A PRACTICAL PLAN

FOR

Heating Cities and Large Villages

WITH STEAM OR HOT WATER,

AFFORDING A CONSTANT SUPPLY

OF THE MEANS FOR

HEATING BUILDINGS, COOKING, PROPELLING MACHINERY, ELECTRIC LIGHTING, TELEGRAPHING, EXTINGUISHING FIRES AUTOMATICALLY, Etc.

BY

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(LATE OF BAKER, SMITH & CO.)

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I.

THE NEED OF A PRACTICAL PLAN.

The development of steam for heating purposes, especially for domestic use, has not kept pace with its application as a motive agent. It is only a few years since it has been used to any great extent for heating public buildings and factories; and it was only twenty years ago that Mr. Baker initiated its employment for warming private dwellings. Still more recent was the first application by him of steam and hot water for warming railway cars, private rooms and the like. In no other way at present, (except, perhaps, in a few isolated cases) is steam employed for domestic uses, yet it is capable of manifold applications for promoting the health and comfort of the inhabitants of our cities and villages; for enhancing the safety of their property; for reducing the cost of living; and lowering rates of insurance. The public scarcely realize the extent, variety and value of the services it may be made to perform in domestic life.

Steam is an untiring agent, and, when generated on a large scale, saves not only labor but *expense.* It may be made to supply not only heat and power, but electricity and light as well.

HEAT—for warming and ventilating apartments, cooking food, thawing frozen leaders and gutters, and clearing sidewalks of snow and ice.

POWER—for propelling engines, elevators, pumping apparatus, fans for cooling, blowers, washing and ironing machines, sewing machines, churns, church and parlor organs, and all other household and shop machinery; and

ELECTRICITY—for illumination, burglar alarms, fire alarms, telegraph communication, telephones, and automatical regulation of the temperature of rooms.

Notwithstanding the convenience and value of steam in private buildings, but few have hitherto introduced it on account of the cost of a special apparatus, and because of the fear of danger and the annoyances likely to be encountered. A practical and economical steam service on a large scale can be organized, however, in every city or village. One of the important necessities of life is the lighting of houses. If all houses were lighted on the same principle as they are now heated, each family for itself, the cost of gas, and the trouble in making it, would put it beyond the reach of the large majority.

Some method of wholesale heating is sure to come into general favor, for many reasons; but one of the most important is its *superior economy*. for the consumption of coal would be greatly reduced and an enormous waste prevented. The forests of the country are rapidly disappearing; the coal mines are growing deeper and becoming more difficult to work: and the time is not remote when it will be imperatively necessary to economize fuel and get from every pound of it the utmost quantity of heat and force.

Mr. Baker, as a practical engineer of many years' experience in this line of business, is well acquainted with the mechanical and physical difficulties which must be overcome before a perfect system of steam heating on a large scale can be adopted. Two or three plans have recently been brought to public notice, coming from men of little or no experience in this special department of engineering, and having defects so serious as to make them fall far short of what is desired. The various apparatus and contrivances mentioned in this pamphlet are *not experimental*, nor are they, to Mr. Baker, new, except in the novel combination and extensive scale in which he proposes to utilize them. Every feature of the system here proposed has been tested and practically operated by him; and all the essential principles have been employed in his practice during the past twenty-five years in New York City. Every large place in the United States will bear witness to the success of his inventions, from the miniature contrivance adapted to a single room, and the apparatus suitable for a dwelling or factory, up to that fitted for the largest buildings, some of them occupying a whole square, and where the heating pipes are measured by miles. Everything Mr. Baker here proposes is perfectly practicable and feasible, and will, we are assured, meet the approbation of all first-class engineers. His combination includes many useful novelties, giving it strong advantages not possessed by any other system.

II.

FEATURES OF THE SYSTEM.

It is not proposed here to explain all the mechanical details of the system, but merely to show that, by the plan outlined, cities and villages may be heated in

Divisions of Blocks, Squares or Districts

of such limited extent that it may be perfectly practical to circulate steam or hot water through them from one cluster or a "battery" of boilers, so that nearly *all the pipes shall be within the buildings* to be warmed; or all the material within easy access; there *being a separate apparatus for each apportioned district.* It is only by this plan that economy in construction can be obtained; and the waste of heat and power reduced to the minimum.

Boiler House and Boilers.

THE BOILER HOUSE, where practicable, will be located at proper intervals, at docks, on one of the rivers, where the coal required can be landed direct from barges, or at the lowest level, to facilitate the return of the hot water condensed from the steam, back again to the boilers. The boiler house will be FIRE PROOF. It will contain a steam pump, for pumping the condensed water back into the boilers when required, and for use also, when needed, for extinguishing fires. It will have a water tank for the storage of the condensed water, when necessary. It will also be supplied with a steam engine and machines for generating Electricity for Illumination, and for numerous auxiliary purposes; electric batteries for burglar alarms, fire alarms, telephones, and telegraphic communications within the square; a set of electric call-bells and signals from the different buildings; tool and repair rooms; scales for weighing coal, coal bins, ash receivers, etc., etc.

THE BOILERS will be constructed on the principle of those employed in thousands of instances by Mr. Baker during the past seventeen years. Without giving mechanical particulars here, it may simply be stated that the boilers will be absolutely safe from danger of explosion under any pressure. They will be the most economical in fuel; the most durable; the least liable to get out of order; and the easiest to repair, of any boilers now in use. They will be sectional, and so constructed that while the whole of any one boiler can be operated at the same time, any one or more sections can be used separately. The size and steam capacity can be increased or diminished at pleasure without interfering with the supply of steam, valves being placed at the points where the new sections may be added. Several surplus boilers will always be in readiness in case of emergency.

The Steam Mains.

