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THE

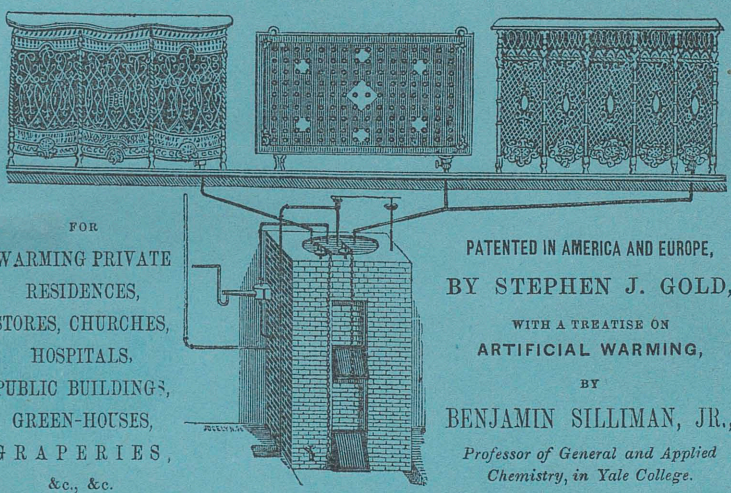
NEW-YORK STEAM HEATING CO.

PROPRIETORS OF

GOLD'S PATENT LOW PRESSURE

SELF-REGULATING

STEAM HEATING APPARATUS,



FOR

WARMING PRIVATE RESIDENCES, STORES, CHURCHES, HOSPITALS, PUBLIC BUILDINGS, GREEN-HOUSES, GRAPERIES, &c., &c.

PATENTED IN AMERICA AND EUROPE,

BY STEPHEN J. GOLD,

WITH A TREATISE ON

ARTIFICIAL WARMING,

BY

BENJAMIN SILLIMAN, JR.,

Professor of General and Applied Chemistry, in Yale College.

MANUFACTURED AND ERECTED BY THE

New-York Steam Heating Co., 442 Broadway, N. Y.

New-York:

W. H. ARTHUR & CO., PRINTERS AND STATIONERS,

No. 39 Nassau, and 56 Liberty-Street.

1859.

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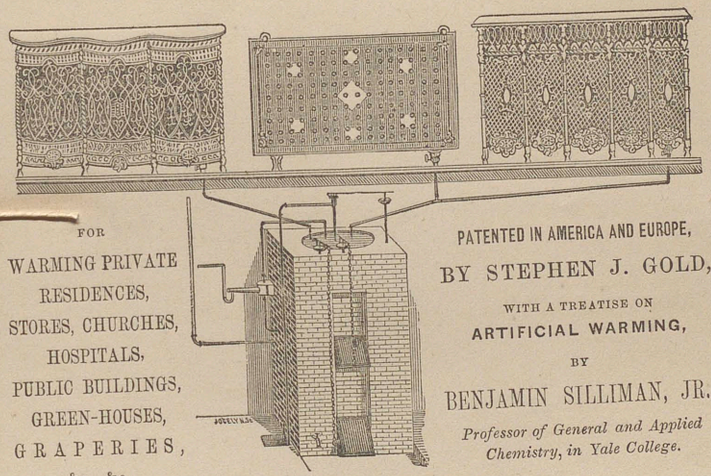

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New-York Steam Heating Company,

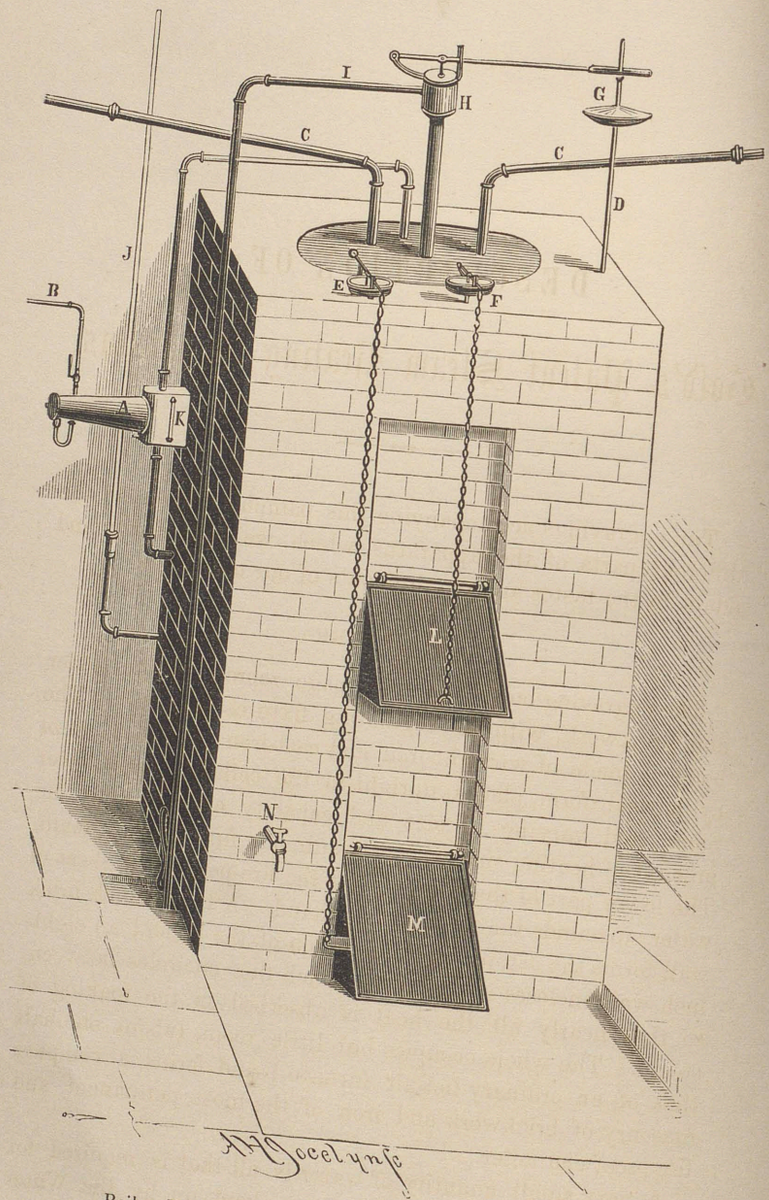
INCORPORATED JUNE 17th, 1858.

CAPITAL, $200,000.

TRUSTEES.

DAVID RYDER,
DAVID M. HOLDREDGE,
LEWIS M. HILLS,
EVERETT A. CARPENTER,
JOHN D. MORIARTY.

LEWIS M. HILLS, PRESIDENT.
DAVID M. HOLDREDGE, SECRETARY AND TREASURER.



Boiler, Brick-work, and Regulating Attachments.

DESCRIPTION OF

Gold's Patent Steam Heating Apparatus.

THE engravings accompanying this pamphlet represent the different parts of the apparatus, which we can modify and adapt to the tastes and requirements of our customers.

THE BOILER.

The engraving on the opposite page represents the Boiler and brickwork, with the regulating fixtures attached. The boiler is made of wrought-iron and cast-iron combined; is of cylindrical form, placed upright in the cellar or some lower room, and varying in size and capacity according to the amount of heating surface it is required to furnish with steam. The lower part of the boiler forms the fire-pot, and a sheet of water surrounds the fire on every hand. A twelve-inch brick wall forms the ash-pit and foundation of the boiler; an eight-inch wall encloses it, and a four-inch flue encircles between, so that nearly all the heat is absorbed in the making of steam. The whole occupies but little room, (about one half that of an ordinary hot-air furnace,) and forms a compact masonry of brickwork and iron of the most permanent and fire-proof character.

