basement ceiling), and a drip pipe carries the water from the condenser back to the boiler.

Pipes are run from the ends of the steam and air mains back to the boiler, to carry all the water from these pipes to the boiler. No water enters the condenser coil except that which results from the condensing of the steam used by the ejector. This water, together with the air from the piping and radiators flows back to the air traps, where the air is discharged from the system and the water is returned to the boiler.

Observe that there is no waste of water or steam and that the removal of air is simple, natural and positive. Also the only automatic part of the Moline System is protected in the fullest possible manner from dirt getting into it from the piping and radiators.

The easiest and cheapest method known to remove air from piping and radiators is to fill them with steam.

Where a full free opening to the atmosphere is provided, as is done with the Moline System, this operation is as simple as boiling water in a kettle. Just a little reflection is needed to show any intelligent person the great waste of energy that occurs where a pump is used to bring about this same result. Pumping the air out of a heating system is like making water run up hill. It is too expensive an operation to be attempted except when absolutely necessary.

When a fire is built in the boiler of a Moline System, the heat first expands the air in the steam space of the boiler. The increased volume so caused escapes from the piping and radiators through the ejector, condenser, and air trap.

The quantity of water contained in the boiler is so small that it soon boils and the vapor follows the path of the air.

Reaching the ejector, the vapor flows through it with tremendous velocity, drawing along the air from the air main. This action drops the pressure in the radiators, promoting a more rapid flow of vapor into them from the steam main.

This action goes on till all the radiators are quickly heated. As the radiators heat thoroughly, a small quantity of vapor passes through the ports in the return valves and on to the condenser, heating it thoroughly also.

When the condenser becomes hot the vapor travels on to the air trap. When it reaches the air trap, however, it expands the small volume of air confined in the trap float, closing off the trap so no vapor can escape.

All the radiators are now hot. While Moline Systems are so designed that pressure, as understood in ordinary steam heating, need not be carried on the radiators, yet if desired, pressure can be carried on them.

The whole operation of heating up the radiators is so speedy that heat can be furnished as quickly as with a hot air furnace.

In moderate weather the radiators need not be entirely heated. As a matter of fact, there are many Moline Systems in use where the radiators are not heated through more than once or twice a winter, yet sufficient heat is furnished to maintain the premises heated to a very comfortable, even temperature.

As the heat of the fire decreases, the quantity of vapor made diminishes until there is not enough to keep the radiators and pipes filled.

At this point with ordinary steam heating the automatic air valves open and the air expelled through the tiny pin holes after so much time and effort, rushes back at a far greater velocity than it was driven out.

Moline Systems operate differently. When the air trap cools and opens up, the vacuum valve closes tight and prevents return of air. The result is that the radiators go on heating, but the temperature gradually drops in them, just as it does in the well designed hot water job when the fire is burning low.

This condition in the Moline System is the vacuum period. Vacuum as used here simply means that the pressure in the piping and radiators is below that of the atmosphere, so that if an opening existed anywhere in them, instead of any outward leakage, the air would rush back into the space formerly filled by the vapor.

There is more misunderstanding about vacuum heating than about all the other phases of the heating problem combined.

The layman and the majority of heating contractors, too, for that matter, believe that a pump applied to a heating job and worked vigorously will perform miracles.

Only a man who has paid the bills for a vacuum so produced can appreciate its cost, and only those who have learned by sad experience know the slight value of the vacuum so produced.

When the average man discovers that water boils in a perfect vacuum at 98 degrees, his imagination immediately suggests the tremendous economy of distributing vapor at low temperatures in a heating job, just as the hot water heating man is enthused by the discovery that hot water can be circulated at a temperature of 220 or more. The vacuum feature of any heating system is not its most valuable feature. We know it, for we have paid the price only by which such knowledge can be acquired, and our effort is to save you the great cost of similar experience.

Do not imagine that because the Moline System is so simple that its value is decreased.

Engineers and trained scientists in every line of effort are striving for simplicity. The cost of effort so expended is incalculable, but it is a mere fraction of the savings that are constantly being made by simplifying methods and appliances.

When you buy a Moline System you buy the results of years of work at simplifying heating methods, and get the best heating system that is on the market today.

We Make Special Plans for Each Moline Job

Co-operative Engineering Services to Increase Efficiency of Our Systems

Perfection in heating buildings cannot be reached without careful installation. Heating jobs cannot be correctly installed unless they are carefully planned.

Every Moline Heating System is carefully planned by competent engineers after a thorough study of all the conditions affecting the heating of the building under consideration.

The experience gained from the designing of thousands of heating systems and from the operation of the heating jobs so designed is embodied in every set of Moline System plans.

No contractor, no matter how careful and competent, could possibly acquire the experience we have had in planning successful heating systems.

We are not architects nor heating contractors, but design complete heating plans and specifications and co-operate with the owner, architect and contractor solely to insure the proper operation of our product.

We are heating specialists and have been years in practicing this phase of the building business.

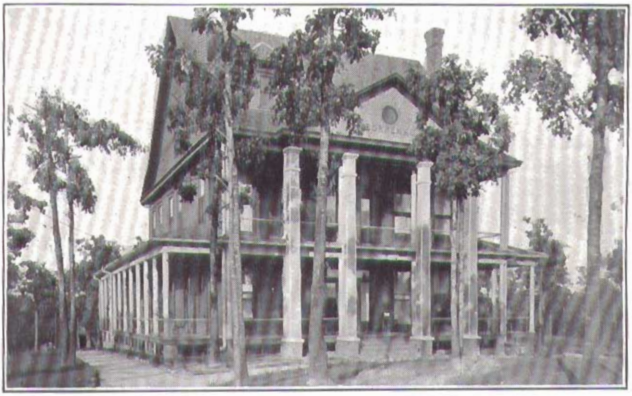
The experience we have gained is yours for the asking.

Best for Every Kind of House and Building

The Moline System of Vacuum Vapor Heating is suited to the smallest or largest building and has been installed with eminent success in all styles of structures, as will be seen by the testimonials and photographs given in this booklet.

The technical explanation refers to gravity heating only. Gravity heating is the type in which a boiler is used and in which all of the water of condensation is returned to the boiler by force of gravity.

For factory heating, systems in connection with central station heating plants or where the water of condensation is pumped or trapped to the boilers, special reading matter is issued. Send for it.



Home of Ignatius Pollak, Cullman, Ala.

Not An Objection

Cullman, Ala., Jan. 27, 1912.
Mr. Wm. Forstman, Cullman, Ala.

Dear Sir: I take pleasure in stating that the heating in my residence, which you installed in the Fall of 1910 with the Moline Vacuum Vapor Heating System, is entirely satisfactory and I recommend this system to everybody who is desirous of uniform and sanitary heating in their houses.

IGNATIUS POLLAK.

He Knows He'll Make Friends

Cullman, Ala., Jan. 27, 1912.
Mr. Wm. Forstman.

Dear Sir: The Moline Vacuum Vapor Heating System you installed for me in the summer of 1910, gives entire satisfaction. I am well pleased with Moline System, and I will recommend it to all my friends.

J. R. GRIFFIN.

Home of J. R. Griffin, Cullman, Ala.

Mr. F. J. Kunz's New Residence, Freeport, Ill.

**15 Degrees Below Outside—
Summer Heat Inside**

Freeport, Ill., Jan. 24, 1912.

The M. L. Parker Co.,
Freeport, Ill.

Gentlemen: I am delighted with the Moline Vacuum Heating System installed in my new residence, last year.

During this winter, with a temperature averaging 15 below for two weeks, I have been able to heat my home without trouble and at a comparatively small expense for fuel.

F. J. KUNZ.

Used at Government Barracks

Dec. 27, 1909.

Mr. H. W. Nelson, President Moline Vacuum Vapor Heating Co.,
Moline, Ill.

Sir: 1. Referring to your letter of the 24th inst., I have no objection to your taking a photograph of the barracks at this arsenal, this photograph to be used by you in connection with prospective installations of systems throughout the country.

Respectfully, S. HOF.
Major, Ord. Dept., U. S. A.,
Commanding.
Per S. B. J.

Rock Island Arsenal, Rock Island, Ill.

Rock Island Arsenal Barracks, Rock Island Arsenal, U. S. Army

Residence of W. W. Finney, Emporia, Kansas

Far Beyond Expectations

July 9, 1909.

Moline Vacuum Vapor Heating Co.,
Moline, Ill.

Gentlemen: The Moline System installed in my residence by Burnap Bros., is giving us entire satisfaction, in fact, it is far beyond our expectations. We never have had to replenish fire more than twice a day in the coldest weather, and have had all the heat desired. We have had experience with hot water heating and consider your system superior. It heats up much quicker, takes much less fuel and is simple to operate.

Sincerely,
W. W. FINNEY,
Emporia Telephone Company, Emporia, Kansas.

Would Use No Other

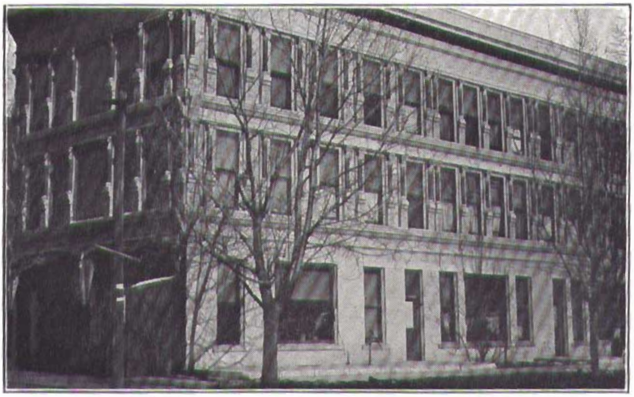
January 28, 1910.