The steam will be distributed to the different buildings through an iron main pipe, running the entire circuit of the district, near the ceiling of the cellar, where practicable, with branches at the various points where heat or power may be required. There will be a second main also, making the entire circuit, located directly under the steam main, with similar branches, for bringing back to the boiler house the water of the condensed steam. These two pipes are intended to be located in the cellars, near the outer edge, or under the streets or sidewalks, where permission of tenants or property owners cannot be obtained to locate them in the cellars.

It is an easy matter to make the necessary openings through the brick or stone walls of the cellars. Two circular apertures, of about twelve inches, will be required; into each of these will be built heavy iron thimbles, through which the two mains will pass, and by which they will be supported. The walls will in no way be injured by this, but left as solid and secure as before. The mains will fill the apertures, and there need be no communication from one cellar or building to another. Access to the cellars need only be through the buildings by the ordinary ways.

For merely crossing from one block to another, a cylindrical hole will be bored through under the street, an iron or earthen thimble inserted, or a small tunnel built of masonry, of such dimensions and strength as to afford full protection, and leave to view all parts of the mains that will be ran therein. This will in no way damage, nor will the work interfere at all with the surface of the street.

Neither will the mains nor the branch pipes in any way interfere with the free use of the cellars, as they will be run overhead and close to the walls, and be altogether unobjectionable.

The mains and branches will be thoroughly covered with the best non-conducting materials, so that no heat will

be radiated from them, leaving the cellars as cool as though no steam-pipes were there. No reasonable objection can be offered to these two pipes being run from cellar to cellar; and it is not anticipated that any house-owner will refuse consent, at least to this much of the work, in view of the many evident advantages to be shared alike by owners and tenants; yet, in case of failure to get the necessary permission, resort must be had to laying the pipes under the sidewalk or street around such premises, the City Franchise granted our Company, giving us full and unlimited permission to do so.

An outlet will always be left on each of the mains at every house and building. On these will be put cocks so constructed that only the engineer in charge of the works, or one provided with a properly fitted key, can open or close them.

Where an occupant is not ready to adopt the steam, no further work will be done. At such time as may be desired the apparatus for that building can be attached without lowering the steam, or in any way interfering with its use by any other of the customers. These two cocks will control the entire steam for those premises.

Plugged outlets will be left at points in each apparatus where it may be desirable to have extra attachments made at any time.

Heaters on Hand.

Where buildings or rooms are already fitted with steam or hot water heating apparatus, the same can be simply detached from their boilers and attached to these mains without any other alterations, or may be partly or wholly changed to conform to the improvements here proposed.

The boilers that may be on hand will be paid for at a fair valuation and removed, or not, as the owner desires.

As nearly all dwelling-houses are supplied with flues built in the walls for furnaces, one of the essential parts of this plan is thereby provided. Where these flues are properly built, or where they have answered well for the furnaces, no alteration will be required to make them serve for the new arrangement. If any change in them is required, it will only be in the basement story.

By Mr. Baker's plan of concentrating the heat at the most effective points, and maintaining it there constantly, instead of wastefully diffusing it as by ordinary plans, the flues need not be of extra size.

Or, if *direct* radiation is preferred, the hot-air flues may be used as conduits for the steam-pipes to the radiators.

The cold-air ducts employed for furnaces can, in most instances, be utilized also for the new arrangement.

Air Permanently Excluded from the Pipes.

When first starting the heating works, all the air within the mains, branches and radiators will be exhausted, and permanently filled with steam or hot water.

The Radiators Placed in the Rooms.

Although any kind can be used, the writer proposes to have them entirely *out of sight*, and without any valves, whatever, upon them. The air-valve would be superfluous, because, during the season for heating, steam will never be allowed to leave the radiators—at least not low enough to form a vacuum for the air to fill. If repairs should be required, which is not likely in the absence of valves—(the only portion likely to get out of order and leak)—steam can be shut off for the purpose in the cellar, as before explained.

The control of the heat from the radiators will be accomplished by enclosing each one, or cluster of them, within a perfect non-heat-conducting casing, made air-tight, except an opening bottom and top for allowing the air of the room to circulate up through. A tight-fitting damper, or hot-air valve will be placed at the top, that can be easily operated with the slightest effort, having it full or partly open, to produce the desired temperature in the room; or this valve may be operated automatically by electricity, as stated elsewhere.

By this arrangement the heat of a room can be controlled much more conveniently and effectually than by steam valves, and by it we get rid of the objections which have given occasion to their being pronounced "*nuisances.*" When opened, the ready volume of heated air within the casing flows out and warms the room in the quickest manner; whereas, if the steam-valve has to be opened, considerable time may elapse before steam would reach the radiator, and when it does, its arrival is accompanied by a hammering and rushing noise, not at all pleasant to hear.

By our plan a single motion of the hand prevents the heat from entering the room. Steam valves seldom close tightly after wear, and, in consequence, steam will leak through into the radiator, even though the valves be closed, and the heavy mass of heated iron will be a long time in cooling. Another objection to the use of valves is the annoyance of burning the fingers and straining the wrist in turning them.

The casing of the radiators can be made of elegant design, or of style and finish in keeping with the furniture of the room. This cannot be said of any radiator devised of raw iron, although the paint and bronze (heat-retarding and unfragrant) be applied to them in the most "artistic" and lavish manner. Nothing but the bare, clean iron will compose the encased radiator. The radiator, including its covering, will be *cheaper to construct* than any "ornamental"

iron one with their steam valves, air-valves, "drip pipes," etc. The same amount of surface will do more heating in this position than in any other, because, although the heating process is, as with the uncovered radiator, by air currents, yet the current is *stronger* and more *positive* when placed in this form—that of a *flue.*

The Radiators Placed Below the Rooms.

By this plan the out-door air will be brought into a chamber enclosing the radiators. There the air will be heated and conducted through flues up into the apartments that are to be warmed. By a simple and inexpensive arrangement (to be described hereafter) the heat can be controlled automatically by electricity, and kept at any temperature desired. All this can be arranged to suit the special requirements of any room and the wishes of its occupants.