A very small quantity of water is all that is required for the boiler at first, and a supply is kept up by the Water

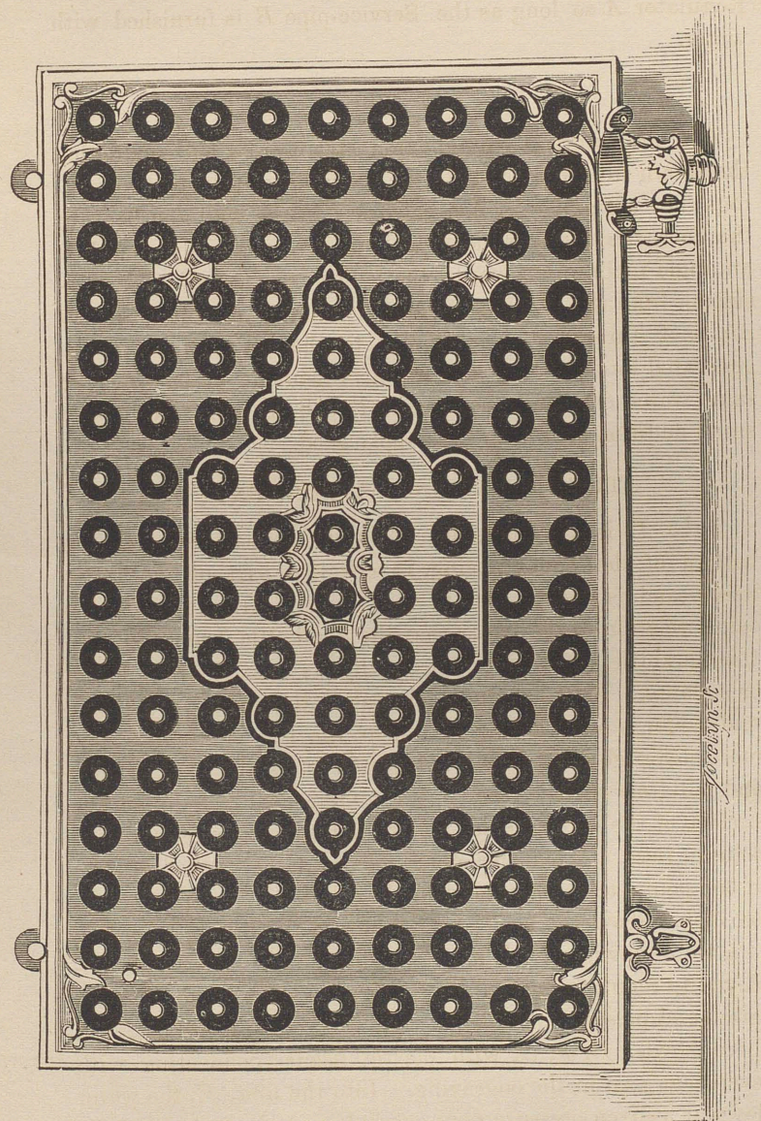
Regulator *A* so long as the Service-pipe *B* is furnished with water.

THE PIPES.

C C are common wrought-iron steam-pipes for conducting the steam from the boiler to the radiators. In private dwellings they are generally concealed within the wall and beneath the floor, the same as gas-pipes, and are invariably placed on an angle inclining towards the boiler, so that all water resulting from the condensation of steam in the radiators may run back through the same pipe to the boiler, again to be generated into steam. By this arrangement of heating the same water over and over again, it will be seen that a very small addition will keep the supply good.

THE REGULATING ATTACHMENTS.

Tube *D* is a Hydrostatic Column, connecting with the bottom of the boiler—being, in effect, a part of the boiler itself—and is *always open to the external air.* It bears the same relation to the boiler that the tea-kettle spout does to the tea-kettle, and renders it equally as safe from explosion or collapse. Before steam is generated, the water in the tube and boiler is on a level; but when the fire is kindled, and more steam generated than is required to fill the proper space, and radiators open to receive it, a pressure is created upon the surface of the water in the boiler, and this counterbalancing column rises. When the steam accumulates to the pressure of one pound to the square inch, the column will stand twenty-six inches above the level of the water in the boiler, according to a well-known law of nature. This simple process is employed to regulate the draft to the fire, as well as the accumulation and pressure of steam. To this column are attached three bowls, *E, F, G,* with elastic heads, connecting with levers—as seen in the engraving. Into the first, *E,* the water flows at a given pressure (say one half pound), and closes the draft to the fire by the ash-pit and draft-door, *M.* This ex-



Radiator.

clusion of air, with the radiator in operation at the same time, will prevent the rising of the column. But should the radiator not be open to use the steam, or the draft-door be accidentally held open, the column of water will continue to rise, until, at the pressure of one or two pounds, as the case may be, it flows into the second bowl *F*, and lifts the lever attached to the feed door *L*, which opens and reverses the draft, causing it to pass over the fire, instead of underneath and through it. This reversal of the draft has the effect to deaden the fire at once, and stop the generation of steam. A slight additional pressure forces the water of the column into the third bowl *G*, and lifts the lever attached to the escape valve *H*, which allows all excess of steam above that pressure to pass freely off through the waste pipe *I*. *Any further accumulation of steam and increase of pressure is utterly impossible.*

The glass tube *J*, represented in the cut, is not a necessary appendage to the apparatus, and may be dispensed with; but it is connected to show the variation in the pressure of the steam, the condition of the fire, and the beautiful phenomenon of the oscillation of the water in the tube.

The small glass tube *K* on the Water Regulator is a gauge to indicate at all times the exact height of the water in the boiler. The draw-off valve *N* is used when the boiler is to be emptied of water and sediment.

THE RADIATORS.

The engraving on page 10 represents the single Radiator or heater, with its appropriate valves and attachments. This, for common use, is located at the side of the room to be warmed, projecting about two inches, occupying but little space, and the best pieces of furniture can be placed nearly in contact with it without the least injury.

The radiators can be suited to almost an endless variety of adaptations. Clusters of them of any desired dimension may

be hid within an ornamental fretwork of iron, with a handsome marble top, (see pages 19 and 25,) or as a marble mantel, (see page 41,) or some elegant article of furniture. A number of them may be enclosed within a chamber in the cellar or some lower apartment, and from thence the heated air be driven up through registers into the room, the same as from a hot-air furnace. This latter mode of conducting heated air into rooms we do not advise, as it is attended with many serious objections, which, however, are not peculiar to this apparatus. It is a philosophical fact, that air heated by steam is better calculated to flow upwards, and distribute itself in an apartment, than that heated by hot-air or hot-water furnaces.

The radiators are made of two plates of Bloom iron, of the best American manufacture. The iron is, of necessity, of the finest and most flexible texture, to withstand the trying process of doubling to form the steam-tight joints. The front plate of the radiators is stamped with conical depressions of about three eighths of an inch in depth, two and one half inches in width, and three and one half inches from centre to centre. The back plate is plain, and the two are riveted closely together, with copper rivets, at each point of indention, and the edges of the two plates are twice doubled, or double-seamed, over a leaded packing-cord, and hammered hard down to a smooth bead of about one fourth of an inch in width. This concave surface gives strength to the radiators, and adds much to their radiating power. The entire thickness of the radiators is about one half of an inch. The size and number vary according to the space to be warmed, the position in which they are placed, &c., &c. The radiators may be painted almost any desired color, and ornamented to suit the different tastes and fancies. Where they are concealed behind screens, the only paint they require is merely to protect the external surface; but when they are put up singly, we generally paint or grain them to correspond with the woodwork or furniture of the rooms in which they are located.

On one of the lower corners of the radiators is a valve to open when steam is to be admitted, and closed when steam is to be excluded. An air-key is placed on the opposite upper corner to regulate the amount of steam to be admitted. No steam will enter any part of the radiator until that part is emptied of air. By closing this air-key when any desired portion of the radiator is heated, the other portion will remain inoperative and cold.

ITS PERFECT SELF-REGULATING OR AUTOMATIC CHARACTER.

The fire being kindled and the day's supply of coal put on, no further attention is necessary. Steam will in a few moments enter all the open radiators, and instantly impart its heat to the space exposed to its influence; the fire will then burn, and the coal be consumed *only in proportion to the amount of heat required.* For as the amount of heat obtained from the radiator depends upon the *condensation* of steam therein—as explained in another part of this book—and as this condensation depends entirely upon the temperature of the atmosphere in which they are placed—*the atmosphere is itself the agent to open and close the draft to the fire.* Thus, when the atmosphere is at a low temperature, and the apartment cold, the condensation in the radiator is rapid, a great amount of heat is thrown out, the steam used fast, the pressure taken from the boiler, the draft door opened—as before explained—and the consumption of fuel increased. But as the temperature of the atmosphere is raised, and the space grows warm, the condensation of steam in the radiator diminishes, less heat is thrown off, less steam used, the pressure increased, the regulating column raised, the draft closed, and the fire deadened to the requirements of the steam. Or if the steam be shut off from any one radiator, *just in that proportion will the draft be closed, and the consumption of fuel be saved.*

This feature of Self-Regulation in Mr. Gold's system, being a matter of *economy*, as well as of comfort and safety, is not to be found in any other heating apparatus of the present age. In fact, none other that we have been able to discover, is at all self-regulating. The closing of the register to exclude the heat of the hot-air furnace from the room, does not, as is well known, deaden the fire in the least, but rather increases it than otherwise.

ITS SAFETY FROM FIRE.

A simple glance at the position of the boiler and fire in Gold's Heater will convince any one of its *perfect safety*. The fire is on all sides enclosed within a fourteen-inch partition, including the water sheet around it, two inches; flue, four inches; and brick wall, eight inches. The heat is so perfectly consumed by traversing the boiler, that the temperature of the smoke-pipe does not exceed that of the steam (212°), which is a degree of safety, as well as economy, hardly to be equalled. The only external openings to the fire are through the feed-spout and ash-mouth, both of which are of iron, substantially built into the brick work, and with a pitch inclining inwards, thus preventing the liability of coals falling out.