The West End Heating & Engineering Co.

Sirs: The Moline Vacuum Vapor Heating System you installed in my home at Melrose Park has proven entirely satisfactory, so much so that if I were to build again the only heating system I would install would be the Vacuum Vapor. Since I have been using this system, and especially during the very cold weather this winter, I have had no difficulty in heating my home comfortably and uniformly throughout, and this without one particle of steam pressure.

Yours very truly,
DR. JOSEPH A. CRAMP,
Philadelphia.

Residence of Dr. Jos. A. Cramp, Philadelphia



Hotel Mann, Virginia, Ill.

"Best on Earth"

Virginia, Ill., Feb. 18, 1911.

J. M. Robb, Heating Engineer, Peoria, Ill.

Dear Sir: The results of the Moline System installed in the Hotel Mann in 1908 have been fully up to my expectations. In my opinion the Moline System of Heating is superior to hot water.

I have so far influenced five friends in installing Moline Systems in fine residences in preference to hot water heating.

The best heat on earth, up to date!

Yours very truly,

R. H. MANN.

Hotel Mann.

Hotel Man Glad He Spent $2500

Winchester, Ky., June 23, 1911.

Moline Vacuum-Vapor Heating Co., Moline, Ill.

Gentlemen: This hotel was originally heated with an unsatisfactory one-pipe gravity steam job.

In 1910 we had it converted into a Moline System after plans prepared by you.

After a full winter's operation conditions are so much improved that we feel that our money has been well spent.

BROWN & PROCTOR.

Brown-Proctoria Hotel, Winchester, Ky.

Residence Archbishop J. L. Spalding, Peoria, Ill.

Takes Less Fuel than Others

Peoria, Ill., Nov. 28, 1910.

Mr. J. M. Robb, Peoria, Ill.

My Dear Mr. Robb: I have the Moline System of Heating in my residence and I consider it excellent.

I have, of course, had experience with other systems, and I do not hesitate to say that the Moline is the best I know.

I am of the opinion that for a given amount of service it consumes less fuel than other systems.

Very sincerely yours,

J. SPALDING, Archbishop.

Heats Whole House—Any Weather—No Pressure

Plainview, Minn., Jan. 4, 1912.

The Moline Vacuum-Vapor Heating Co., Moline, Ill.

Gentlemen: The Moline System installed in my residence by E. R. Cornwell is more than satisfactory, in fact, is far beyond our expectations. The most desirable features being simplicity, the absence of all noise, and the ability to heat the whole house in the coldest weather without one ounce of steam pressure, and quicker than by any other system I know of.

I am indeed pleased to recommend your system. O. C. WOODCOCK.

O. C. Woodcock's Home, Plain View, Minn.

Mr. Saterlee's Store and Block, Moberly, Mo.

Heats Store and Three-Story House $1.00 a Day

Moberly, Mo., Jan. 26, 1912.
Mr. J. Oscar Smith, Moberly, Mo.

Dear Sir: The Moline Heating System, in my three story store and rooming house, has given entire satisfaction. During the past two winters it has not consumed over one dollar's worth of fuel per day in the coldest weather, while in moderate weather half this amount has run it.

I was so greatly surprised, that I replaced the old style heating system in my residence with a Moline. Both jobs have given equal satisfaction during the recent 20-below-zero weather.

(Signed) P. B. SATERLEE.

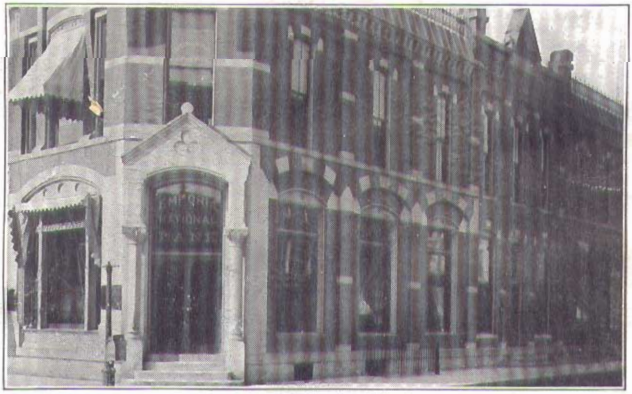
Rapid, Economical, Even Heating

Emporia, Kas., Aug. 31, 1909.
Moline Vacuum Vapor Heating Co.,
Moline, Ill.

Gentlemen: The Moline Vacuum Vapor Heating System installed for us two years ago has proven satisfactory in every respect; heats evenly and is economical. Since the plant was installed we have not had to repair it once.

A particularly valuable feature of your system is the rapidity with which heat can be raised. In the coldest weather we always maintain an even temperature.

Yours very truly,
H. DUNLAP, President.
The Emporia National Bank.



Emporia National Bank

Magnolia Court, Jersey City, N. J.

Apartment House—110 Radiators—No Pressure

New York, Jan. 5, 1912.

New York Heater & Supply Co.,
39 Cortlandt St., New York.

Gentlemen: The Moline System that was installed in my apartment building (Magnolia Court), corner of Magnolia and Chestnut avenues, Jersey City, in 1910, has proven entirely satisfactory.

Magnolia Court contains about 110 radiators. All can be heated with practically no pressure and a portion of the time the gauge shows a vacuum. I would cheerfully recommend it to my friends.

JOHN J. HOGAN.

Exceedingly Well Pleased

Pasadena, Cal., Nov. 19, 1910.

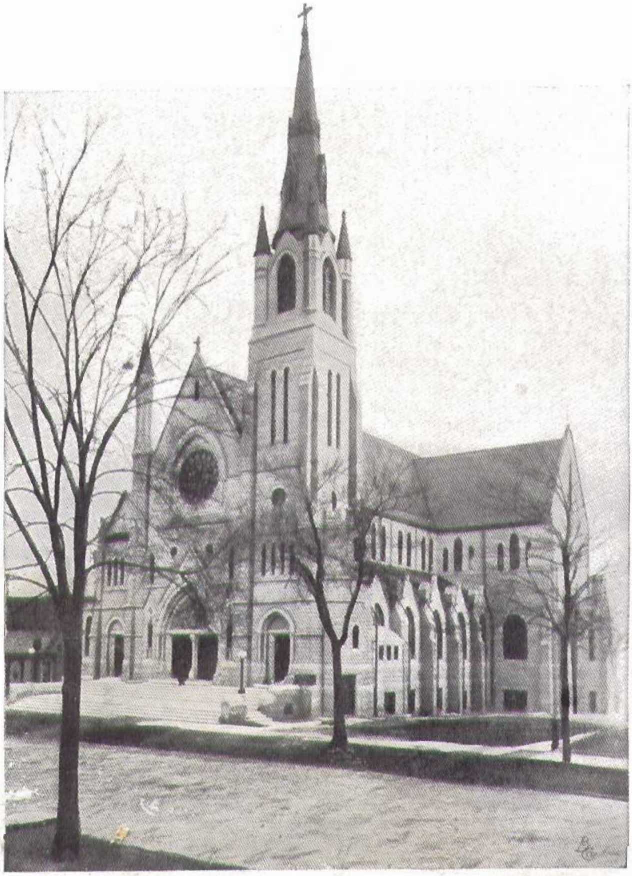
Mr. J. M. Robb, 602 Y. M. C. A. Bldg., Peoria, Ill.

Dear Sir: The Moline System of heating, with packless valves on the radiators, works very satisfactorily. We have been using this system but a short time, getting it the latter part of last winter. We are exceedingly well pleased.

Regarding the consumption of distillate, which is our fuel, I am unable to give you information.

THE HOGAN COMPANY,
Per M. D. Stambach,
Sec'y and Treas.

. . ..nd Apartments, Pasadena, Cal.



St. Patrick's Cathedral, Decatur, Ill.
Geo. P. Stauduhar

The Moline System in this church gives such good service that it has been adopted for their school and residence. The architect has since used the Moline System in many buildings, including the St. Benedict's Convent and Academy Building, at St. Joseph, Minn. And, in fact, is specifying it in all of his work.

Evelyn Apartments, Wilson and Malden Aves., Chicago

Exceeds Highest Expectations

January 10, 1910.

The Moline System, Moline, Ill.

Gentlemen: Your system of Vacuum Vapor Heating, which was installed in my building at Wilson and Malden, is giving entire satisfaction. In fact, it exceeds my highest expectations and I take pleasure in recommending it most highly to anyone contemplating the erection of a building.

Yours respectfully,

HERMAN FIETSCH, JR.

H.F.Jr. C.

Glad He Replaced His Coal-Wasting Furnace

Saffordville, Kans., Jan. 29, 1912.

Burnap Brothers, Emporia, Kansas.

Gentlemen: I am indeed glad that I had you replace my hot air heating plant with the Moline System. I find that the system heats all rooms alike and during the last cold spell I was able to keep the house comfortable without any special effort. It also takes a good deal less fuel.

HENRY IM MASCHE.

Home of Henry Im Masche, Saffordville, Kans.

Residence of John C. Worthington, Emporia, Kans.

Induces Friends to Follow his Example

Emporia, Kans., Jan. 27, 1912.
Moline Vacuum Vapor Heating Co.,
Moline, Ill.