Automatic Regulation of the Heat BY ELECTRICITY.

The most important objects in artificial heating are, first, *to obtain the best quality of heat;* and, secondly, *the proper quantity.* The first can be practically secured by the use of good hot water or steam apparatus. The second has never before been attained, and the want of it is the bane of all heating arrangements. Our rooms are hot one hour and cold the next. And these extremes (a prolific subject for a medical discourse) have yielded rich harvests for the doctors and the grave-yards.

The proper regulation of the heat in the rooms cannot be effected by any adjustment of steam valves. The manipulation of the valves (usually three in number) on the radi-

ators or coils, to keep the heat *exactly right*, by the present modes of steam heating, would almost require the presence of a skillful engineer in every room. Besides, it is well known to the trade that no steam valve has yet been made that will remain tight enough to be trusted over a good floor or carpet.

It is imperatively demanded that some reliable device be furnished whereby the temperature of living rooms may be kept at the desired point without the attention of the occupants—leaving them free from this care while attending to their household or office duties. The most important point, the heat of the rooms, is left to *mere chance.*

We must have *an automatic regulation of heat, and a corresponding consumption of fuel.* This is accomplished only by the aid of electricity.

By this process the temperature of a room can be kept at an *unvarying point.* The arrangement is applicable to radiators placed directly within the rooms, as well as to those placed below. In both cases the heat of the rooms may be governed by a damper placed over the radiator (as already referred to). When the radiators are placed within the rooms, this regulator will be attached inside of the covering, no part of it, except the *dictating dial*, being in sight. Where the heating is through flues, as by the indirect plan, the regulating damper is placed below at the mouth of the flue and operates as follows: When the air of the room is too cold, the damper will turn so as to let the warm air in, and, at the same time, shut the cold air out. When the room is too warm, the damper turns so as to shut out the warm air, and to let in the cold air through the same flue. Thus the circulation of the air into the room, and ventilation, are not stopped as by the closing of the ordinary furnace registers.

This operation is dictated by an electric thermostatic hand and dial, an ornamental fixture resembling the face of a small clock. It is placed within the room; and the

hand is moved so as to point to the figures representing the number of degrees of heat required. For instance, if the room is to be kept at the desirable temperature of 70 degrees, the hand is simply to be placed at those figures on the dial. The air in the room will then be kept steadily at that temperature. The expense of this device is trifling, while the benefit and comfort resulting from its adoption are incalculable. The batteries and conductors used for telegraphic purposes will answer also for this. The attention required will be small, and no extra help will be necessary.

Hot Water Heating.

There are several ways in which the steam can be made to perform the service of heating. Where it is desired, *hot water* can be used in the radiators instead of steam for warming an apartment, the steam being employed as the medium for heating the water. This is accomplished in a simple manner, at a small additional outlay, and it involves no mechanical complication, nor extra care in management.

The principal advantage of hot water as a heating agent is, that *any required temperature can be obtained from it.* It may be kept at a very low temperature, just giving a perceptible warmth to the radiators, or it may be heated to the *highest point;* or graduated to any lower temperature. *Steam* radiators can never be *moderately* warm. They must be either *cold* or *hot.* The temperature of steam being 212 degrees, this heat, which is necessary to its existence, is often too high for the temperate weather of the fall and spring. Hot water, on the other hand, can be graduated to meet the changeable weather of this climate. This, and its *heat-retaining* quality, make hot water an admirable heating agent, especially for private dwellings, and where the *very best* heating qualities are demanded.

Sand-Packed Radiators.

A device whereby sand is substituted for producing the heating effects of water in the use of steam; and the saving of steam pipe.—In this arrangement, each tube, or each section of the radiator, is encased within another tube, and the space between firmly packed with dried sand. The outer tube is usually made of thin galvanized sheet-iron. The inner, or steam tube, can be of any size, and the layer of sand surrounding it can be of any thickness to serve the purposes that may be desired of it. The smaller the steam tube, and the thicker the sand-layer, the slower and more lasting will be the heat radiated from them; while the larger the steam tube, and the thinner the layer of sand, the more rapid, intense, and less lasting will be the heat.

Mr. Baker has found, by experiments, that a 1¼-inch steam tube, and a 4-inch pipe outside, with a packing of 1¼ inches of sand between, is the right combination for direct radiation, and will, for most indoor places, prove as effective a radiator as a 4-inch pipe actually filled with steam at the same pressure. Thus, an inch-and-a-quarter pipe, with a slight additional cost, may do the duty of a 4-inch steam pipe.

The radiators are made of these dimensions for all the cars of the Elevated Railroads (600 in number), which have been most satisfactorily heated during the past three winters. Here they are unprotected, running the whole length of the cars, under the seats, near the front edge, exposed to the drafts of cold air forced in by the motion of the train and the frequent opening of the doors. Yet, in spite of these severe conditions, they have kept the cars most agreeably warm in zero weather, and that with a light head of steam from the locomotive. A cold radiator of this kind, charged with steam at 50 lbs. pressure for 25 minutes, in ordinary winter weather, has

yielded an effective heat for the space of three hours after steam was excluded.

Radiation being from the centre outwards, the outer pipe will actually *increase* in heat for some time after the steam is shut off. When enclosed in the rooms, the size of the steam tube should be about ¾ of an inch, and the thickness of the sand packing diminished proportionally. But when placed below to heat cold outdoor air for the apartments, the proportions of the steam surface and of the sand should be so as to favor the most rapid radiation of heat from them.

The sand in these radiators will absorb heat from the hottest steam to any extent up to saturation; and will hold the heat in store and gradually impart it, either at a high temperature (almost equal to that of the steam itself) or at any point in the descending scale to that of tepid water.

Thus these radiators possess all the good qualities of hot water radiators,—and *more*, for their heat is *more enduring;* and they will also not allow the condensed water of the steam pipe within them to freeze, because of their large heat-retaining qualities; and the protection they afford the steam pipe by the jacket of warm sand around it.