According to recent reports of the Fire-Marshal, two thirds of the fires in New-York city are traceable to the use of Hot-air Furnaces; and the evil is increasing to such an alarming extent, that THE FIRE INSURANCE COMPANIES HAVE BEEN COMPELLED TO INCREASE THE RATES OF INSURANCE WHERE THEY ARE USED, and to offer a premium on safer modes of heating. To this end, the authorized agents of the companies have carefully examined our apparatus, and have pronounced it the most free from danger of fire of any method of heating buildings now in use; and THE NEW-YORK COMPANIES HAVE decided TO MAKE A DEDUCTION OF TEN PER CENT. ON ALL RISKS WHERE THIS MODE OF HEATING IS ADOPTED.

The following letter in relation to this subject has been

kindly furnished us by the Secretary of THE BOARD OF FIRE INSURANCE COMPANIES, which Board comprises ALL, or nearly all, THE FIRE INSURANCE COMPANIES OF THE CITY OF NEW-YORK:

NEW-YORK BOARD OF FIRE INSURANCE COMPANIES,

NEW-YORK, *Oct. 12th*, 1858.

New-York Steam Heating Company:

GENTLEMEN:—In accordance with your request, I would state that the Fire Insurance Companies of this city make a deduction of 10 per cent. on the premiums on all risks where your mode of heating is adopted.

The Board adopted a rule to that effect, in consideration of the greater safety as regards the happening of fire, and deem your apparatus (Gold's Patent) much safer than the usual modes of heating.

Respectfully yours,

W. F. UNDERHILL.

ITS DURABILITY.

In point of durability, it is believed that this apparatus will be found remarkably free from objection. The boiler is built as substantially as any other steam boiler, and with careful usage must last almost indefinitely. Even limestone water used in it can do no harm, since the same bulk of water is used over and over again without sensible addition being required. The radiators and conducting pipes being of iron, might be regarded as liable to rapid oxidization. Such is, however, proved by experience not to be the case. The oldest operators in steam pipe affirm that they never rust internally. The nature of steam is to prevent corrosion. The radiators are externally protected by paint put on at a high temperature. When not in use they are closed air-tight, and all perfectly dry on the inside. After four years' use, one of them being cut open, was found to be quite as clean and free from rust as when it was made.

The following letter from an eminent authority, should be taken as positive evidence on this point. Mr. Mills has the honor of being the first to adopt, on a large scale, this plan of warming.

New-York Steam Heating Company: NEW-HAVEN, *Oct. 1st*, 1858.

GENTS:—You have the liberty to use my letter to which you refer; though I have the impression that this method of heating is no longer an experiment, but a fixed fact, satisfactory to all who have used it. One doubt still seems to be hanging to the mind of a few of the fastidious, to wit: whether the radiators will not rust out. In the early part of the winter of 1857, I had the satisfaction of examining mine, and know that they were free from rust, and as sound as when first put up. Mine, it should be observed, were among the first put to use, and had then served me three years.

Yours, respectfully,

LEWIS M. MILLS.

VENTILATION.

Too much importance cannot be attached to this department, in the architectural and domestic arrangement of buildings. The common plan of constructing chimneys, with flues opening through the fire-place into the rooms, is an excellent provision for ordinary dwelling-houses; and the occasionally opening and shutting of doors, with the unavoidable ingress of air through the crevices of windows, amply supply ventilation where there is no unusual perversion of the atmosphere. But for the purpose of ventilation, merely, we would recommend that the flues or vents be made of tin, thus avoiding the expense of chimneys, which only disfigure the interior of a house, and take up valuable room. By this arrangement, where Gold's plan of warming is adopted, but *one* chimney is needed, even in the largest building. The atmosphere in the room being evenly rarified, by coming in contact with surface never sufficiently heated to char the innumerable minute particles of dust always floating therein, and rendered impure only by respiration, is constantly but imperceptibly being carried off, while a sufficient supply of fresh air is continually entering. It has been found that a gradual change is thus effected in the atmosphere of the whole house.

Gold's apparatus does not profess to be, of itself, *a ventilating machine*, although *it admits of the most thorough ventilation*. We must be pardoned for asserting in this connection, without entering into the proof, that the various appliances for heating, so much in vogue at the present time, not only *do not produce proper ventilation*, but they actually do not *permit of it*, although the *term* "VENTILATION" is conspicuously affixed as a redeeming appendage, to each yearly revision of the old system.

GENERAL REMARKS.

The construction of the boiler is such as to insure a very perfect combustion of the fuel without forming clinker, or leaving unburned portions of coal. The conducting pipes, when exposed in damp cellars, or where the heat from them would be lost, are generally wound with felt, or some hair or woollen substance that is a non-conductor of heat.

The heat from the radiators is of the mildest and most agreeable character; it produces no such effect of giddiness, dryness, or of oppression about the head, as is attributed to stove and furnace heat; and as the air never comes in contact with any surface warmer than 200°, no odor of burnt particles is perceived in the apartments. It is *radiant* heat which is given off from them; hence the limbs and feet, feeling its genial influence equally at the same time, are free from the unpleasant coldness so often complained of in furnace heat, where, as elsewhere explained, the effect of radiant heat is almost entirely lost.

The *uniform distribution* of heat effected by this means of warming, is another very noticeable advantage in its favor. It is entirely unaffected by wind, and, for a simple and obvious reason, is more efficient and rapid in its operation in very cold weather than in more moderate temperatures, because the more rapidly the condensation takes place, the more heat is evolved, and this happens when the atmosphere is of a low temperature.

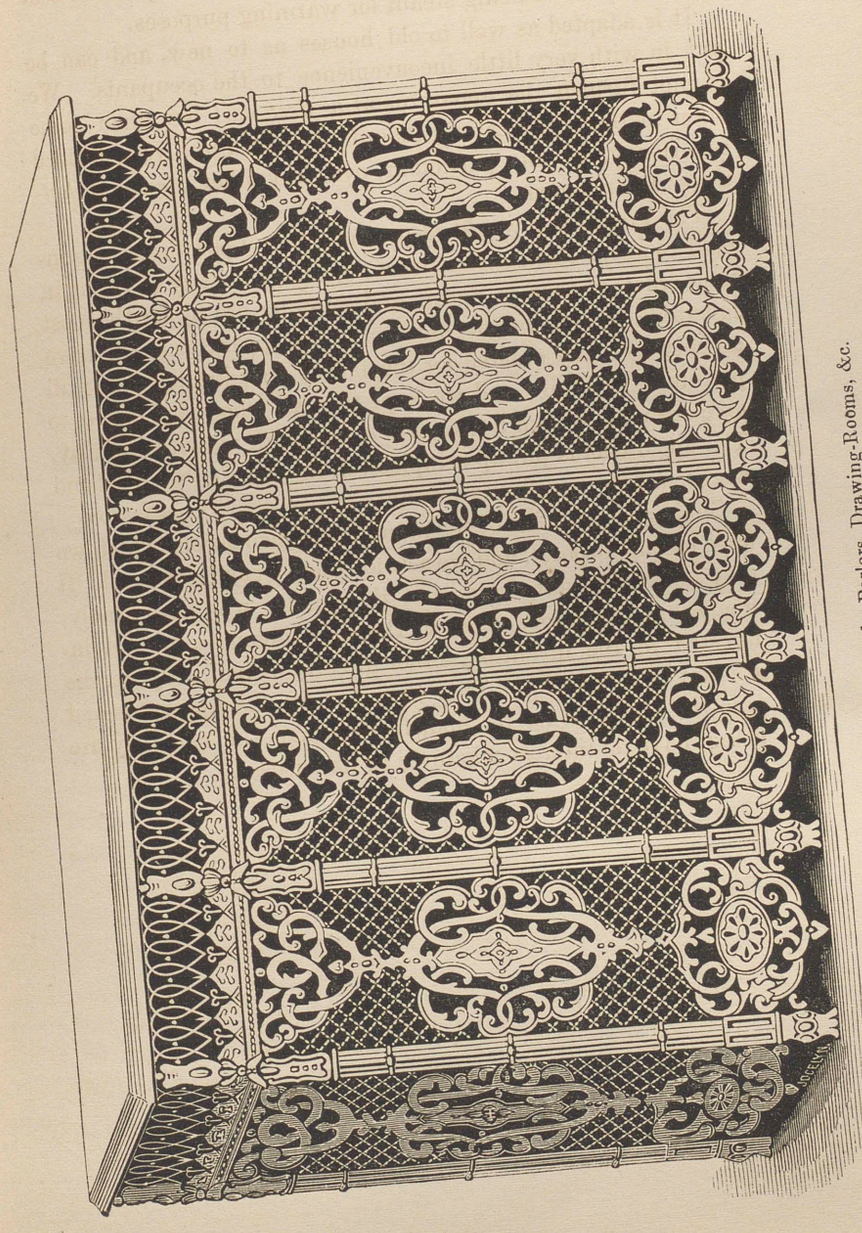
Having given a full description of this new method of heating, and spoken briefly of its prominent advantages, we will omit noticing the various modifications to which it is pe-

culiarly susceptible, and submit to all interested in the subject, whether this apparatus does not supply the want so long felt in the community, of some exceedingly simple and economical mode of using steam for warming purposes.