Gentlemen: I am so pleased with the Moline System installed in my residence, that I have induced two of my friends to use the same system, and am glad to know they are very well satisfied with the same.

JOHN G. WORTHINGTON.

Reduces Fuel Bill

Oct. 7, 1910.
The Moline Vacuum Vapor Heating Co., Moline, Ill.

We are pleased to advise you that the Moline System installed in our apartment building, this city, has been entirely satisfactory. In another building of the same character hot water heat is used, giving an excellent opportunity for comparison. I prefer the Moline System because it is so speedy in operation and can be regulated with greater ease. Gas fuel is used in both buildings. THE BUILDING HEATED BY THE MOLINE SYSTEM IS A LITTLE LARGER AND REQUIRES TEN PER CENT. LESS GAS TO HEAT IT. Yours very truly,

O. D. BARNES, Wichita, Kans.

Barnes Apartment Bldg., Wichita, Kans.

Price and Method of Selling

The Moline System is not intended for cheap and competitive work.

Neither is it a high priced luxury.

Nor will any higher priced system deliver any better heating results than the Moline System.

The Moline System is designed for those who appreciate real worth, and its price will compare favorably with steam or hot water systems of **equal** heating capacities.

When measured by the value given in heating results a Moline System is the best investment about a building, but compared with the competitive propositions that are often made by contractors who either are not properly informed or are willing to take long chances, Moline System proposals seem very expensive.

The owner who attempts to make money by buying cheap heating apparatus only discovers after his money is gone that he has "saved at the spigot to waste at the bung hole."

Costly experience has taught engineers and designers to appreciate the utmost importance of good installation and good installation has its price.

The owner or his representative must contribute towards the success of his heating plant by awarding the installation to a heating contractor of known integrity and responsibility. There is no more certain way of buying trouble than dealing with the other kind.

It is the policy of the Moline System to co-operate with capable and reliable contractors in each community and there may be a Moline representative near you.

If not, send us your architect's building plans.

Where no architect's plans are available, we will furnish data sheets upon request.

We make working drawings and specifications for Moline Systems, but in no case do we sell direct to the owners or install the work ourselves.

The price is fixed by the amount of apparatus required, and this can be determined only from a study of conditions to be met on each individual building.

The price asked is so low that it is speedily returned in the saving and satisfactory results obtained.

W. SHURTLEFF.

DIFFERENTIAL CHECK VALVE FOR RADIATORS.

APPLICATION FILED MAY 18, 1915.

1,287,119. Patented Dec. 10, 1918.

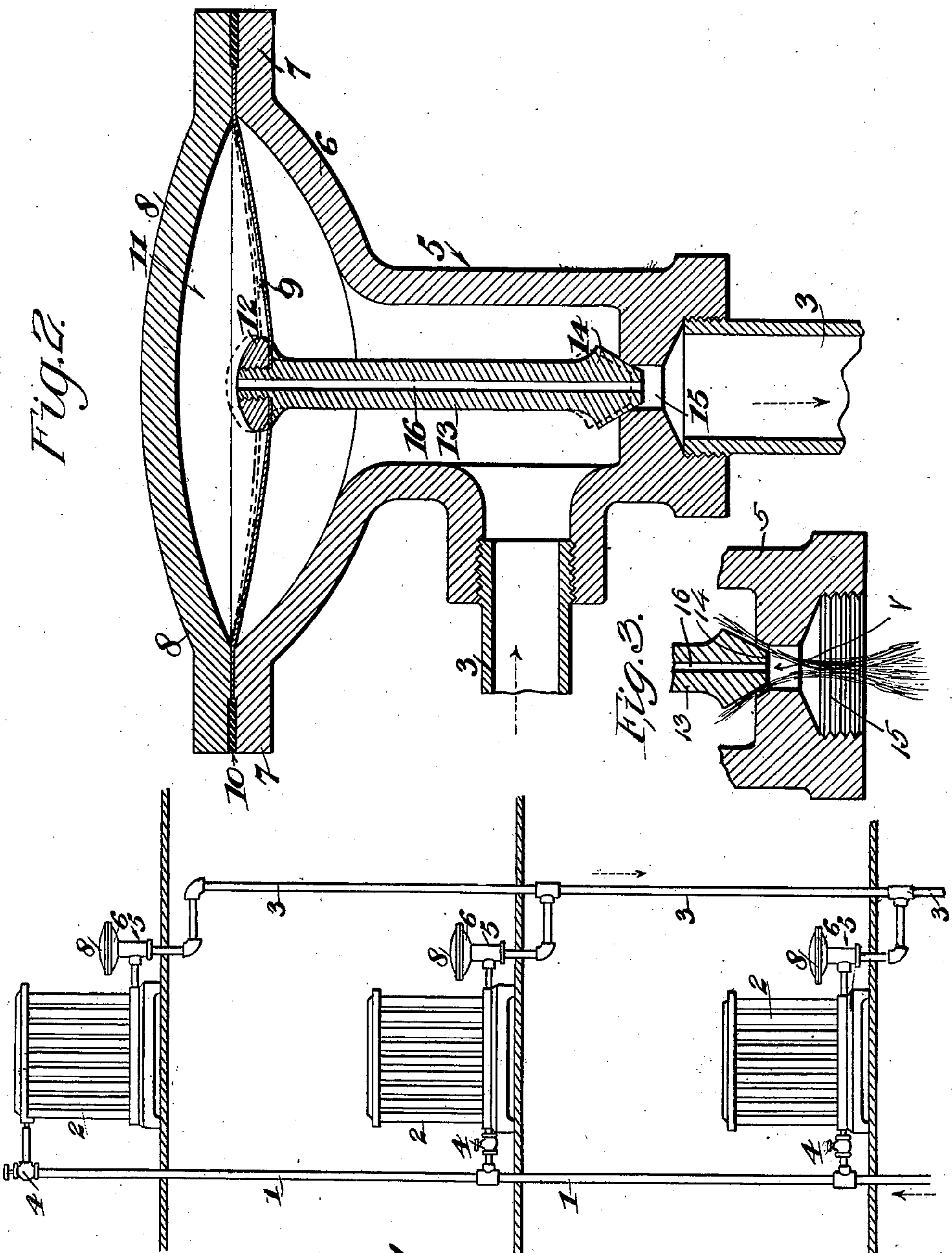


Fig. 2.

Fig. 3.

Fig. 1.

WITNESSES:
S. E. Wade.
J. G. Schrott

INVENTOR
Wilfred Shurtleff,
BY Munn & Co.
ATTORNEYS

UNITED STATES PATENT OFFICE.

WILFRED SHURTLEFF, OF MOLINE, ILLINOIS, ASSIGNOR TO MOLINE HEAT, OF MOLINE, ILLINOIS, A CORPORATION OF ILLINOIS.

DIFFERENTIAL CHECK-VALVE FOR RADIATORS.

1,287,119. Specification of Letters Patent. Patented Dec. 10, 1918.

Application filed May 18, 1915. Serial No. 28,848.

To all whom it may concern:

Be it known that I, WILFRED SHURTLEFF, a citizen of the United States, residing at Moline, in the county of Rock Island and State of Illinois, have invented a new and useful Improvement in Differential Check-Valves for Radiators, of which the following is a specification.

In the present practice of steam heat installation, especially that of the two-pipe system, it is essential to provide a globe or cut-off valve at both the steam inlet side and also at the steam return or discharge side so that all communication of the radiator with the steam pipe lines may be severed when it is desired to cool the radiator.

In certain modifications of the two-pipe system, a valve is provided at the steam inlet side and either a swing-check or ball-check valve at the outlet side of the radiator which valve acts as a check against the return of the steam into the radiator.

It has, however, been found from experience that this method of preventing the reëntrance of the steam to the radiator is unreliable for the reason that an ordinary check valve will not close sufficiently tight to serve this purpose and steam can therefore reënter the radiator, assuming the inlet valve to have been closed.

Therefore, the object of my invention is to provide a fluid operated back-check valve which is to be connected in the return or steam discharge pipe of a radiator of the two-pipe system which back-check valve will positively prevent the entrance of steam into the radiator from the return side of the pipe line after the inlet valve in the steam inlet side has once been cut off.

A further object of my invention is to provide a valve in the steam discharge or return pipe which will be susceptible to an opening movement when the valve in the steam inlet pipe is opened, this function being obtained by the slight excess pressure of steam in the inlet side over that in the outlet side thus allowing any water of condensation or air present within the radiator to be discharged into the return or discharge pipe.

In order that the aforesaid objects may be accomplished, I provide a valve casing connectible in the return side of a two-pipe steam heating system, at the top of which casing is clamped a flexible diaphragm of relatively large area which diaphragm in turn carries a pendent closure valve which coöperates with a suitable valve seat formed in the body of the casing.

In the normal operation of the radiator or when the inlet valve is open and the steam pressure is on, the aforesaid valve contained in the valve casing is raised or opened, this being caused by the pressure of the incoming steam acting on the underside of the diaphragm from which the valve is pendent, thus keeping the valve raised from its seat and establishing a through passage for the steam.

Should the steam inlet valve be suddenly closed, a rapid condensation of the steam within the radiator will result, causing a partial vacuum to form; and since the pressure in the return pipe is now in excess of that in the radiator, the steam in the return pipe will tend to rush into the radiator thus causing a re-heating of it.