HOT WATER MAY BE EMPLOYED to circulate through the inner pipe and heat the sand instead of steam; and, for the same reasons cited in the use of steam, the water is not likely to freeze in the radiators when placed within a tolerably well protected building—even though the fire be out.

So it must be seen, from the nature of these radiators, that they are admirably adapted to heating dwellings and all places in which it is desirable to have the very cheapest and best heat, free from impure mixtures, tempered and varied in temperature according to that of the weather, suited to the conditions of the living apartments, and to the requirements of the inmates.

Hot Water may Generate Steam.

In a confined condition, and where perfect circulation can be secured, water can be heated to an almost unlimited degree. So, when it may be desirable to use steam in buildings where the water is employed for heating, the water may in turn be made to generate steam. This is simply and readily accomplished without the aid of any machinery—as Mr. Baker has proved by its employment by him in this manner for several years past.

Steam Power.

For running elevators, engines, household machinery, and for mechanical purposes in general, steam in abundance will *always be on hand*, day and night, the year around. It may be taken out for use at any desired point.

Cooking.

For cooking, this steam is admirably adapted, being very hot and dry. Boiling, baking, broiling, roasting, and all kinds of cooking can be accomplished by it, as well all other domestic operations, such as washing and ironing, boiling water in kettles and tanks, and providing the hot water for the house in place of the water back of the kitchen range. *All fires*, and all of the present cumbersome cooking and laundry paraphernalia can be dispensed with. By the simple opening of a valve or two, heat for these purposes will be instantly at service. A full assortment of steam cooking utensils will be supplied by the Company at a low cost.

Thawing Ice and Snow.

The freezing of pipes, and the accumulation of snow and ice in gutters, and on the sidewalks and streets, are annoyances with which all the inhabitants of our Northern States have to contend. Steam supplies a quick remedy. By opening a single valve in a pipe to which a hose is attached, and by directing the nozzle so that the steam will blow against the frozen pipes, or under the ice and snow, the difficulty will rapidly disappear.

For clearing the streets of snow and ice, outlets should be left at intervals of about one hundred feet, so that a hose of this length attached can sweep an area of two hundred feet and the width of the street. For this service, it is expected that the city will pay the company a large annual sum. The same outlets and hose can easily be connected with the water pipes, and be used in summer for washing or sprinkling the sidewalks and streets.

For thawing out leaders and gutters, a small pipe will be laid with an open end just entering the bottom of the leader, so that by opening a valve placed indoors, a current of steam will be liberated which will soon melt its way through.

Electric Signals.

There may be a complete set of apparatus in this system for signaling to the engineer, attendants or watchmen. Electric buttons will be placed upon the wall, by simply pressing upon which the engineer can be notified that the services of himself or assistant are required; and a code of signals will be arranged to signify the nature of the demand.

Automatic electric signals may be employed to keep the engineer posted as to the temperature of the rooms.

Bells may be rung, or discs moved, to indicate the particular room in which the temperature has fallen or increased beyond the limited point.

Automatic Extinguisher of Fires.

There may be attached to each radiator, or to a branch pipe run into the room for the purpose, a small arrangement, hardly large enough to be noticed, by which the mere overheating of the air caused by a fire will let the steam escape into the room. The room will be filled with the vapor almost instantaneously, and the fire will be extinguished in the quickest, most effective, and most harmless manner.

Electric Lighting.

One of the most important of the auxiliary uses to which this system of furnishing heat and power can be applied, is that of Electric Lighting. The electric light will come into universal use as soon as the proper lamp is perfected (even though it may be no cheaper than gas), on account of its greater beauty, convenience, and healthfulness. The great objection to gaslight is that it contaminates the air in proportion as it illuminates it; and the unhealthful heating of the same. The principal objection now to electric lighting is the *expense of running the engine* for developing or "generating" the electricity. This objection is obviated in this system. Steam for this purpose will be supplied from the boilers used for heating purposes, at a very small increase of cost. The light being needed only a small portion of the time, the same attendance required for the heating will suffice for this purpose. It is doubtful whether it will ever be practicable to light more than a small district from one station, economically.

Telegraph and Telephone.

This system will also supply telegraphic communication to any part of the block or square, for business or social purposes; for giving an alarm to the engineer on duty of the presence of burglars in any of the buildings; or for announcing the outbreak of a fire. For this, the main feature of security, the burglar and fire-proof electric conductors, are provided the substantial steam pipes that make the circuit of all the buildings. Their conducting power is of the best. The burglar cannot clip them with his pliers; nor can fire disqualify them before they have performed their duty.

THE TELEPHONE has also in the steam pipes its essential feature, a reliable transmitting medium.

The Air Automatically Moistened.

As the colder the atmosphere, the less humidity it contains, it is desirable to furnish it, when heated artificially, with that amount of moisture it would contain if rarified by Nature's process—the summer sun. For this Mr. Baker has a most effective and simple plan, whereby water self-imparts its vapor to the air in proportion as its rarified condition is lacking in moisture.

A HYGROMETRIC THERMOSTAT, or Electric Circuit Closer (an entirely new invention by Mr. Baker), may be placed within the rooms, and, by its adjustment, the air within, as respects humidity, may be kept at any point desired.

FILTERING THE AIR before being heated may also be accomplished in several ways; but frequent substitution or cleansing of the filtering subtances will be required to make any plan of practical utility.

Fans for Cooling.

As we are as much too warm in some seasons of the year as we are too cold in others, there is no reason why resort should not be had to mechanism for counteracting the one discomfort as well as the other. In connection with this system, air ducts can be run to all desirable points, such as the principal living rooms; and air may be driven through them by fans or blowers run by the engine (a large portion of the boiler capacity being idle at this season of the year), and these ducts may connect with the upright ones that convey the heated air to the rooms in the winter by the indirect radiation plan. These air ducts should run underground, in the cellars, so that the air may be cooled in passing through them.