It is adapted as well to old houses as to new, and can be put in with very little inconvenience to the occupants. We cannot furnish the apparatus at a *first cost* less than some other methods of heating, though we do claim a very decided superiority, in this particular, over any other *steam* or *hot-water* arrangement.

The Proprietors would respectfully urge upon those who intend to adopt this mode of warming, the necessity of giving in their orders at once, as Spring and Summer are by far the most favorable seasons for the erection of the apparatus. We have already as many ordered for the fall as that limited time will permit us to fulfil; and we hope that all who are disposed to give our new system a trial, will confer with us without delay. The apparatus is put up complete, in the most substantial and workmanlike manner, AND WARRANTED TO GIVE SATISFACTION.

Subjoined are a few of the many recommendations which we have at our disposal, and we ask for them a candid perusal. It may be well to state here, that the parties who have kindly, freely, and obligingly given us these testimonials, are not interested in the invention, either directly or indirectly, to the amount of a farthing. They have bought the apparatus and paid the full price for it; and, further than the one they are using, have no interest whatever in its success.



Straight-Front Screen, for Parlors, Drawing-Rooms, &c.

Letters and Recommendations.

NEW-YORK, *September* 1*st*, 1858.

NEW-YORK STEAM HEATING CO.:

GENTS.: After having made use of one of your new Steam Heating Apparatus for two years, and after having carefully watched its operations, it is with great pleasure that I comply with your request, and bear my testimony in its favor. From its self-regulating power, it requires less attention and consumes less fuel than any stove or furnace, giving out the same amount of heat, that I have ever known. The heat produced is exceedingly agreeable, having the softness of mild summer air, free from dust and dryness, and the escape of gases. The heating by steam which can be so regulated as by your process, must be highly important to those who have sensitive lungs, and to young children. My attention was drawn to the value of heating by steam by the effect upon a lady whose lungs were extremely delicate, and who had had for the past twelve years, during the winter months, repeated colds, which were followed by hemorrhages from the lungs, though every precaution was taken to prevent them, by confining herself to the house, heating the entries with a furnace, and the rooms with Cannel coal in an open grate, regulated by a thermometer; yet the variableness and severity of our winter climate would reach her, and produce these dreaded attacks. She removed, three years ago, to a hotel heated by steam *exclusively*, from which time to the present she has not had a single attack of hemorrhage, though two of the past three winters have been unusually severe. This result was, no doubt, owing to the peculiar character of the heat generated by steam. I regretted that steam heat was not within the reach of all, for as then used, it was on a large scale, requiring the attention of an en-

gineer. I have now learned and found that you have so completely domesticated steam, that it can safely be left to take care of itself. Yours respectfully,

EDWARD BAYARD, M. D.,
No. 6 West Fourteenth-street.

BROOKLYN, *Sept. 25th*, 1858.

NEW-YORK STEAM HEATING CO.:

GENTS: With a comparatively slight examination of your Steam Heating Apparatus, I was so well satisfied, that I was induced last autumn to order one put in my house, with radiators in every room; and I am pleased to be able to state that my anticipations respecting it have been fully realized.

The attendance on the fire is less onerous than on that of a common furnace; no special skill or experience being required, as is usually the case with steam boilers.

It regulates the draft perfectly, preventing a greater consumption of fuel than is just sufficient to produce the required head of steam; closing the draft when above, and re-opening it again when below that point, and this without any attendance whatever. No adjustment can well be perceived more perfect, and the same remark will apply to the machinery by which the boiler is regularly supplied with the exact quantity of water, which is very small. Both arrangements are quite remarkable for their beautiful simplicity. In all respects, it is perfectly safe.

The economy in fuel, as compared with a hot-air furnace, I judge to be very considerable; greater in a severely cold than in a mild winter.

In healthfulness, comfort, convenience, cleanliness, and pleasurable feelings, the heat from the Steam Radiator surpasses, incomparably, that of any hot-air furnace whatever. To persons subject to pulmonary affections it is invaluable.

The improvement you have recently made, by which the radiators are all filled, and when full the escape of the steam is prevented, without the attention heretofore required, is very valuable, contributing almost the only desideratum to enable one to say, "It is nearly perfect."

I have been thus minute, because, among modern house improvements, I can hardly conceive one more conducive to health and comfort, than your Low Pressure Steam Heater.

I am, respectfully, yours,

E. W. DUNHAM,
No. 65 West Warren-street.

NEW-YORK, *Sept 29th*, 1858.

To the New-York Steam Heating Company:

GENTS: Three years ago last winter, I used in my dwelling-house a hot-air furnace of the most approved pattern, but in consequence of the unpleasant and choking kind of heat, I took out the hot-air furnace, and put in its place Gold's Patent Steam Heating Apparatus. I have used it for two winters, and most cheerfully recommend it as being superior to anything I have yet seen. The health of my family has been much benefited by the pleasant, soft heat produced by it.

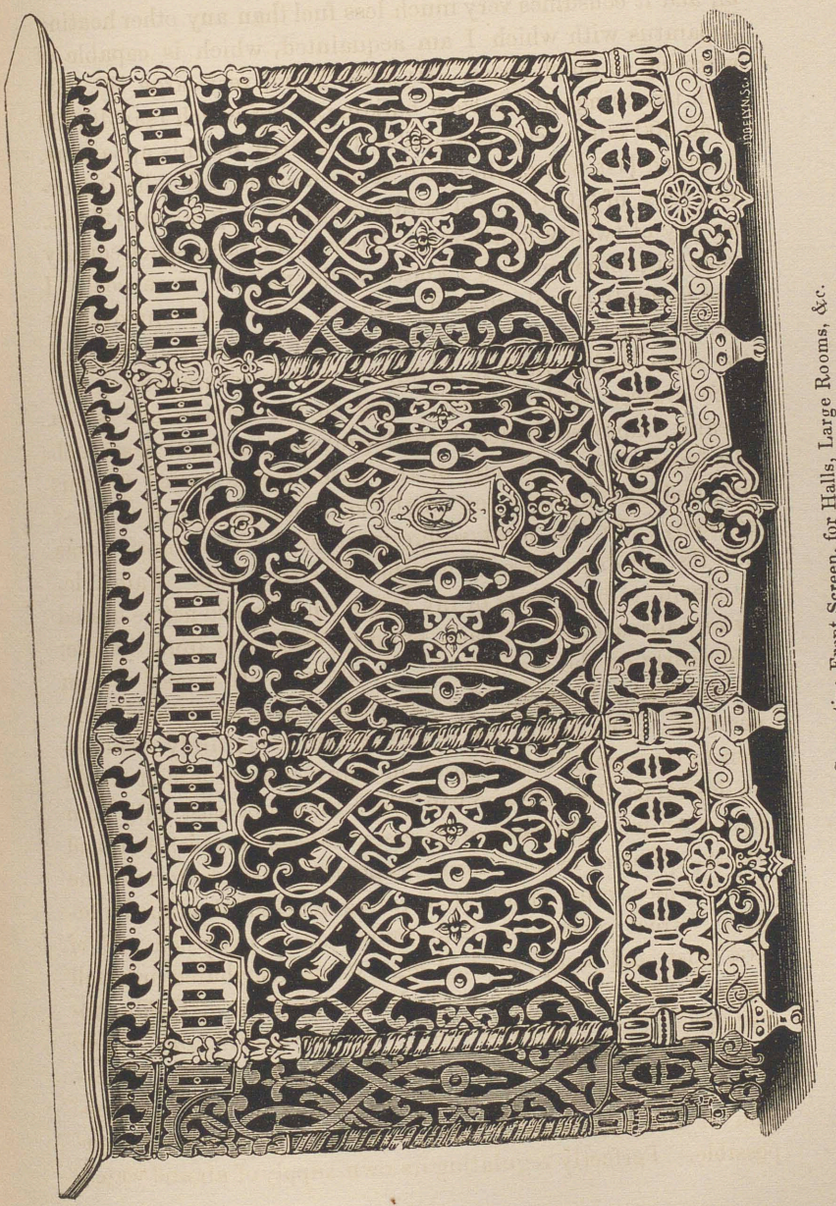
J. B. PECK,
299 *West Twenty-second-street.*

NEW-HAVEN, *Oct 6th*, 1858.