To obviate this, the stem of the pendent valve is provided with an aperture communicating with the chamber above the diaphragm through which aperture steam will enter filling the chamber thus allowing pressure to be distributed over the area of the diaphragm and consequently reseating the valve.

The invention also resides in these novel details of construction, combination and arrangement of parts, all of which will be hereinafter fully explained and then specifically pointed out in the appended claim, reference being had to the accompanying drawing in which:—

Figure 1 is a diagrammatical representation of a steam heating system of the two-pipe type showing my invention applied to the steam return pipe.

Fig. 2 is a central vertical section of the back-check valve which is the object of my invention, the valve being closed in full lines and open, in dotted lines.

Fig. 3 is a sectional view of the lower part of the valve structure showing the valve raised.

Referring now to Fig. 1, 1 is the steam inlet pipe of a heating system of the usual two-pipe type which pipe 1 is common to a plurality of radiators 2, while 3, indicates the steam return or discharge pipe which carries the steam back to the source of supply.

Connected between the inlet pipe 1, and the individual radiator 2, is a cut-off valve 4, by which the steam may be turned off or on to effect the cooling or the heating of the radiator.

Oppositely to the inlet valve 4, and connected in the return pipe 3, of the system is a check valve 5, the detailed operation of which will presently be explained.

The valve 5, merges at its upper extremity, with a semi-globular portion 6, which in turn is flattened horizontally to form a circumferential flange 7, between which and the corresponding flange of a cover 8, a flexible diaphragm 9 of relatively large area, is fixedly clamped. 10 is a gasket which renders the chamber 11, above the diaphragm 9, steam-tight as well as preventing escape of steam from the interior of the valve 5.

Connected pendently from the diaphragm 9, as at 12, is a stem 13, at the bottom of which is formed a valve which is adapted to engage a suitably ground seat in the steam discharge port 15 of the valve 5. Arranged vertically in the stem 13, is a bleeder passage 16 which offers communication between the chamber 11 and with the discharge pipe 3 and interior of the valve 5, alternately.

By providing the diaphragm 9 of relatively large area and a bleeder passage of small diameter through the stem 13 of the valve 14, a differential valve with a large area at the top of same is provided thus affording additional pressure to insure the closing of the valve 14 at certain times when this is desirable.

In the normal operation of the system with the valves 4 open, steam is being admitted into the radiators, and in passing outwardly toward the discharge pipe, pressure is exerted against the underside of diaphragm 9 thus raising valve 14 from its seat a short distance whereupon the steam rushes between the valve and seat and through the restricted port 15 into the outlet 3. Such flow causes a void *v* at the lower end of the passageway 16 and automatically removes pressure from the passageway 16 and chamber 11. In other words, a suction effect is caused below the passageway 16 which is communicated to the upper diaphragm chamber 11 and assists in holding the valve raised. The weight of the valve is always acting on the steam flowing between it and the seat and causes maintenance of the void *v*.

Should one of the valves 4 be suddenly closed, a rapid condensation of the steam within the radiator will result and cause a partial vacuum to form and in turn produce a pressure of less degree in the radiator than in the return pipe 3 which would naturally cause the discharge steam to return to the radiator causing the undesirable re-heating. By reason of the provision of the bleeder passage 16 in the stem of valve 14, steam will collect in the chamber 11 and exert a great pressure over the large area of the diaphragm in chamber 11 thus causing valve 14 to be re-seated, this being accomplished quickly because of the difference in pressure in the radiator and the return or discharge pipe.

Thus, the higher the pressure in the discharge pipe 3 and the lower the pressure in the radiator 2, the more pressure will be brought to bear against the diaphragm 9 and consequently the valve seat 15 thus insuring an absolute seal against the return of the steam into the radiator from the discharge pipe line.

What I claim is:—

In a check valve for preventing the back heating of a steam radiator, the combination of a casing having a valve chamber and an inlet and an outlet for said chamber, there being a restricted valve port between said inlet and outlet, a valve seat surrounding said port, the upper end of said casing being expanded, a diaphragm extending transversely across said expanded upper part to divide such part into an upper diaphragm chamber and a lower diaphragm chamber, said lower diaphragm chamber being at all times in communication with said valve chamber, a valve suspended from said diaphragm and free to move downwardly with the diaphragm to engage said valve seat to close said port, said diaphragm being entirely free to be raised to unseat the valve when the pressure at said inlet is greater than that at the outlet, said valve having a restricted passageway extending lengthwise therethrough for connecting said outlet with the upper diaphragm chamber when the valve is down and in closed position, said valve chamber being disconnected from the upper diaphragm chamber when the valve is closed, said valve being held closed by the pressure in the upper diaphragm chamber when the pressure at said outlet is greater than at said inlet.

WILFRED SHURTLEFF.

Witnesses:

L. C. BECKWITH,
E. C. JAMISON.

W. SHURTLEFF.

VALVE.

APPLICATION FILED APR. 22, 1909.

944,155.

Patented Dec. 21, 1909.

Fig. 1.

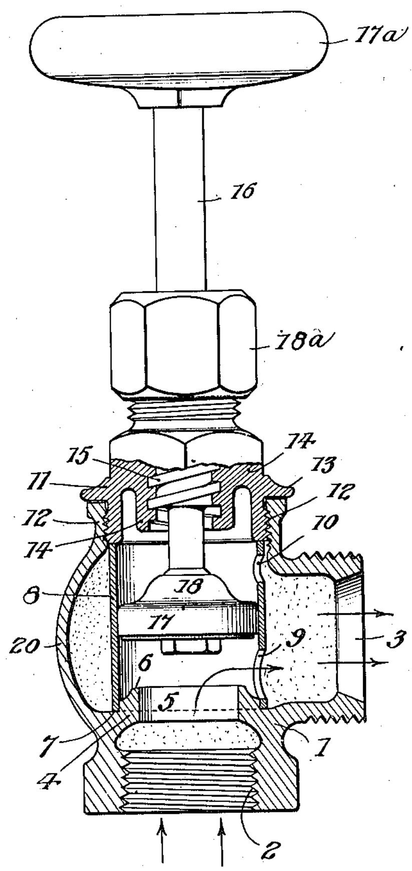
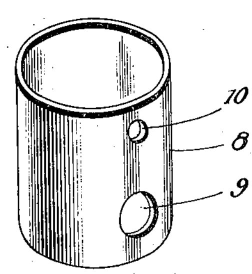


Fig. 2.



WITNESSES

L. H. Schmidt

C. E. Trainor

INVENTOR

WILFRED SHURTLEFF,

BY Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

WILFRED SHURTLEFF, OF MOLINE, ILLINOIS, ASSIGNOR OF ONE-HALF TO MOLINE VACUUM-VAPOR HEATING COMPANY, OF MOLINE, ILLINOIS, A CORPORATION OF ILLINOIS.

VALVE.

944,155. Specification of Letters Patent. Patented Dec. 21, 1909.

Application filed April 22, 1909. Serial No. 491,486.

To all whom it may concern:

Be it known that I, WILFRED SHURTLEFF, a citizen of the United States, and a resident of Moline, in the county of Rock Island and State of Illinois, have made certain new and useful Improvements in Valves, of which the following is a specification.

My invention is an improvement in valves, and consists in certain novel constructions and combinations of parts, hereinafter described and claimed.

The object of the invention is to provide a valve, especially adapted for use with vapor heating apparatus for controlling the supply of vapor to the coils of the radiators, and wherein the size of the opening for admitting the vapor may be contracted or enlarged, without the use of special tools.

Referring to the drawings forming a part hereof, Figure 1 is a longitudinal section of the valve, and Fig. 2 is a perspective view of the reversible shell or sleeve.

The embodiment of the invention shown in the drawings, consists of a substantially cylindrical casing 1 of general T-shape, having an end inlet 2, and a side outlet 3. A diaphragm 4, is arranged between the body of the valve casing and the inlet 2, and the diaphragm is centrally perforated as at 5, and provided with an annular flange 6 encircling its opening and forming a valve seat, and extending into the body portion of the casing. A shoulder 7 is formed between the flange and the diaphragm, and a sleeve or shell 8 encircles the flange, the lower end of the sleeve resting on the diaphragm, with the inner edge engaging the shoulder.

The shell is provided near each end with an opening 9 and 10, and the opening 9 is of greater diameter than the opening 10, one of the said openings forming the communication between the inlet 2 and the outlet 3 of the casing. The shell is retained in position by a nut 11 threaded into the end 12 of the casing directly opposite the inlet 2, the nut being provided with a lateral annular flange 13 engaging the end of the casing, and with a central boss or hub 14. The boss 14 is adapted to engage an enlargement 18, on the body of the valve for limiting the opening or upward movement thereof, so that the said valve cannot be moved far enough to uncover any opening except the lowermost. The measure of the vapor transmitting capacity of the valve, under like conditions as to pressure etc., is the area of the opening 9 or 10 which may be uncovered by the valve. When the shell is in the position shown in Fig. 1 such measure is the area of the opening 9, and when the shell is reversed the measure is the area of the opening 10. The boss is internally threaded, and the threads are engaged by the threaded portion 15, of a stem 16, of the valve 18, which is movable in the shell or sleeve 8. The free end of the stem 16 is provided with a handwheel 17[a], and a packing nut 18[a] encircles the stem and engages the nut 11 before mentioned.

The shell may be easily reversed by unscrewing the nut 14, and withdrawing the valve from the shell. It will be observed that all of the valve operating parts are carried by the nut, and are removed and replaced therewith. It will be noticed from Fig. 1 that the casing is enlarged annularly as at 20, around the sleeve, so that it is not necessary to aline the openings 9 and 10 with the outlet.