A Substitute for the Hand Fan.

A single air tube, an inch or so in diameter, run to some convenient point in the room, at about five feet from the floor, connecting with a short elastic tube with a sprinkler-shaped nozzle, would be a good substitute for the hand fan. The person making use of it has only to sit near and direct the air in a most agreeable cooling spray; or the outlet may be fixed, and an occupant of the room may sit in the line of the current; or more than one of these fan tubes may be provided so that several persons can enjoy them at the same time. The expense would be trifling compared with the plan of setting *all* the air of the room in motion; and each occupant can be suited as to the *amount* of individual ventilation.

Fans for Heating and Ventilation.

When desirable, the blower may be run in cold weather to force air through the same ducts and accelerate the flow of warmed air upwards from the indirect radiators. The cold, out-door air, would thus be somewhat tempered in passing through the now comparatively *warm* flues under ground. This plan has the advantages of producing a positive and regular flow of air in spite of winds or other disturbing conditions of the weather. For hospitals, and where the *most thorough ventilation* is demanded, the blower would be almost indispensable.

Electric Boiler Alarm and Recorder.

This invention is a guide for and a check upon those in charge of boilers. It will furnish valuable data at headquarters as to the conditions of the various boilers of the company. It will not only ring an alarm bell in the office, or at any distant point, automatically, but also *record*, on a dial the number of times the water in the boiler has been too low, or the pressure of steam too high. The *recording* of these facts is important inasmuch as the counting-room or office in which the bell and register are located may be unoccupied at night, and at intervals during the day when the ringing of a bell would not be heard. The recording hand will be found at all times pointing unerringly to figures showing the number of times the water in the boiler has been neglected, or the pressure of steam allowed to go beyond a fixed limit. A bell and recorder may be worked in the engineer's room as well as elsewhere. Simple pressure on a push-button will indicate if the apparatus is in working order, or not.

III.

Advantages of this System.

A general comparison between this and the common modes of heating, shows that there would be as great a saving of expense, and as great a corresponding gain of comfort and convenience in the employment of steam from a single source, on a large scale, as in the use of public gas or water. Below are enumerated some of the advantages assured to the patrons of this system:

No heating apparatus to furnish.

No fuel to supply.

No fireman to employ.

No ashes or cinders to remove.

Heat, abundantly and constantly supplied, without any care or attention.

Minimum risk of fire, and lowest rates of insurance.

The convenience, comfort, and health of the occupants greatly promoted.

The services of faithful and competent engineers, and vigilant watchmen, at hand at all times.

No smell of coal gas, no ashes to remove and no dirt and noise from the management of furnaces or stoves.

No need of the time-honored, though dangerous, dirty, and expensive open-fires.

It is as practicable (and far more important) to have a general distribution of the means for heat and power, as it is to thus distribute gas or water, as is now done. The pliant fluid STEAM, possessing as it does HEAT AND POWER to a greater extent than any known agent, is admirably adapted to flow long distances from its sources —the few clusters of boilers placed at convenient locations to receive the *coal*—the substance which of itself is valueless, except for HEAT and POWER that can be

distilled or *manufactured* therefrom. Why, then, cling to the old, inconsistent custom of CARTING COAL through our already overcrowded streets, while a single tube of moderate and practicable size will noiselessly convey to every desired point, FOR ALL PURPOSES FOR HEATING, POWER, AND COOKING, STEAM (*the best representative of fuel*), that embodies all that is desirable in hundreds of tons of coal that would otherwise have to be carted OVER AN AREA OF THE CITY EQUAL TO ABOUT A HALF MILE SQUARE? Besides avoiding the nuisances of two trips of dirty, unsightly carts through our streets—*one to bring the coal*, the other to take it awa.,—or what is left of it—ashes and debris. A GREAT SOURCE OF CLEANLINESS AND HEALTH, the avoidance of the smoke that hangs heavily over cities, (especially over Western ones) during all the season when artificial heat must be furnished our dwelling places, factories, etc.

ONE SMOKE STACK, ONE COAL DEPOT WILL TAKE THE PLACE OF THOUSANDS.

PLUMBERS' BILLS WILL BE AVOIDED, as the *constant heat* will not allow the premises to get down to freezing point, and special pains will be taken in running our mains, either under the streets or in the cellars, to run them under or contingent to the water-pipes.

BY DOING AWAY WITH ALL FIRES, except at the boiler departments, the tens of thousands of chances for firing our premises, that we now stand in hourly dread of, will not exist.

CHEAP HEAT, with the entire absence of danger from fire, can be furnished to all the POORER CLASSES cheaper by far than the purchasing of coal by the hod, or kindling by the bundle, at the nearest grocery store.

CHEAP POWER, as no boiler will be required, no engineer to be employed; and steam made at *wholesale* can be afforded at a price, and at such convenient points that any householder will find it—besides a *mechanical luxury*—an economical agent for running washing, wringing, sewing and other domestic machinery—the simple turning of a valve on a small steam pipe that will project through the wall, by our customers will substitute a steam boiler.

Compared to what they might and should be, THE PRESENT MODES OF HEATING BUILDINGS ARE SCARCELY BETTER THAN NUISANCES.

Although a luxury in comparison to utterly cold houses, yet the best constructed heating arrangements are annoyances, comparatively, to the real healthful enjoyment, that steam or hot water are susceptible of giving when the objectionable portions—the furnaces, fire and dirt part—as well as the necessarily incompetent and *chance* management of the fires and apparatus are dispensed with. It is a fact that thousands upon thousands of householders will bear us testimony, *that a real cold snap brings with it more discomfort (the derangement of heaters, &c.) in the household or the office* than any other matter connected with them.

VENTILATION.—Although the need of special ventilation in our dwellings will, by the adoption of our system, not be necessary, yet a smaller flue (and less room required in the building) can have its draught, increased by the simple insertion of a small steam pipe within it.