New-York Steam Heating Company:

GENTS: I have used in my dwelling-house here, for four winters past, Gold's Steam Heater, and with much satisfaction to all the members of my family. During the very severe weather of 1856–'57, we found no difficulty in keeping our house comfortably warm with this, and this alone, as our sole dependence for heat. It requires less care in the management of the fire than any furnace I have had any personal experience

of, and it consumes very much less fuel than any other heating apparatus with which I am acquainted, which is capable of warming so much space. My house is not very large, 38 × 38, with two wings and a back building, all of which (say 40,000 to 45,000 cubic feet) is abundantly heated by this apparatus. I burned last winter (in about seven months and a half) fourteen tons, of 2,000 lbs., of anthracite coal—say, about 120 lbs. per day of twenty-four hours. To heat the same space equally well, with other means, I know would require more coal. I was formerly unable to heat, with any apparatus employed by me, the whole of this space, and to heat a part of it required the same fuel burned in a furnace and in several stoves and open grates. This winter, owing to my having had set a greatly improved boiler, I shall probably consume less fuel. My former boiler was one of the earliest constructed for this use, and was always too small to do its duty with the best economy. In the most severe weather the consumption was 200 lbs. per day; in mild weather, less than 100. I am able, by steam, to heat parts of my house which could not be heated by any furnace, viz., a back building sixty feet from the fire, and nearly on the same level. Combined with a good system of ventilation, I consider this the perfection of an artificial temperature. The prime cost of the system is certainly an objection to its general introduction in many cases where it would be desirable. But all who can afford the prime cost will, I am sure, soon feel convinced of its essential economy, comfort, and safety. Steam, in some form of apparatus, is sure to take the place of most other means of warming houses and public buildings. Great objections, both from fear of explosion and of fire, exist, and justly, against *high steam* distributed in small pipes. These dangers are avoided in the case of Gold's Apparatus. This apparatus uses only *low* steam, *one* to *two* pounds per inch, and at that pressure no danger can be experienced, either from fire or explosion; and the very construction of the apparatus is such, that a higher pressure is impossible. Perfectly regulating its own supply of air and water,



Ogee, or Serpentine-Front Screen, for Halls, Large Rooms, &c.

it needs only to feed itself with fuel to be independent of human aid.

It is superior to all hot-air furnaces in not over-heating and burning the air, in absence of dust and dirt, in ease of its management, and safety from fire, as well as in economy of fuel. To the hot water apparatus it is superior in activity, and less cost; and in giving an ample supply of RADIANT HEAT in the apartments, is very greatly superior to both, and supplies, in fact, the place of an open fire.

Yours respectfully,

B. SILLIMAN, JR.

EXTRACT FROM A LETTER.

Yet another advantage is the small consumption of fuel, which amounts to less than half the quantity required by the ordinary furnaces.

J. V. D. STEWART, M. D.

Baltimore, Maryland.

NEW-YORK, *Oct. 1st*, 1858.

New-York Steam Heating Co.,

GENTLEMEN: After two years' trial of Gold's Patent Steam Heating Apparatus, in my house at Elizabeth, N. J., it affords me pleasure to state that my anticipations regarding it have been fully realized.

It requires but little attention, gives a remarkably pleasant heat, and is very economical in fuel, burning but little more coal to warm my house than is usually consumed in one ordinary cylinder stove. The fire went out but once during the whole of last winter, and that was in consequence of a few days' absence from home.

The fact that the atmosphere in the house is always maintained at the same temperature in mild and extremely cold

weather, surprises those who have seen the operation; and the wonder is increased on learning the extreme simplicity and perfect safety of the apparatus.

I consider it by far the best heater ever brought to my notice, and think it only requires to be known to be generally introduced.

Very respectfully yours,

J. J. SMITH,

69 Wall Street.

NEW-YORK, *Sept. 29th*, 1858.

Our offices and sample rooms, occupying the entire second story of the store 13 Beekman street, we were unable to satisfactorily heat by a large stove and furnace.

In October, 1856, we introduced Gold's Patent Steam Heater. The boiler (which will hold about 40 gallons, with a 20-inch grate, is located in the under cellar, about thirty feet below the offices, and the pipes conducting the steam are placed in exposed positions. Yet the consumption of coal is small, and much less than we formerly used.

During the severest weather we have had all the heat desired to keep our rooms comfortable, and it has always been of an agreeable nature.

The apparatus is safe, simple, and easily managed.

We take pleasure in recommending it to the public.

B. M. & E. A. WHITLOCK & CO.

NEW-YORK, *Oct. 4th*, 1858.

It affords me pleasure to give my good opinion of Gold's Low Pressure Steam Heating Apparatus. I have used it in my house for two years with great satisfaction. It is the most healthy, comfortable, and economical way of heating a house. The air is soft and agreeable as that of summer, and adapted

to delicate and feeble constitutions, as well as others; and I can recommend it to those troubled with pulmonary diseases, rather than to go South.

I have used the Hot-air Furnaces, which will give a sufficient amount of heat, but the air is not healthy, and the more delicate and confined the person, the more deleterious to their health.

I have been for a long time (thirty years) engaged in the Medical Profession, and can speak from my own observation, of the necessity of a pure, healthy atmosphere, as of the first importance. Who can think and study with a dizzy head and a parched throat? Ask the scholar, the churchman, the physician! Yes! ask the pale-faced mother what can relieve her depression? Ask the committees upon heating our public buildings, if they understand the principles of health, thought, and economy! Or must a few educated men spend their lives in advising what science and philosophy have developed, and never feel that a grateful community can appreciate it? Look at the names of the scientific men who have recommended this apparatus, and can our own committees say they have examined this subject as guardians of health, happiness, and interest, in neglecting this most comfortable and healthy luxury?

LEVI FOLSOM, M. D.

No. 124 West Twenty-eighth-street, New-York.

NEW-YORK, *Oct. 15th*, 1858.

New-York Steam Heating Co.:

GENTS: Through the two past winters our store has been heated by Gold's Steam Heater. A very noticeable feature in its *favor* is the entire absence of the fine dusty particles that are constantly thrown off from Stoves and Hot-air Furnaces, and which discolor and otherwise injure fine goods. We take

great pleasure in recommending your mode of warming to the public.

ARCHER, WARNER & CO.,
376 *Broadway.*

TROY, New-York, *October 5th*, 1858.

New-York Steam Heating Co.:

GENTS: My new store, 50 feet front, 130 feet deep, and four stories high, has been thoroughly and satisfactorily warmed through the past two winters, by Gold's Patent Low-Pressure Steam Heating Apparatus.

I consider this an invaluable heater for *Dry Goods Houses*, being entirely free from the dry and dusty air so invariably arising from Hot-air Furnaces and Stoves.

The heat is of a mild and most agreeable character. The apparatus is self-regulating, safe, simple, and easily managed.

Yours, &c.,

G. V. S. QUACKENBUSH.

NEW-HAVEN, *October 1st*, 1858.

New-York Steam Heating Co.:

I take pleasure to say that my experience in the use of Gold's Heating Apparatus, through the past four winters, is highly satisfactory. The area heated exceeds 47,000 cubic feet. (The basement has a dining-room and hall; the first story has five rooms; the second, eight; and the third, nine—each story having its respective hall.) The most remote radiator is elevated about 35 feet above the boiler, which is as readily filled as any of the intermediate ones. My fire was managed by a lad of fourteen, most of the time, at other times by myself. I weighed the coal for three weeks in succession, and the average consumption was 84 lbs. per diem. During this time I burned the siftings, which are included in the

above weight. Through the winter it averaged about 100 lbs. a day. There was no lack of heat during the severest weather, nor was there difficulty in excluding it in milder weather. The heat furnished by the Apparatus gives entire satisfaction to *all* my family, and a large number of friends, besides the inquisitive. I consider a decided advantage gained in the purity of the air heated, and in exemption from gas, ashes, and smoke. The often repeated inquiries, "Is there no danger of explosion or of fire? Will it not need frequent repairs?" &c., as far as my experience goes, must be answered in the negative, and I think all similar use elsewhere strengthens this opinion.

LEWIS M. MILLS.

NEW-YORK, *October 14th*, 1858.

New-York Steam Heating Co.

GENTS: My School-House on Eighth-street, near Avenue B, and in which are convened a thousand scholars, was warmed last winter by your Low-Pressure Steam Heating Apparatus, to the entire satisfaction of myself, the teachers, pupils, parents, and all interested. I take great pleasure in recommending it as the most proper mode of warming apartments in which children are required to study. The heat is peculiarly calculated to give a clear head to scholars, differing in this respect from Hot-air Furnaces and Stoves. These latter modes heat the upper strata of air to a much higher temperature than the lower, emit burnt particles of dust, produce an unhealthy flow of blood to the head, and otherwise disorder the mental capacities of the student. The apparatus is perfectly safe, is easily managed, and very economical in the consumption of fuel.

THOMAS J. MOONEY,
Pastor of St. Bridget's Church.

YONKERS, *October 2d*, 1858.

The New-York Steam Heating Co.

GENTS: In regard to the working of Gold's Steam Heating Apparatus, which has been in use in my dwelling here for the past two winters, I can cheerfully say it operates very much to my satisfaction. I was prepared, by previous examination of the apparatus, to expect a good deal from it, and have not been disappointed. I have no doubt of its capability of heating any ordinary dwelling, to entire satisfaction, in the coldest weather. As a mode of heating I consider it superior to any other I have seen tried. It has some decided advantages. The air of the room is not vitiated, it is merely heated by radiation. There is no opportunity for the escape of dust or of gas, as from registers. The steam will go in one direction as well as another, no matter what the direction of the wind is. It is very complete as a self-regulator. If water and coal are supplied, the regulating fixtures will control the consumption, almost to perfection. It is very economical in the consumption of coal, consuming just in proportion to the demand for steam, and as soon as that demand is met, invariably shutting off the draft. With regard to danger of explosion, I do not think there is the least occasion for apprehension.