I claim—

1. A device of the class described, comprising a substantially cylindrical casing having at one end an inlet, and at the side an outlet, a perforated diaphragm separating the inlet from the body of the valve, an annular flange encircling the perforation of the diaphragm and forming a valve seat, a sleeve seated on the diaphragm and encircling the seat, said sleeve having at each end an opening one of which is of greater diameter than the other, a valve slidable in the sleeve and coöperating with the seat, and means for limiting the opening movement of the valve to prevent said valve uncovering its upper opening, and a nut threaded into the casing and carrying the valve, said nut being of greater diameter than the sleeve to permit the removal thereof, and engaging the end thereof to retain it in position.

2. A device of the class described, comprising a casing provided at one end with an inlet, and at its side with an outlet, a perforated diaphragm between the inlet end and the body of the casing, a sleeve resting on the diaphragm, and encircling the perforation, said sleeve being provided with a longitudinal series of side openings of different diameters and forming a communication between the inlet and the outlet, a valve movable in the sleeve for closing the perfo-

ration of the diaphragm, means for moving the valve, means for limiting the opening movement thereof for the purpose specified, and a nut threaded into the casing and carrying the valve and of greater diameter than the sleeve.

3. A device of the class described comprising a casing having an inlet and an outlet at right angles to each other, a sleeve encircling the inlet, and having a longitudinal series of side openings of different sizes communicating with the outlet, said casing having a threaded opening through which the sleeve may be removed, a nut closing the opening, a valve movable on the sleeve and having a stem passing through the nut and carried thereby, and means for limiting the movement of the valve for the purpose specified.

4. A device of the class described, comprising a valve casing provided with inlet and outlet ports, a sleeve reversibly mounted in the casing, and communicating by one end with one of said ports and provided with a longitudinal series of side openings of different areas communicating with the other of said ports, a valve movable in the sleeve for closing the port communicating with the end thereof, and means for limiting the movement of the valve to prevent it uncovering more than one opening.

5. A device of the class described, comprising a valve casing provided with an inlet and an outlet port at right angles to each other, a sleeve removably mounted in the casing, and registering with one of the ports and having a longitudinal series of different sized side openings registering with the other port, a valve for closing the sleeve, and means for limiting the movement of the valve to prevent the uncovering of more than one opening.

6. In a device of the class described, a valve casing having an inlet and outlet port, said inlet and outlet ports being out of alinement with each other, a sleeve removably mounted in the casing and registering with one of the ports, and having a longitudinal series of different sized openings registering with the other port, a valve for closing the sleeve, and means for limiting the movement of the valve to prevent the uncovering of more than one opening.

7. A valve casing having an inlet and an outlet port, a reversible sleeve in the casing registering with one port and having a plurality of side openings of different size registering with the other port and a valve movable in the sleeve.

WILFRED SHURTLEFF.

Witnesses:
LAWRENCE E. BECKWITH,
THOS. R. STOTTENBERG.

W. SHURTLEFF.

HEATING SYSTEM.

APPLICATION FILED APR. 19, 1915.

1,166,092.

Patented Dec. 28, 1915.

2 SHEETS—SHEET 1.

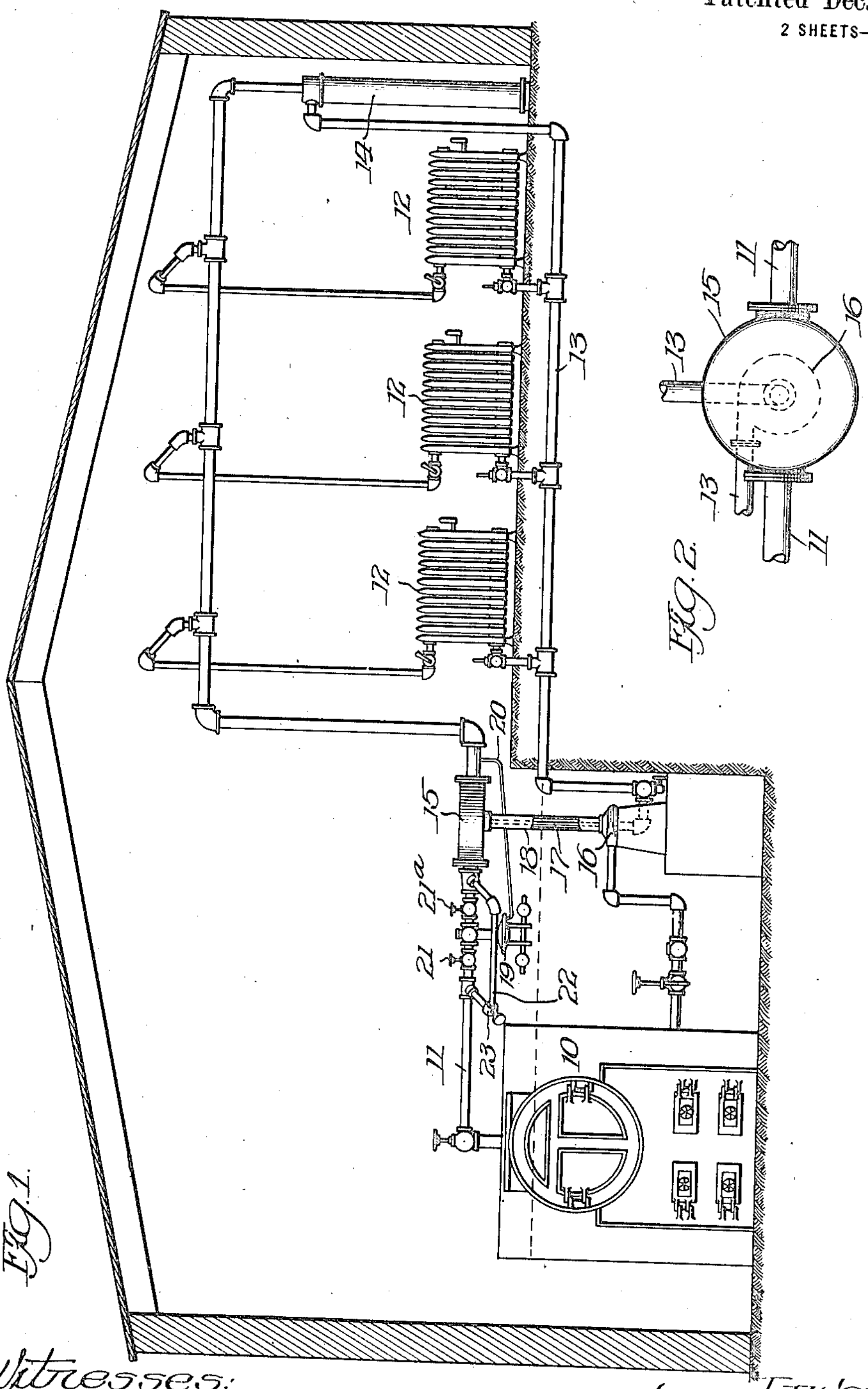


Fig. 1.

Fig. 2.

Witnesses:
Geo. C. Lawson
C. H. Roessner.

Inventor:
Wilfred Shurtleff
By Walter M. Fuller
Atty.

W. SHURTLEFF.
HEATING SYSTEM.
APPLICATION FILED APR. 19, 1915.

1,166,092.

Patented Dec. 28, 1915.
2 SHEETS—SHEET 2.