In buildings, as now constructed, much space is necessarily appropriated to flues to promote combustion, and for ventilation, not required where our system is

used. Under this system, smoke flues will be unnecessary, consequently there will be not only an economy of cost in their construction, but a great economy of space.

When the present modes of heating are superseded by this system, the various nuisances attending the RETAIL COAL TRAFFIC, and the unsightly yards employed therefor, will be occupied for more valuable purposes.

It is conceded that the EXHALATIONS OF FOUL GASES FROM DRAINAGE PIPES in our dwellings is a fruitful source of various diseases—denominated Zymotic diseases, and reports from the most authentic sources in Europe and this country show that more than *twenty per cent. of the whole number of deaths are from those disorders.*

The interior surfaces of these pipes are coated with putrescent matter, deposited from the fermenting processes, and the small amount of cold water which is let into them from water-closets to drive away the excremental matter deposited in the basins is not sufficient to eradicate the matter.

THE SOLVENT PROPERTY OF HOT WATER is required for that purpose. SCALDING WATER OR STEAM *is a sanitary necessity in such cases*—its application will quickly restore them to their original pure condition.

With this convenient remedy at hand, *for the public health*, this system of heating will in time be regarded an *invaluable benefaction.*

Great advantages will accrue from CENTRALIZING THE SOURCES OF THE SUPPLY OF POWER. Danger lurks under the pavement, throughout the business districts of the city, from steam boilers, (*our city is literally undermined with them*); they are attended for the most part by men possessing little engineering skill — the position not warranting the expense of competent engineers.

Some figures as to the saving to be effected.

An ordinary sized square, of say eighty houses, each 20 by 60, and four stories high, would contain about 3,840,000 cubic feet of space to be heated; and cover a distance of about 2,000 feet for the mains to run. To erect in each of these houses a separate good steam heating apparatus would cost about $1,300, $300 of which would be for the boiler and its attachments. On the wholesale plan proposed, the cost of apparatus sufficient to do the same amount of heating, would not exceed $500 for each house.

In the consumption of fuel for heating, cooking, washing, &c., by the common modes, an average of about 30 tons of coal, and two cords of wood a year would be consumed and wasted in each house, making a total of 2,400 tons of coal, and 160 cords of wood. Taking coal at $4 per ton, and kindling $12 a cord, put into the cellar, the total cost per year by the old plan would be $11,520, or $144 for fuel alone for each house.

By this plan, the consumption of coal to heat the entire square from one source, would not exceed 500 tons; and only wood enough would be required to start the initial fire. The expense of coal, at say $3.50 per gross ton (bought by the cargo), would be $1,750 per annum, or $22 for each house. Account is not here taken of the necessary expenses of attending the heater or furnace in each house; putting in the coal and wood; cutting up the latter; taking out ashes; sweeping the sidewalks; to say nothing of the *liability* of *short weight* or measure in the furnishing of the fuel.

The cost of labor for constant attendance on the apparatus for the whole square would be, for two skilled engineers and four firemen or attendants (one-half to be on duty during the day, the other at night);

engineer's wages, say $3 per day of twelve hours, and $1.50 for each fireman, a total of $12.00 per 24 hours, or less than 8 cents for each house per day, or about 15 cents for 24 hours.

It is evident from these, and other comparisons which could be truthfully made, that, by the adoption of this plan, a grand *saving of three-fourths* of the present cost of heating would be effected. On a still larger scale the saving would be proportionately greater.

Safety from Fire.

When the fires are removed from the house, all danger from that source is removed also, except that from illumination and the matches used therefor. From investigation by the Fire Department, it has been shown that fully three-fourths of all fires that have occurred in New York City, were traceable to defective furnaces or furnace flues.

The lamentable loss of life from fires, and from the burning of buildings, should be seriously considered.

The death from fire caused by a defective hot-air furnace, of a gentleman and his wife, in their own palatial dwelling-house, in one of the best portions of the city, must be fresh in many minds. Yet this is but a single instance in a long and sad record.

Gain of Valuable Space.

By removing the heating apparatus from the cellars, one of the most valuable portions of the building will be left free to be occupied for its proper and legitimate objects. It is well known that the placing of heaters, coal bins, ash barrels, coal sifters, kindling wood, etc., in the cellar of a building, especially of a dwelling

house, not only consumes the greater part of the available space there, but disqualifies the remaining room for use in keeping meat, vegetables, wines, sweetmeats, vinegar, cider, and other provisions which can only be well preserved in the cool, dry and natural atmosphere which the secluded cellar alone affords. With the introduction of this system the cellar will be cleared of its present heater incumbrances and rendered available for other purposes. Valuable space may be saved throughout houses, also, by the removal of stoves and their attendant implements.

No Loss of Heat—Constant Heat.

All the water condensed from the steam in the mains, branches and radiators, will flow back by its own gravity into the boilers; or will be pumped back, hot, to be reconverted into steam. It requires only a few degrees of heat to convert the returned hot water into steam again in this arrangement, and there can be but a very small, if any, waste of heat. Fuel is immensely economized by not being drawn upon to heat the cold water which would otherwise be required to replenish the boiler. (The boilers of steamships do not now burn half the fuel they did before the adoption of this principle of reconverting the water into steam.) Economy will also be effected by the smaller size of the boiler required; and the saving of water.

There will also be economy in the *Constant Supply*. In the consumption of fuel, it is more economical in all instances to keep the buildings warmed at *all* hours. Heat is lost by allowing the rooms to cool off. The walls, ceilings and furniture become, as it were, radiators of *cold*, rather than of heat. The same is true of steam-pipes, radiators and boilers. In order to regain the heat that

would be lost by dropping the fires, draft must be heavy upon the steam before the air of the rooms can be sufficiently warmed. The consumption of fuel in keeping up a minimum amount of steam for short periods, such as during a night or day when not wanted, is less than would be necessary to make good the loss of heat by drawing or "banking" the fire of the boiler for that length of time.