Yours truly,

W. C. FOOTE.

NEWARK, N. J., *October 8th*, 1858.

The New-York Steam Heating Co.

GENTS: In answer to your inquiry as to the working of my Gold's Steam Heater, I can truly say it exceeds my most sanguine expectations. I have given the subject of heating dwellings considerable attention, and have long been convinced of the superiority of steam over all other methods of

artificial heating; but it had never been presented in any form that we could domesticate, and take into our homes with that feeling of security which is necessary in all household apparatus. The invention of Mr. Gold has put to flight all former objections to steam heating. It can be put up at a price within the reach of all—it is perfectly safe, there being no more danger of explosion than exists in an ordinary tea-kettle—it can be put up in a form suitable for the most costly dwellings—much less coal is consumed than in the best constructed furnace. I carefully weighed the coal when the apparatus was first put up, (the fall of 1855,) and I found that I burned, in 24 hours, 36 lbs., against 50 lbs. formerly consumed by my furnace; thus making a saving of about 30 per cent., and I think the same ratio will hold good through the past three winters. The sensations produced on a person occupying rooms warmed by steam are so different, that I would not use the Hot-air furnaces at half-price. I am satisfied that for a person with weak lungs, a hot-air furnace is very injurious, and a person who suffers from headache, in apartments warmed with a furnace, would be entirely free from it if the same were warmed by steam. I have conclusive evidence of this last fact in my own family. Having given this apparatus a fair trial, I can cheerfully recommend it to all who wish to have a healthy, agreeable, and economical heat.

Your obedient servant,

HENRY E. RICHARDS.

NEW-HAVEN, CONN., *October 12th*, 1858.

New-York Steam Heating Co.

GENTS: In reply to your brief note asking my "*experience in heating with Gold's Steam Heater*," I would say, my sales-rooms are some 16×90 feet, my work-room 20×36 feet, having some 16 windows, a large part of which open to

the north and west. I formerly *attempted* to warm the same with furnace and stoves, and managed, by burning some 10 to 12 tons of coal, to get along comfortably, *excepting* in very cold weather, when my clerks found it absolutely necessary to huddle around registers instead of being at their counters, while workmen in my work-room often accomplished less than two thirds as much work as they would have done had their rooms been evenly and thoroughly warmed. Since the fall of 1855, I have used Gold's Heater, burning from 7 to 8 tons of coal per year only; my premises are *evenly and thoroughly* warmed in the *coldest* weather: in very severe weather, customers frequently remark, "*How comfortable you are here.*" "*Your store is the warmest place I have found to-day.*" "*How very pleasant the heat is:*"—in a word, I liked my first year's experience (or experiment) so well, I placed another Heater (No. 3) in my house two years ago last fall, which has given entire satisfaction; and now to answer your question, would quote the language of a friend, who has tested the apparatus for the past four years: "*I consider Gold's Steam Heating Apparatus, for heating purposes, one of the greatest improvements of the age. Where known, it needs no recommendation, as it recommends itself.*"

Yours respectfully,

T. B. CARPENTER,

97 *Chapel street.*

Statement of JONATHAN KNIGHT, M. D., *Professor of Surgery in Yale College.*

I have examined, with some care, Gold's Steam Heating Apparatus, in reference to its influence upon the health of those who employ it. That method of warming apartments is the most healthful which, while it produces the proper temperature most uniformly, adds nothing to the air and takes nothing from it, so that it remains in its natural condition. This is most happily accomplished by this Apparatus.

Uniformity of temperature is readily preserved by the ease which a greater or less amount of heat can be almost instantly communicated to the air of the whole or any part of a house which is provided with it, and this without any unpleasant current of hot or cold air.

In all the ordinary modes of warming buildings by furnaces or stoves of every kind, the air is liable to become impure by the addition to it of dust, smoke, and gases of various kinds. This cannot be entirely obviated, and is often greatly increased by the imperfect contrivance of the furnaces, and especially by portions of them becoming impaired by gradual decay. So also the heated air becomes impure by its contact with the iron of the furnaces and stoves, raised to a high temperature. The particles of vegetable and animal matter always present in the air are burnt, and the products of the combustion are mixed with the air, which at the same time is deprived of the moisture which belongs to it in its natural state, and which is essential to easy and healthful respiration.

All these sources of impurity in the air of apartments warmed by this Apparatus are entirely avoided. The air is simply warmed, while nothing foreign is added to it. It is at the same time warmed by contact with the heaters, at a temperature but little below that of boiling water; too low to burn the particles of matter which may be in it, or to deprive it of its moisture, in such a degree as to render it unfit for respiration.

In warming rooms by this Apparatus, all that is necessary to preserve the air in a state of absolute purity is to prevent its contamination by the products of respiration, and of whatever means are used to produce artificial light. In the common apartments of dwelling-houses, the frequent opening of doors and windows which necessarily takes place, will usually suffice, and if more is required, an open fire-place or flue communicating with the chimney will be an abundant means of ventilation. In other apartments, such as school and

lecture-rooms, more efficient means of ventilation will be required. There are no more required in this than in any other mode in common use of warming such rooms. The same means are necessary, and are equally efficient in them all.

For reasons such as the above, and which might be easily multiplied, I have no hesitation in expressing the confident opinion that this Apparatus will be a more healthful method of warming houses than any other now in use.

J. KNIGHT, M. D.

From the Hon. James F. Babcock, *Editor of The New-Haven Palladium.*

We are often asked personally, and by letter, how we are pleased with the operation of Gold's Patent Steam Heater, which was put into our dwelling-house early last fall. We reply to these many inquiries, that we regard the apparatus as one of the very greatest inventions of the present age. It has been thoroughly tested by many persons, and we believe is universally commended as possessing all the qualities claimed for it; besides some that were not thought of until they were developed in the process of using it. We should now as soon think of giving up the use of friction matches and going back to the old tinder-box, as to return to the use of hot-air furnaces—for with steam you have no burnt atmosphere to breathe. You are not dependent upon the power or course of the wind for increasing a volume of warm air sufficiently to pervade thoroughly the space to be heated. You are not sitting or sleeping over a volcano, or a mass of fire which may ignite your building; or if it does not do that, certainly does consume from two to three times as much coal as is necessary to heat *the same amount* of space. You are not having, and cannot have, a fumigation of sulphur or impure air from gas, that finds its way through the warped and half-melted furnace flues into all your rooms. You are not

having colds from a great variation of temperature, and the more variable from standing over a hot-air register at one moment, and sitting by a door or window at the next,—and cold feet are among the things unknown and unspoken of where the steam apparatus is used.

We are not aware that any member of our family had a cold during the whole of last winter, which, as we believe, was a fact without precedent; and the only ice that was made in the building was a slight covering of the tank in the attic on one of the coldest nights of the winter, when the steam had gone down; for we prefer not to sleep in a warm room.

We cannot state the exact amount of fuel consumed, as it was mixed with that used for kitchen range, which was the only other fire we had in the house; but we suppose the amount was between seven and eight tons—possibly nine tons. The same space we are confident will be more thoroughly heated next winter with one or two tons less, in consequence of some few improvements which have been made in the Apparatus. With the above specified amount of fuel, we warmed a dining-room of 15 by 18 feet size; four rooms above it, one of them 15 by 22 feet; and five chambers, —besides an upper and lower hall.

This is our experience. We give our account of it cheerfully, and with a great deal of satisfaction, and we believe it is substantially the experience of all, or nearly all, who have used the Apparatus. It costs much more than a furnace in the beginning; but it will pay for itself in a few seasons, especially in large houses, which require large furnaces, grates, &c., for warming.

The Steam Heater is free from every kind of danger, as it will feed itself with water; open and shut its draft doors, let off its surplus steam, should any accumulate; and cannot do any damage in the way of bursting, because its steam can escape in two or three ways more easily, without putting itself to all the trouble of a "smash up." An intelligent boy of ten years of age can manage it.

The radiators into which the steam is conducted through small iron pipes, are very ornamental as now finished—much more so than an ordinary grate. We should perhaps state here, that we have not a dollar's interest in the invention, and that its success or failure, beyond the one we are using, is of no pecuniary concern to us. We have bought and paid for it, and we would pay the same amount over again, rather than part with it.

REFERENCES.