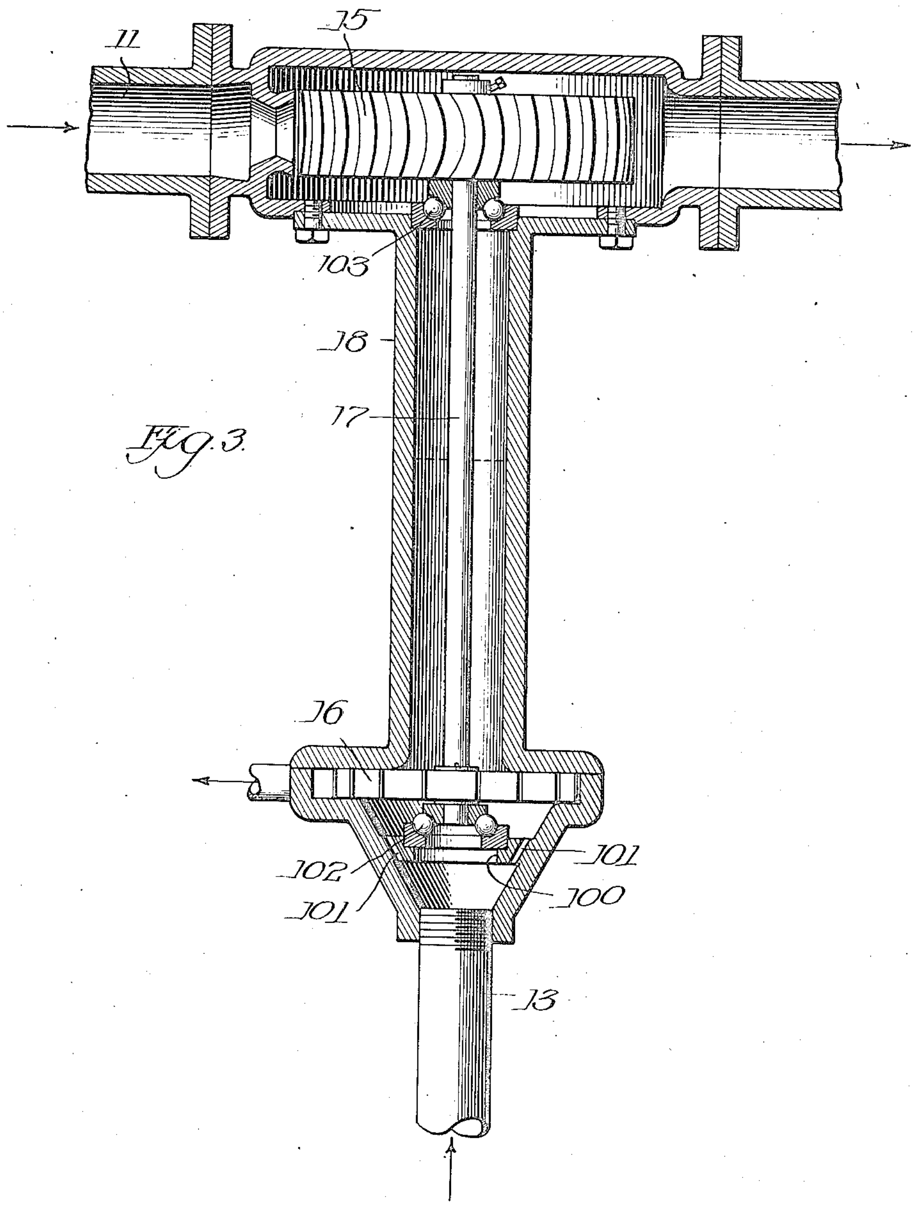


Fig. 3.

Witnesses:
Fred S. Lavison
C. H. Roessner

Inventor:
Wilfred Shurtleff
By Walter M. Fuller
Atty

UNITED STATES PATENT OFFICE.

WILFRED SHURTLEFF, OF MOLINE, ILLINOIS, ASSIGNOR OF ONE-HALF TO MOLINE VACUUM VAPOR-HEATING CO., OF MOLINE, ILLINOIS, A CORPORATION OF ILLINOIS.

HEATING SYSTEM.

1,166,092. Specification of Letters Patent. Patented Dec. 28, 1915.

Application filed April 19, 1915. Serial No. 22,491.

To all whom it may concern:

Be it known that I, WILFRED SHURTLEFF, a citizen of the United States, residing at Moline, in the county of Rock Island and State of Illinois, have invented certain new and useful Improvements in Heating Systems, of which the following is a specification.

One of the leading objects of this invention is the provision of efficient means for the return of the water of condensation of a heating system to the steam boiler or generator, particularly when a relatively low boiler pressure is employed. To reach this result, the preferred manner of practising the invention involves the employment of a pump, preferably, though not necessarily, one of the centrifugal type, actuated by a suitable source of power, such as a rotary steam engine or turbine, through which the steam fed to the heating system passes, whereby the operation of the pump will in general be proportioned to the amount of pumping to be performed, that is, to the amount of steam being condensed in the radiators.

In some cases a pressure-reducing means may desirably be employed between the generator and the turbine or other steam prime-mover, and, in some instances it is well to connect such means to the exhaust side of the turbine to regulate the working pressure thereon.

In some installations it is advisable or convenient to so arrange the system that the water of condensation will return to the boiler by gravity when low pressure prevails, the pump becoming automatically effective when the pressure increases.

In order that those skilled in this art may have a full and clear understanding of the invention and the advantages accruing from the use thereof, I have illustrated a desirable embodiment of the same in the accompanying drawing which forms a part of this specification and to which reference should be made in connection with the following detailed description.

In the drawing: Figure 1 illustrates the whole steam heating system somewhat diagrammatically, Fig. 2 illustrates a fragmentary detail of the turbine and pump, and Fig. 3 is a vertical section through the casing inclosing the turbine and pump.

Referring to the drawings, it will be clear that in this embodiment of the invention the system comprises a suitable form of steam-generator or boiler 10 supplying steam through a main 11 to a number of radiators 12, all of which in the present instance are above the water-line of the boiler, although in its broader and more general uses the invention is susceptible of employment in a system where one or more of the radiators is below the boiler water-level. All of the radiators are connected to a common pipe 13 by means of which the water of condensation is returned to the boiler, and at the end of the system, if desired, a seal or trap 14 may be employed.

A rotary steam-engine or turbine 15 is connected in the steam main 11, so that all steam which passes to the radiators necessarily flows through such turbine. In the return pipe 13 a pump 16 is inserted, preferably one of the centrifugal type, the turbine operating the pump by means of a vertical shaft 17 inclosed in a casing or shell 18 forming a part of or a connecting portion for the casings of the turbine and pump.

Stated differently, the turbine 15 and water-pump 16 are mounted on the same vertical shaft 17 and all three are housed in the casing 18 common to all, the upper portion of the casing containing the turbine being connected in the steam-main 11 while the lower portion of the casing accommodating the pump is connected in the water return pipe 13, whereby the turbine actuates the pump and the casing acts as an equalizer for the system. This action is brought about due to the fact that that portion of the casing containing the turbine is in direct communication with that part of the casing housing the pump. In the particular embodiment illustrated in these drawings the lower part of the casing is supplied with a wall 100 apertured at 101, 101, permitting the passage of the water from the pipe 13 to the casing and pump. On this wall 100 a ball-bearing 102 is mounted on which the lower end of shaft 17 rests and revolves. The upper portion of the casing beneath the turbine is equipped with a ball-bearing 103, the passages between the balls permitting the draining of the moisture of the steam-main to the lower-portion of the casing, the steam and water being in direct contact. In this way, the central or connecting portion of the casing acts as an equalizer and the water therein prevents the steam entering the pump chamber, or, stated differently, such part of the casing constitutes a standpipe, seal, and drip for the steam-main.

Between the turbine and the boiler a pressure reducing or regulating device 19 may be used, and in some instances it is desirable to connect such device by means of a pipe 20 to the steam main on the exhaust side of the turbine, whereby to regulate or limit the pressure supplied to the turbine. This pressure-reducing or regulating appliance 19 is also conveniently supplied with valves 21 and 21ª on opposite sides thereof and with a by-pass 22 equipped with a valve 23 whereby the device 19 may be cut into or cut out of the system at will.

Since, as has been indicated, all of the steam condensed in the radiators passes through the steam turbine, the speed of rotation of the latter and of the pump will in general be proportionate to the work which the pump is called upon to do in returning the water of condensation to the boiler. The use of a horizontal turbine and a horizontal pump connected to and driven by the turbine by a vertical shaft all properly incased, forms an extremely simple and effective construction for performing the functions desired. If no pressure regulating or reducing device is used then, of course, the turbine is subjected directly to the boiler pressure. In many installations, however, it is desirable to carry a higher pressure on the boiler and use any suitable form of pressure reducing appliance. The present invention is particularly adapted for employment in such systems because it is necessary to use some form of appliance which will return the water into the boiler against its higher pressure and in this case the effort of the pump is properly regulated automatically by the flow of steam through the turbine with respect to the amount of water to be returned. In case all of the radiators are above the water level of the boiler then this water may, under low pressure, be returned to the boiler by gravity and the pump and turbine so arranged that upon suitable increase of pressure they will automatically become operative. By connecting the pressure regulator with the exhaust side of the turbine main a predetermined limiting difference of pressure becomes operative on the turbine, restricting or limiting the speed to which it may attain. In case one or more of the radiators is below the water level of the boiler then, of course, a pump or similar appliance is necessary to effectively return the water of the radiators to the steam generator.

In the particular embodiment of the invention illustrated, the turbine is positioned above the water-level of the boiler and the pump below such level, but the exact positions of these devices is susceptible to considerable variation. For example, in some installations both the turbine and the pump may be below the boiler water-line. By placing the pump below such level there is no necessity for priming and the lubrication of the appliance is facilitated, the water itself assisting in the smooth and easy running of the parts.

To those skilled in this art it will be apparent that many other minor changes may be made in the embodiment of the invention presented without departure from the substance and essence of the invention and without the sacrifice of any of its substantial benefits and advantages.

I am aware that heretofore it has been proposed to return to the boiler the water of condensation by means of a pump actuated by a rotary steam engine through which the steam flowing to the system passed, but my invention comprises the several features of novelty and improvement presented in the appended claims which give to such a system the various important and valuable characteristics of structure and function hereinbefore described.

I claim:

1. In a heating system of the character described, the combination of a steam generator, a radiator, a steam main connecting said generator to said radiator, a return-pipe from the radiator to the generator arranged for the gravity return of the water of condensation to the generator when the pressure is low, a steam turbine connected in said steam main, a centrifugal pump located below the water level of the generator and connected in said return-pipe, and a vertical shaft connecting said turbine and pump whereby upon increase of pressure the turbine will actuate the pump to return the water of condensation into the generator and the speed of the pump will be regulated by the volume of steam flowing to the radiator, substantially as described.

2. In a heating system of the character described, the combination of a steam-generator, one or more radiators, a steam turbine, a water-pump, a shaft connecting said turbine and pump, a casing common to said turbine and pump with communication between the turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main, and a return pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return pipe, whereby the turbine drives the pump to return the water of condensation, substantially as described.