Constant heat has other important advantages besides economy. Nothing is so discomforting, especially in dwellings, as to be without heat when it is needed, or to have its supply uncertain or irregular. In case of sickness, or unlooked for emergencies on cold nights and early mornings, a ready supply of warmth may often prevent fatal consequences.

For power purposes, great inconvenience and loss have been occasioned to manufacturers and others who cannot have at their control the power they depend upon for their business.

Freezing of Pipes Prevented.

Who that have depended upon steam to heat their buildings—(notably stores and factories)—have not found on extra cold mornings,—especially *Mondays*—not only a cold counting-room and store, but *frozen steam pipes, frozen water pipes*—no water for the boiler—the boiler perhaps "burned out"—to say nothing of thawing out—flooding the floors with *water*, and the rooms with *steam*—damages to goods; and the inevitable delays and heavy expenses involved by this condition of things.

All of this will positively be avoided by this system; for steam will never be out or *low*, and the engineer in charge at headquarters, or his assistants, will see that every

thing connected with the *entire heating works* is in proper shape—as much so as though a faithful man was constantly on duty in each of the buildings.

Comfort versus Discomfort.

If heed were given to one half the truths that have been uttered concerning the evils of the common modes of heating, particularly that by *Hot-Air Furnaces*, the registers which discharge their vicious current into our rooms would be closed forever. A cold house would be tolerated rather than breathe the hot, dry, gaseous, poison-laden air sent up from these "*fiery furnaces of death*," put in by the contractor on the sole merit that they *were cheap*.

Even with good steam or hot water heaters, where their treatment is left, as it usually is, to the caprice of ignorant and unfaithful servants, little more comfort can be expected. In the morning heat is not up, (*nor are the servants*,) at *just* the *time*, and, perhaps, the *only* time when heat is wanted during the day. By noon, when the weather may be mild, fuel has been wasted in heating the house throughout to a suffocating degree. At night, the fire too early goes out,—because the *servants* have gone out also. Or, when the fire is "fixed for the night," the escaping gases from the fresh coal, indiscreetly piled on, leak up, with the fumes of the cellar, through the registers, to pollute the air of the rooms. The inmates of the house suffer and the seeds of disease and death are abundantly sown.

And there cannot, from the very nature of the case, be any improvement in this department until the *obnoxious part* of the heating paraphernalia,—the furnace with its fire and attendant nuisances,—is removed bodily from the premises, and the old, antiquated, individual heating system abandoned. The extremely cold weather which most

necessitates attention to the heaters, also imposes additional labor on the servants; and even if they had the time at the right hour, they have not, nor never will have, the *ability* to properly attend to this most important matter. By the adoption of this system, every separate householder will have, in effect, a skilled engineer in his employ, whose exclusive duty it will be to attend to the heating apparatus, day and night. The supply will be the most ample when it is most needed. The heated air will be pure, fresh and healthful.

Each occupant, of course, will have the means of controlling the heat at pleasure. It can be let on or turned off, wholly or in part, from any room. It can be regulated so as to have the temperature uniform throughout the house; or different temperatures in each room may be produced; or heat can be entirely excluded from any portion of the house.

By the laws of gravity, the air of the cellar with its coal gas, coal dust, smoke, ashes and smells, will inevitably find its way up through the house, by the present modes! While better ventilation will be secured by the new system, most of the evil will be overcome by *removing the cause* of the foul air, which now makes copious ventilation necessary. With no heat in the cellar, and no fire in the kitchen, nearly all the upward draughts of air will be prevented, and the fumes from the cooking will be much less liable to find their way up through the house. Doors may be left open, ventilating flues may be allowed to draw, and windows may be opened without increasing the upward flow of unpleasant odors from below.

The nuisances of the present methods begin when the coal cart dumps its first black load upon the sidewalk, and the wood wagon discharges its contents in the same inconsistent place. After both have been deposited, amid dust and din, the shoveling, shaking, sifting and raking

of the household stoker begins. The sidewalks are encumbered with ash barrels and the debris of the furnace, while gusts of wind blow the ashes through the street and back into the house; and thus these domestic discomforts are prolonged till warm weather comes to the rescue.

How Customers will be Charged.

An equitable rate, based, as nearly as possible, on the amount of steam actually used by each one, will be charged. For heating the rooms, the square feet of radiating surface will be the basis of charge, the tenant having the privilege of using it more or less as desired. For power, cooking, and the like, where the steam is actually taken out and not returned to the boilers, the *area* of the outlet or valve, and the *length of time* it is used, will be the basis of charge.

This Plan May be Applied on a Smaller Scale.

FOR ANY SMALLER NUMBER OF BUILDINGS than contained within a block or square, this system is entirely practicable and desirable. A party of two or more may unite, and by so doing partake of a portion of the advantages of this system.

IT IS NOT REQUIRED, OF COURSE, TO EMPLOY ALL OF THE IMPROVEMENTS and novelties that are explained or referred to as applicable or desirable constituents of the system. All, or any one of them, can be adopted, from time to time, at the wish of the tenants or owners.

OTHER SYSTEMS FOR HEATING CITIES.