Metropolitan Bank, 108 Broadway,	New York.
Corn Exchange Bank, 13 William Street,	"
Bowery Savings Bank, 130 Bowery,	"
Great Western Insurance Co., 33 Pine Street,	"
Home Insurance Co., 112 & 114 Broadway,	"
Orient Mutual Ins. Co., 2, 4 & 6 Merchants' Exchange,	"
Homestead Insurance Co., 11 Merchants' Exchange,	"
Broadway Ins. Co., 4 Wall Street,	"
Kings County Ins. Co., 4 Wall Street,	"
Athenæum Club, 108 Fifth Avenue,	"
St. Vincent's Hospiial Eleventh Street, near Seventh Avenue,	"
George Griswold, 72 South Street,	"
Brown, Bros. & Co., 59 Wall Street,	"
Bliss, Williams & Co. 4 Wall Street,	"
T. G. Hodgkins, 154 Greenwich Street,	"
B. M. & E. A. Whitlock & Co., 13 Beekman Street,	"
Atwood & Co., Broadway,	"
T. L. McElrath, New York Tribune,	"
C. H. Ludington, 23 Park Place,	"
R. T. Wilde, 251 Broadway,	"
Bowen, Holmes & Co., 320 & 322 Broadway,	"
Eno, Roberts, Rhodes & Co. 324 Broadway,	"
Paton & Co., 341 Broadway,	"
Asahel Jones, 333 Broadway,	"

Warner, Peck & Co., 376 Broadway,	New York.
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E. Walters, 60 Clinton Place	"
James Renwick, Jr., 56 Ninth Street,	"
Wm. H. Aspinwall, 33 University Place,	"
Edward T. Riley, Eleventh Street, cor. University Place,	"
Florence Verdin, 55 St. Mark's Place,	"
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Andrew Mills, 207 Second Avenue,	"
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Dr. Edward Bayard, 6 West Fourteenth St.,	"
Wickham Hoffman, 21 Nineteenth Street,	"
Capt. J. B. Peck, 299 West Twenty-second St.,	"
Dr. L. Folsom, 124 West Twenty-eighth St.,	"
A. L. Jordan, 31 East Thirty-first Street,	"
John Gray, 6 West Thirty-second Street,	"
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J. B. Devoe, cor. First Avenue and 114th St.,	"
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E. W. Dunham, 65 Warren Street,	"
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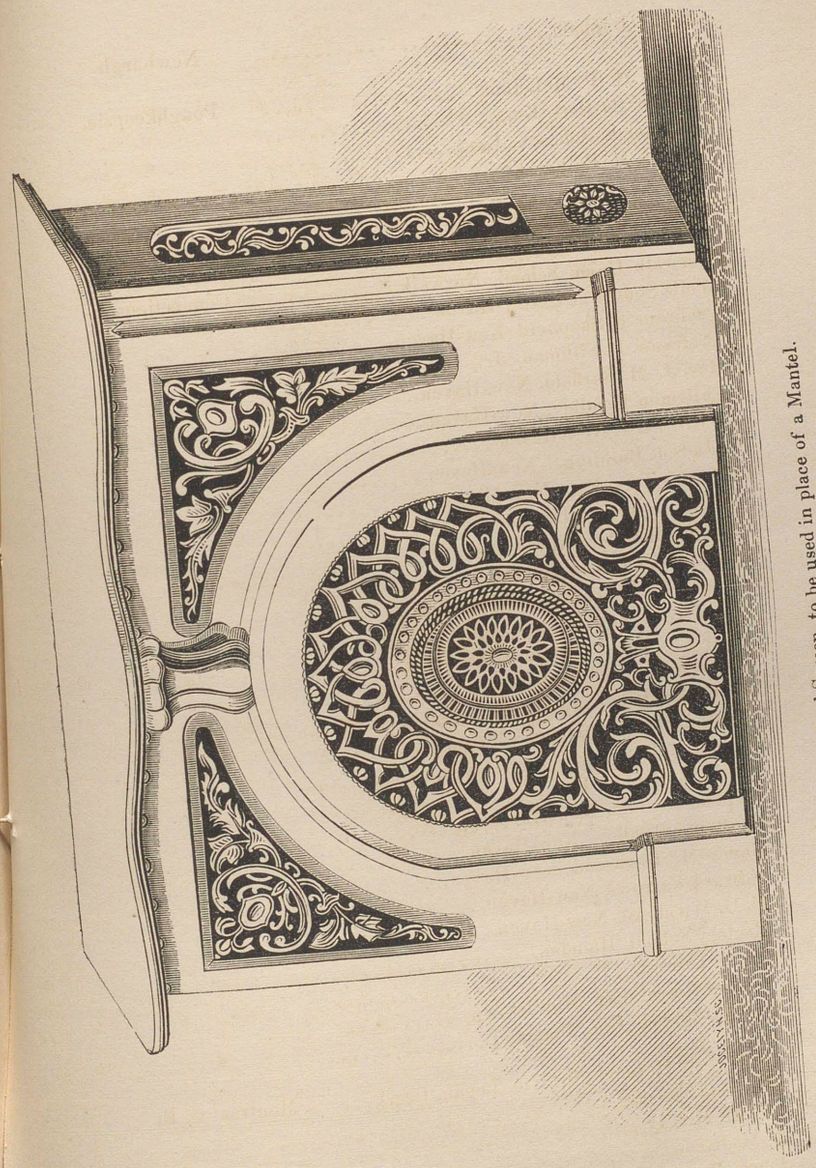
Dr. T. L. Smith, 118 Joralemon Street,	"
Clinton Colton, 90 State Street,	"
Dr. T. C. Durant, 17 Strong Place,	"
Rev. J. Lewis, Clifton,	Staten Island.
Wiliam D. Cromwell, Esq., Riverdale,	Westchester Co.
Academy of St. Vincent de Paul, Font Hill,	"
Rev. William C. Foote, Yonkers,	"
Everett Clapp, Esq., Yonkers,	"
A. J. Scoburg, Esq., Glen Wood,	"
Dr. J. B. Smith, Glen Wood,	"
Cyrus Townsend, Esq., Peekskill,	"
Military Academy,	West Point.

Dr. C. Dunham,	Newburgh.
Dr. C. H. P. McLellan,	Poughkeepsie.
Joseph Bartlett, Esq.,	"
William S. Johnson, Esq.,	"
Charles M. Pelton, Esq.,	"
R. B. Shepard, Esq.,	Hudson.
Norwalk Union School, Norwalk,	Connecticut.
Wells Southward, New-Haven,	"
Professor F. Shepherd, New-Haven,	"
Professor B. Silliman, Jr., New-Haven,	"
Rev. J. M. Garfield, New-Haven,	"
Philemon Hoadley, New-Haven,	"
Willis Peck, New-Haven,	"
"Judson Building," New-Haven,	"
Charles Ives, Esq., New-Haven,	"
W. A. Ives, New-Haven,	"
Riley Blakeslee, New-Haven,	"
George King, New-Haven,	"
James F. Babcock, New-Haven,	"
R. F. Lyon, New-Haven,	"
T. B. Carpenter, (House & Store,) New-Haven,	"
Atwater Treate, New-Haven,	"
Lewis M. Hills, New-Haven,	"
L. M. Mills, New-Haven,	"
"Stafford Building," New-Haven,	"
David R. Benton, Esq.,	"
Orphan Asylum, New-Haven,	"
Seymour Bradley, New-Haven,	"
James M. Townsend, New-Haven,	"
Edward Barrows, New-Haven,	"
O. O. Woodford, New-Haven,	"
Rectory School, Hamden,	"
C. W. Everest,	"
Samuel Russel, Esq., Middletown,	"
Daniel Russel, Esq., Portland,	"
Geological Museum (Sir Wm. Logan, Peer),	Montreal C. E.
Harrison Stevens,	"
Joseph McKay,	"
T. M. Ryson,	"
Lewis Renaud,	"



Marble Mantel-Screen, to be used in place of a Mantel.

The General Principles of Artificial Warming,

AND OF THE

SYSTEM OF MR. GOLD IN PARTICULAR.

BY B. SILLIMAN, JR.,

PROFESSOR OF GENERAL AND APPLIED CHEMISTRY, IN YALE COLLEGE.

HEAT is distributed from an open fire, stove, or other source of heat, either by *radiation*, or by *immediate contact*. In the old-fashioned open fire-place, or in the modern grate, radiation is almost the only source, of any practical value, for the distribution of heat. The draught in these cases carries off nearly all the heat communicated by actual contact of air with the ignited fuel. In anthracite coal and charcoal, the amount of heat sent out in the rays to the surrounding air, is nearly or quite equal to that communicated by contact; while from wood it has been ascertained by experiment to be only about one fourth part of the whole amount of heat set free in combustion. Hence the disadvantage, in point of economy of fuel, of the old methods of heating, compared with the modern, while in respect to perfectness of ventilation, many of the more potent forms of modern apparatus are decidedly inferior to the open fire.