3. In a heating system of the character described, the combination of a steam gen-

erator, one or more radiators, a steam turbine, a centrifugal water pump below the turbine, a shaft connecting said turbine and pump, a vertically-disposed casing common to said turbine and pump with communication between the turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main, and a return pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return pipe, whereby the turbine drives the pump to return the water of condensation, substantially as described.

4. In a heating-system of the character described, the combination of a steam-generator, one or more radiators, a steam-turbine, a water pump, a shaft connecting said turbine and pump, a casing common to said turbine and pump with communication between the turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main and located above the water level of the generator, and a return pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return pipe and located below the water line in the generator, whereby the turbine drives the pump to return the water of condensation, substantially as described.

5. In a heating system of the character described, the combination of a steam generator, one or more radiators, a horizontal steam turbine, a horizontal centrifugal water pump below said turbine, a shaft connecting said turbine and pump, a vertically-disposed casing common to said turbine and pump with communication between the turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main, and a return pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return pipe, whereby the turbine drives the pump to return the water of condensation, substantially as described.

6. In a heating system of the character described, the combination of a steam-generator, one or more radiators, a horizontal steam-turbine, a horizontal centrifugal water pump below the turbine, a shaft connecting said turbine and pump, a vertically-disposed casing common to said turbine and pump with communication between the turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main and located above the water line of the generator, and a return pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return pipe and located below the water line of the generator, whereby the turbine drives the pump to return the water of condensation, substantially as described.

7. In a heating system of the character described, the combination of a steam generator, one or more radiators, a steam turbine, a water-pump, a shaft connecting said turbine and pump, a casing common to said turbine and pump with communication between the turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main, a return pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return pipe, whereby the turbine drives the pump to return the water of condensation, and a pressure-regulating means in the steam main between the generator and the turbine, substantially as described.

8. In a heating system of the character described, the combination of a steam generator, one or more radiators, a steam turbine, a water pump, a shaft connecting said turbine and pump, a casing common to said turbine and pump with communication between the turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main, a return pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return-pipe, whereby the turbine drives the pump to return the water of condensation, pressure-regulating means in the steam main between the generator and turbine, and means governing the pressure-regulating means and connected to said steam-main at the exhaust side of the turbine, substantially as described.

9. In a heating-system of the character described, the combination of a steam-generator, one or more radiators, a horizontal steam turbine, a horizontal centrifugal water-pump, a shaft connecting said turbine and pump, a casing common to said turbine and pump with communication between the

turbine and pump portions thereof, a steam main connecting said generator and the one or more radiators, the portion of said casing accommodating the turbine being interposed in said main and located above the water line of the generator, a return-pipe from the one or more radiators to the generator for the return of the water of condensation, the portion of said casing accommodating said pump being interposed in said return pipe and located below the water line of the generator, whereby the turbine drives the pump to return the water of condensation, a pressure-regulating means in the steam main between the generator and the turbine, and means governing said pressure-regulating means and connected to said main at the exhaust side of the turbine, substantially as described.

10. In a heating system of the character described, the combination of a steam generator, one or more radiators, a steam turbine, a water pump, a shaft connecting said turbine and pump, a steam main connecting the generator and the one or more radiators and having the steam turbine interposed therein, a return-pipe from the one or more radiators to the generator for the return of the water of condensation and having the pump interposed therein, whereby the turbine drives the pump to return the water of condensation, a pressure-regulating means in the steam main between the generator and the turbine, and means governing said pressure-regulating means and connected to the steam main at the exhaust side of the turbine, substantially as described.

11. In a heating system of the character described, the combination of a steam generator, one or more radiators, a steam main connecting said generator to said one or more radiators, a return-pipe from the radiators to the generator arranged for the gravity return of the water of condensation to the generator when the pressure is low, a steam turbine connected in the steam main, a pump connected in the return-pipe, and a driving-connection between the turbine and pump whereby upon increase of pressure the turbine will pump the water of condensation back into the generator and the speed of the pump will be regulated by the volume of steam flowing to the radiators, substantially as described.

WILFRED SHURTLEFF.

Witnesses:

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ANTISIPHON SEAL FOR HEATING SYSTEMS.
APPLICATION FILED SEPT. 27, 1918.

1,304,612.

Patented May 27, 1919.
2 SHEETS—SHEET 1.

Fig. 1.

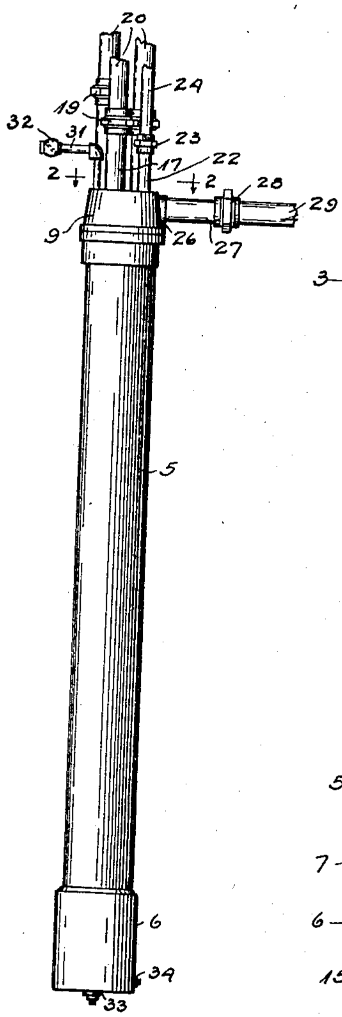
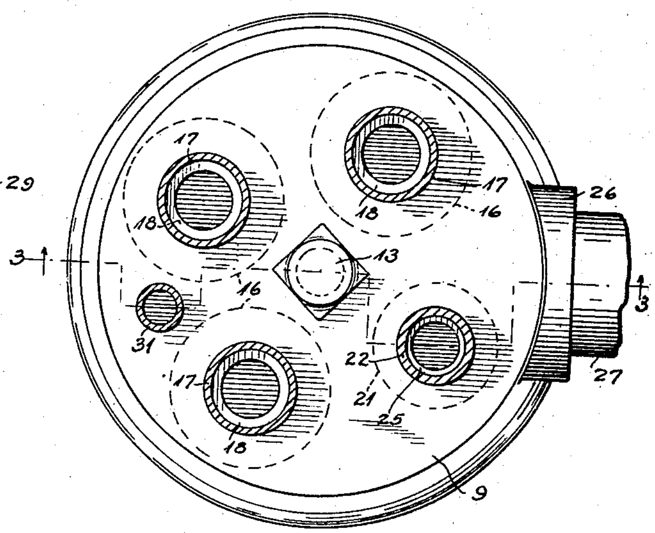


Fig. 2.



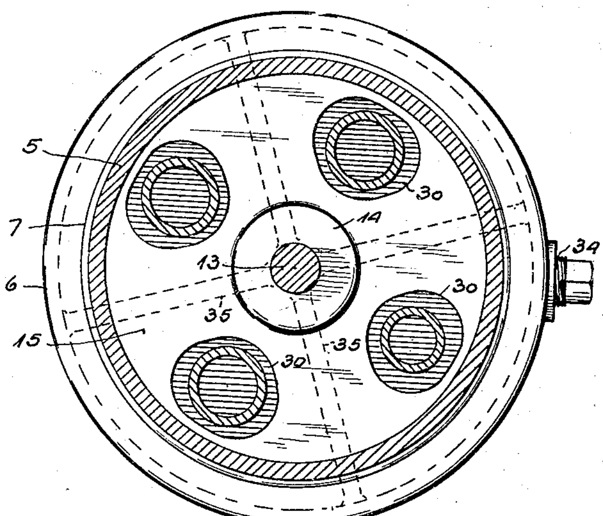


Fig. 4.

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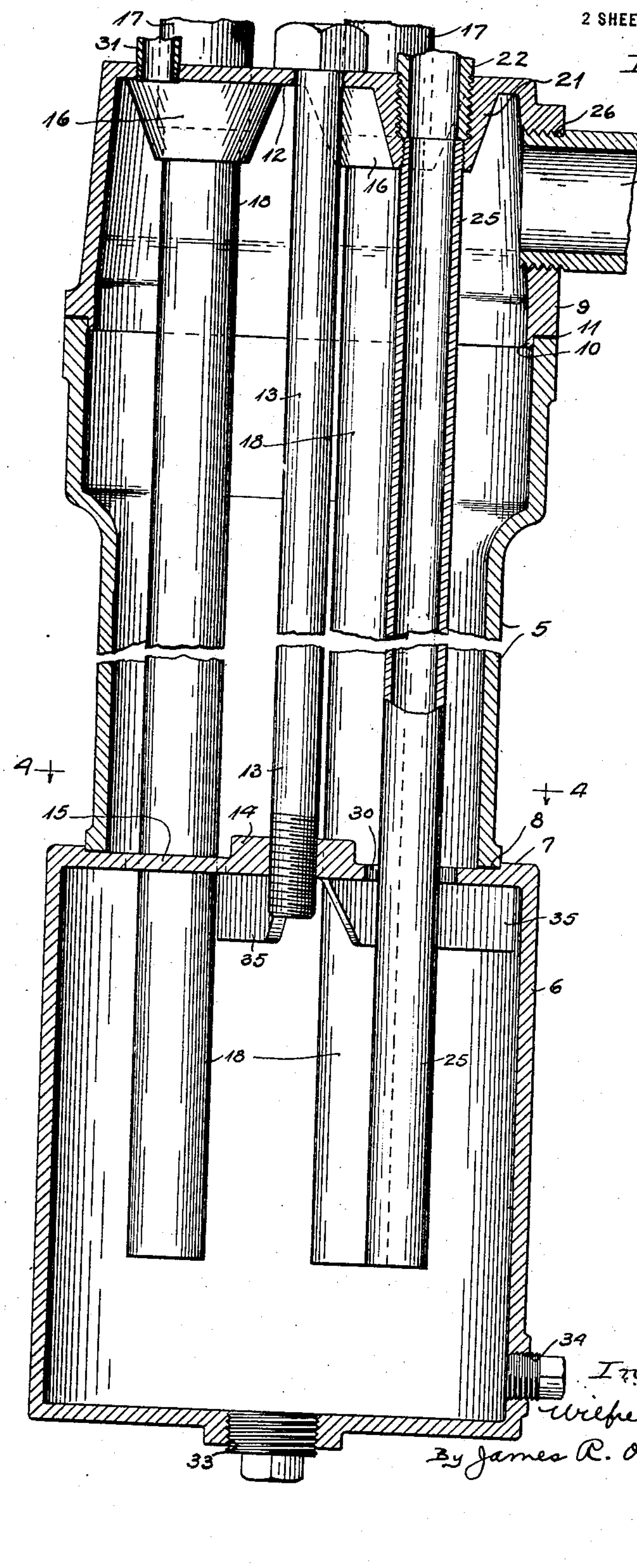
2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