A few words should be said, by way of comparison, regarding other "systems" for heating cities by steam, one or two of which are claimed, by shrewd business men, to have already passed the point of doubt as to their financial success. They propose to heat from too small a number of sources. All of their steam mains are buried under ground in the streets. THEY ALLOW ALL THE WATER OF THEIR CONDENSED STEAM TO ESCAPE AND BE WASTED, THUS INVOLVING A LARGE EXPENSE FOR WATER SUPPLY, and produce other objectionable features. Their system involves a great waste of pipe, and suffers a great loss of steam by their plan of laying all the mains under ground, and the length of the branches necessary to reach the buildings. THIS EXPENDITURE OF MATERIAL AND STEAM WILL APPROXIMATE THE AMOUNT REQUIRED TO HEAT THE BUILDINGS THEMSELVES. These mains and their branches are peculiarly liable to get out of order, and, being out of sight, the break or obstruction will be difficult to discover. Not only is a wasteful escape of steam liable, but the repairs required must, from the nature of the case, be of the most expensive kind. The protection of their pipes is bad, as practically shown in the city of Troy, Springfield, and in other places the past and present winter, where the line of the pipes has been distinctly indicated by the melted snow in the streets above them, and the frequent and expensive repairs required. The expenditure for boilers, and the cost of fuel for heating the cold water required to replace that which is constantly being exhausted, must be nearly double what is required in the system here proposed.

The Hot Water System for Heating Cities.

A plan which is yet untried, except through a comparatively few feet of small mains without branches, is proposed, whereby water heated in the boilers is to be pumped through the mains and distributed for heating and power purposes, instead of steam. The undemonstrated proposition of "liberating steam from water" at points where engines or machinery are desired to be run; the complicated and delicate machinery necessary for "measuring" the quantity of water or steam used, as proposed; and the expense for the lavish expenditure of water in drawing it out for use by the customers, as proposed by this system, are objections which render this project altogether impractical.

There are, also, several other useless contrivances, mechanical complications, and impracticable features connected with both of the "systems" here spoken of, which we respectfully submit, leave them far behind, in point of merit, the one we have endeavored to have understood in this brief pamphlet.

Mr. Baker's system, as explained in these pages, embraces patents to him, and improvements in

ELECTRIC TEMPERATURE REGULATORS;

ELECTRIC BOILER ALARM AND REGISTER;

CALORIC STORAGE RADIATOR;

A BOILER WHOSE SURFACES ARE ALL EFFECTIVE OR DIRECTLY WITHIN THE FIRE;

A DEVICE FOR CONTROLLING THE HEAT FROM RADIATORS WITHOUT THE USE OF STEAM VALVES;

A METHOD FOR GENERATING STEAM BY RADIATION FROM HOT-WATER PIPES;

ELECTRIC LIGHTING IN CONNECTION WITH HEATING;

TELEGRAPHIC AND TELEPHONIC COMMUNICATION IN CONNECTION WITH HEATING;

COOLING APPARATUS FOR SUMMER IN CONNECTION WITH HEATING APPARATUS;

AUTOMATIC EXTINGUISHING OF FIRE BY STEAM IN CONNECTION WITH HEATING;

DEVICE FOR CLEARING SNOW AND ICE FROM THE STREETS BY STEAM IN CONNECTION WITH HEATING;

And many other inventions, particularly adapted to extensive heating apparatus.

Mr. Baker has demonstrated, by actual practice for years, that

BUILDINGS AND BLOCKS CAN BE HEATED BY STEAM, WITHOUT WASTE OF WATER FROM THE BOILERS OR PIPES.

He has also demonstrated, by actual practice, that THE SAME HOT WATER MAY CIRCULATE THROUGH THE MAINS AND GENERATE STEAM AT ANY POINT WITHOUT LESSENING THE QUANTITY OF WATER THUS CIRCULATING.

Mr. Baker's inventions make a complete and perfect system for supplying heat and power over large areas *without a single device of any kind belonging to any one else, or to any other system.*

The simple laying of pipes under ground, and driving steam or hot water through them, constitutes but a *fragmentary portion* of a plan for the purposes heretofore named.

A "system" pre-supposes a combination of every essential thing needful to supply the cheapest and most equable heat of any required intensity, with regularity, in the simplest mode, attended with the least possible care, and to give to customers the amount of power they may respectively require, coupled with equitable modes of measuring the amounts of heat and power used. The inventions which Mr. Baker has made to effect such a system, united with many years of actual practice in the business of supplying heat and power on large scales, (many of his pipes being laid under ground), should be regarded by the public as a guarantee that his system is entitled to the most favorable consideration.

The most important considerations connected with this subject, and that which naturally most interests the customer, are, first, as to the qualifications of the party who propose to enter the premises to erect or attach the required heating fixtures therein—whether they are competent for this most particular, if not the most *difficult, part of the "system."* Whether the heat-imparting parts to be placed within the premises are *just what they should be*—of right dimensions; placed at the most desirable and effective points; made tasteful in appearance, and not liable to leak or otherwise get deranged. Whether the workmen on the indoor work will be honest, civil and courteous.

We are confident, that from Mr. Baker's long experience in this special branch, "fittting private dwellings with steam and water heating appliances, and the many new and desirable fixtures he proposes to introduce in connection with his Extended Steam System," unusual inducements, will be offered to those who avail themselves of the advantages here spoken of.

Mr. Baker's system, as herein partially explained, has been exclusively adopted by the UNITED STATES HEATING AND POWER COMPANY, to whom has been granted THE ONLY IRREVOCABLE AND UNINCUMBERED FRANCHISE FOR LAYING STEAM PIPES UNDER ALL THE STREETS, ALLEYS, LANES, AND SIDEWALKS, IN THE CITY OF NEW YORK; and Mr. Baker's entire services have been engaged as chief superintendent of all the mechanical work connected therewith.

THE UNITED STATES HEATING AND POWER COMPANY, (as its name implies,) will negotiate for forming companies, or making contracts for the introduction of their system of heating into any other city or town within the United States.

THIS COMPANY WILL ALSO DO ALL KINDS OF WORK IN THE STEAM OR HOT WATER FITTING LINE. They will equip buildings not already supplied with steam fixtures, or alter those that are now in, that may be unsatisfactory.

DODGE, POTTER & CO.
BANKERS
AND COMMISSION MERCHANTS
NEW YORK.

For further particulars, enquire of

W. C. BAKER,

(LATE OF BAKER, SMITH & CO.,)

Supt. United States Heating & Power Co.