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ANTISIPHON-SEAL FOR HEATING SYSTEMS.

1,304,612. Specification of Letters Patent. Patented May 27, 1919.

Application filed September 27, 1918. Serial No. 255,966.

To all whom it may concern:

Be it known that I, WILFRED SHURTLEFF, a citizen of the United States, and a resident of Moline, in the county of Rock Island and State of Illinois, have invented certain new and useful Improvements in Antisiphon-Seals for Heating Systems, of which the following is a specification.

My invention relates to anti-siphon seals for heating systems, its object being to produce improved construction and arrangement which will permit more efficient operation of the seal and which will render the seal more accessible for inspection or renewals.

The various features of my invention will be apparent from the following specification taken with the accompanying drawings in which drawings—

Figure 1 is an elevational view of a seal,

Fig. 2 is an enlarged plan view thereof,

Fig. 3 is an enlarged sectional view on plane 3—3, Fig. 2, and

Fig. 4 is a sectional view on plane 4—4, Fig. 3.

The cylindrical body 5 of the seal structure is of pipe-shape and rests at its lower end on the cylindrical base part 6, the top of the base having the annular flange 7 within which the lower end of the body part seats, preferably with the interposition of the gasket 8. At the top of the body part is supported the cap 9, the cap having the internal alining flange 10 and the gasket 11 being interposed between the cap and body. In the top of the cap is the central passageway 12 for the bolt 13 whose lower end threads through the boss 14 formed at the center of the top wall 15 of the base 6. This bolt securely ties the head, body and base parts together into a rigid structure.

Depending from the top wall of the cap are a number of bosses or lugs 16 each having a passageway therethrough tapped in its outer part for securing pipe sections 17, and also tapped at their inner ends for supporting drop pipes 18. In practice the pipes 17 are connected by unions 19 with the drips 20 leading from the low pressure supply and return mains or the air and water return main of a heating system. Another tap opening 21 is also shown from which a pipe 22 extends to be connected by a union 23 with the drip pipe 24 leading from the air relief valve (not shown). Secured in the lower end of the tap 21 is the drop pipe 25. The side of the cap has the threaded opening 26 in which is secured the pipe stub 27 connected by coupling 28 with the pipe 29 which connects with the pump and water receiver.

The various drop pipes 18 and 25 extend downwardly to within a short distance of the bottom of the base 6, the top wall 15 of the base having the openings 30 therethrough through which the pipes extend, these openings being a trifle larger than the pipes to more or less restrict the flow of water between the base and the body parts of the seal structure. The drip water from the various pipes of the heating system soon fill the seal well and the overflow returning through pipe 29 to the water receiver. In order to prevent siphoning of the seal an air intake pipe 31 is connected with the interior of the cap 9 above the water level, and has a check valve 32 at its end which is set so that air may be drawn into the space above the water. This check valve will also prevent the escape of any steam which may reach the space above the water.

The water of condensation coming from the steam supply mains is much higher in temperature than the water of condensation coming from the air and water return mains. As these waters are both discharged into the base 6 of the seal there is a tendency, on account of the difference in pressure, to create what is called "water bubbles." Unless guarded against these water bubbles interfere with the proper functioning of the seal and the steam would not be held back. The formation of water bubbles is prevented in my improved seal by the restricted passageways 30 which provide a practically closed water chamber at the lower end of the seal. The waters of different temperature flowing into this lower chamber will be retained and retarded and will mix to a great extent before rising through the restricted passageways into the body section 5 of the seal, such passage through the restricted passageways causing the further and practically complete mixture of the waters of different temperature and the formation of water bubbles is prevented. The base section 6 acts also as a mud drum, clean-out plugs 33 and 34 being provided.

My improved construction in which the cap, body and base parts are separably held together by a bolt 13 eliminates the need of pits or sewer tiles for installing the seals. The seals can be buried directly in the ground. Upon loosening of the various unions and unscrewing of the bolt 13 the cap with the drop pipes thereon can be withdrawn from the seal body and inspection, renewals, or repairs can readily and quickly be made. In order to strengthen against strain caused by the bolt 13 the wall 15 of the base part 6 is reinforced by ribs 35.

My improved seal is particularly adaptable for use in steam or vapor heating systems where the pressure is substantially the same as that of the atmosphere or only a few pounds thereover. I do not desire to be limited to the exact details of construction and arrangement shown and described as modifications are no doubt possible which would still come within the scope of the invention. I claim as follows:

1. In a device of the class described, the combination of a well comprising upper and lower compartments, drop pipes extending through the upper compartment and into the lower compartment, there being only restricted passageway between said compartments.

2. In a device of the class described, the combination of a well comprising upper and lower compartments, the upper wall of said lower compartment having passageways, drop pipes extending downwardly through said upper compartment and through said passageways into the lower compartments for discharging water into the lower compartment, said passageways restricting the flow of water between the compartments, and an overflow outlet at the upper end of the upper compartment.

3. In a device of the class described, the combination of a base part having passageways in its upper wall, a body part mounted on and secured to said base part, drop pipes suspended from the top of said body part and extending downwardly through said passageways and into the base part, the relative sizes of said passageways and said pipes passing therethrough being such that the flow between the base part and the body part is restricted, and an overflow outlet from the top of the body part.

4. In a device of the class described, the combination of a base part, a body part mounted thereon, a screw extending centrally through said body part and threading into the base part to secure said parts together, drop pipes extending through the body part and into the base part, and an overflow outlet at the upper end of said body part.

5. A device of the class described comprising a base part, a body part and a cap part, a bolt connecting said cap part with the base part to lock said parts together to form a well, and drop pipes extending through said body and base parts, there being an overflow outlet from said cap part.

6. A device of the class described comprising a base part, a body part and a cap part, said parts being detachably held together to form a well, drip pipes adapted at their upper ends for connection with piping of a heating system and extending downwardly through said body part into the base part, there being an overflow outlet from the cap part.

7. A device of the class described comprising a base part, a body part and a cap part, a bolt extending through the parts and connecting with the cap part and base parts to clamp the body part therebetween, said parts forming a well, drip pipes suspended from the cap part and extending through the body part into the base part, and an overflow outlet from the upper end of said well.

8. A device of the class described comprising a base part, a body part and a cap part, a bolt extending axially through said parts with its head engaging the cap part and its threaded end engaging in the upper wall of the base part whereby said cap, body and base part are clamped together in axial alinement to form a well, drop pipes extending from the cap part through the body part and through the upper wall of the base part into the interior of said base part, there being restricted passageway through the upper wall of said base part for the flow of water between said base and body parts, and an overflow outlet at the upper end of the well.

9. A device of the class described comprising a base part, a body part and a cap part, a single bolt locking said parts together in axial alinement, drop pipes secured to the cap part and extending downwardly through the body part and into the base part, there being an overflow outlet at the upper part of the well.

10. In a device of the class described, the combination of a base part, a top part mounted on said base part, drop pipes extending through said top part and into the base part, a water outlet at the upper end of said top part, restricted passageway for water flow between said base part and top part, said base part except for said restricted passageway being entirely closed and forming a mixing chamber for water received through said drop pipes.

11. In a device of the class described, the combination of a base part, a top part mounted on said base part, drop pipes extending through said top part and into the base part, a water outlet at the upper end of said top part, restricted passageway for water flow between said base part and the top part, said base part except for said restricted passageway being entirely closed and forming a mixing chamber for water

received through said drop pipes, an air inlet to said top part above the water level therein for preventing siphoning, and a check valve for preventing outward flow through said inlet.

12. A device of the class described comprising a well having a chamber near its bottom connected only by restricted passageway with the space above, drop pipes extending downwardly through said well to discharge into the bottom chamber, and an overflow outlet at the upper end of said well.

13. A device of the class described comprising a well having a chamber near its bottom connected only by restricted passageway with the space above, drop pipes extending downwardly through said well to discharge into the bottom chamber, an overflow outlet at the upper end of said well, and an air inlet to the space above the water level.

In witness whereof, I hereunto subscribe my name this 24th day of September, A. D. 1918.

WILFRED SHURTLEFF.