In the *hot-air furnace*, so much used at present, the effect of radiant heat is in a great measure lost, the extended surfaces of hot cast iron communicating heat to the air, in its passage through the hot chamber, chiefly by *immediate contact* of the air with the heated iron surfaces. Unfortunately, the excessive heat of these surfaces often, and indeed generally,

burns the insensible dust always present in the air, producing an unwholesome and disagreeable odor in the apartments, while at the same time the capacity of the air for moisture is greatly increased. The effects of this last evil are seen in the deterioration of wood-work and furniture, and are *felt* in the brittleness of the finger-nails, the dryness of the skin, producing an intolerable itching, and an oppressive sense of fulness about the head. These evils are very imperfectly obviated by the evaporation of water in the chamber of the furnace, a practice which also introduces new evils, without fully remedying the old. *The loss of heat* in the use of the best constructed furnaces, is always very great, and any attempt to economize it by extending the iron surfaces of the smoke flues, beyond a certain limited point, is checked by the leakage of sulphurous and other irrespirable and deadly gases from the joinings of the flues, when these are cooled below a certain pretty elevated point. The advantages ascribed to hot-air furnaces from the equable distribution of heat over the whole house, are often counteracted by the changes in direction of the wind, and other atmospheric causes, which frequently act to expel the heat entirely from one side of a house (particularly if it is in an isolated situation), while in some cases, the direction of the current is reversed, and the heat driven through the cold air box into the outer air. There is also plainly a loss of heat in raising the temperature of the external air (taken in, perhaps, at ZERO, or below), to 70 degrees or 80 degrees, while the efficient ventilation which this system is capable of, when well managed, is usually, in a good degree, lost by the want of any escape being provided for the effete products of respiration and combustion.

Moreover, owing to the total absence of all *rays of heat* from the heated atmosphere blown through the *registers* of a hot-air furnace, it becomes needful, in order to secure an equal feeling of comfort, to keep the air of apartments heated by hot-air furnaces, from 5 degrees to 8 degrees hotter than is needed, in case of radiant heat forming the whole or part of

the heat given to the apartments. Thus, rooms warmed to 65 or 68 degrees by Gold's Heater, are generally considered warm enough, and by people of sedentary habits; while 70 to 80 degrees is the average temperature demanded by those who use hot-air furnaces. The difference is between being in the sunshine and in the shade. An apartment warmed only by heated air blown through it is like a warm air bath.

Notwithstanding the frequent adoption of this system of warming dwellings wherever anthracite coal can be obtained, it is generally felt by those who have had experience in the use of hot-air furnaces, that the objections just enumerated have great force. We have daily opportunities to note the existence and increase of this conviction, in the eagerness manifested at every hand to know the merits of Mr. Gold's system of heating by steam.

EFFICIENCY OF STEAM HEAT.

Ever since the celebrated Dr. Joseph Black, of Edinburgh, in 1764, discovered and explained the laws of heat in their application to steam, it has been well known that steam was the most economical and efficient agent that could be employed for the rapid and easy transmission and distribution of heat. Numerous plans for the employment of steam for warming buildings have been proposed, and one (its circulation in small wrought-iron tubes) has been for a long time in use, to a limited extent, in domestic economy, and much more largely in public buildings. Without pausing to consider in detail the reasons why previous plans for steam heating have been only partially successful, and not generally adopted, it is sufficient to say that they have been very costly, often noisy (*and always liable* to the noise resulting from a vacuum in presence of water in small tubes), and that the high pressure required always involved the sense, and, sometimes, the reality, of danger. Indeed, such an apparatus as has been before used for this purpose, demands an engineer

to look after it, and is, of course, expensive to maintain, and not economical of fuel. These and other difficulties the inventor of the present system believes he has entirely overcome; and he presents his apparatus to the critical consideration of practical and scientific men, with the conviction that a candid examination of its peculiarities will satisfy them that it will accomplish all that he claims for it.

As many intelligent persons have never had occasion to consider the laws of heat in relation to *steam*, and the reason why this subtle agent is at once the safest, most manageable, and most economical mode of distributing heat, it is proposed here to consider these laws and reasons very briefly, and in the plainest manner possible.

GENERAL PRINCIPLES ON WHICH GOLD'S SYSTEM DEPENDS FOR SPECIAL VALUE.

It is a fact made known by experiment, that the quantity of heat which various substances can absorb in the same time from sources of equal intensity, are very various, and consequently, that in cooling from a given temperature, different kinds of matter give out very different quantities of heat.

Now, with respect to air and water, it has been proved by accurate trial, by eminent philosophers, that in cooling from 212° to 32°, water liberates 3.74 times as much heat as the same weight of air will do, and consequently will raise the temperature of 3.74 times as much air to the same degree. This peculiarity is described by the terms *specific heat*, or *capacity* for heat. The power of water to store away heat in itself in a way insensible to the thermometer, and to give it out again on cooling, is nearly four times as great as that of air, and hence the heat which is required by a given quantity of air to raise it to a certain temperature, can be stored away in a much less quantity of water, being as it were accumulated or condensed in it.

When *steam* is made the means of communicating heat, this advantage is much more sensible than it is in the case of water. For on passing into the state of vapor, water absorbs nearly six times as much heat as is required to heat it from 32° to 212°, and this great quantity of heat ($20\frac{1}{2}$ times as much as an equal weight of air can contain, and consequently capable of heating to the same point $20\frac{1}{2}$ times its own weight of air), produced no increased *sensible* temperature in the steam, which has still by the thermometer the temperature of 212°, the same as the water from which it comes. But the instant the vapor or steam is condensed, by re-conversion into water, this enormous quantity of heat is liberated, and becomes available to heat the surrounding air both by radiation and conduction, or by immediate contact. To give this statement in figures, 1 lb. of vapor of water (steam) at 212° will, by condensing, to form water of the same temperature, give off sufficient heat to raise the temperature of $5\frac{1}{2}$ lbs. of water to 212°, equal (3.746×5.5) 20.6 lbs. of air to 212°, or 103 lbs. of air to 68°. A cubic foot of air at 68° = 0.037 lbs. A cubic foot of water is 770 times heavier than a cubic foot of air. At 32° 24.6 cubic feet of air weigh 1 lb. Aqueous vapor at 212° has density of 0.622 air = 1, and 100 cubic inches of it weigh very nearly 15 grains. (Knapp's Chemical Technology, v. p. 89. London edition.)

Because this prodigious quantity of heat is stored away in steam in a perfectly hidden and insensible manner, it has been called the *latent heat of steam*, becoming *sensible* heat again only when the steam is re-converted into water. A careful consideration of the operation of this beautiful law will render clear the fact, so mysterious otherwise, that a comparatively small radiating surface heated by steam should prove sufficient to heat a large volume of air without at any time passing the limit of 212°.

For the sake of more completely explaining the law to those who are not already familiar with it, we will quote the following passage from Silliman's Chemistry, p. 85:

"If we place a known quantity of water over a steady source of heat, we shall see the thermometer indicating each moment a higher temperature, until, at 212°, the fluid boils; after which the thermometer indicates no further change, but remains steady at the same point until all the water is boiled away. Let us suppose that, at the commencement of the experiment, the temperature of the water was 62°, and that it boiled in six minutes after it was first exposed to the heat: then the quantity of heat which entered into it each minute was 25°, because 212°, the boiling point, less 62°, leaves 150° of heat accumulated in six minutes, or 25° each minute. Now if the source of heat continue uniform, we shall find that in forty minutes all the water will be boiled away; and hence there must have passed into the water, to convert it into steam, $25° \times 40 = 1000°$. One thousand degrees of heat, therefore, have been absorbed in the process, and this constitutes the *latent heat* of steam. So much heat, indeed, was imparted to the water, that if it had been a fixed solid, it would have been heated to redness; and yet the steam from it, and the fluid itself, had during the whole time a temperature of only 212°."

It is, therefore, a matter of easy and accurate calculation, what effect may be produced from the condensation of a given volume of steam in an iron or copper radiator, or what amount of such condensation will be required to warm a given bulk of air to a certain temperature. It is commonly stated as the result of experience in the use of the old form of steam heating apparatus, that to heat buildings by steam, every 2,000 cubic feet of space to be heated to 75° requires 1 cubic foot of boiler capacity, and that every square foot of radiating surface on the pipes will heat 200 cubic feet of space to the degree named. Much depends, however, for the amount of boiler capacity on the construction of the boiler, and our experience leads us to the conviction that such a boiler, as is figured in this statement, will accomplish more work than would be implied in the numbers just quoted, with no increase of consumption of fuel. The material of which the radiators are made,

and the nature of the surface, has also much to do with rapidity of condensation, and consequently with the efficiency of the apparatus. It has been determined that at 59° F. one square foot of cast-iron horizontal surface in pipes will condense 0.234 lbs. of vapor, of bright copper 0.184, and of blackened copper tube 0.213. A *vertical* position of the tubes somewhat increases this amount of condensation. American sheet iron (*i. e.* iron not smooth and polished like Russia iron) is believed to be in condensing power nearly equal to cast iron, which is well known to have the highest radiating power of any substance in use. American sheet iron is, therefore, the material which both theory and practice recommend as the best for constructing the radiators in Gold's Apparatus.

ECONOMY OF FUEL IN HEATING BY STEAM.

The means universally resorted to for testing the relative value of different fuels, is to ascertain their respective powers of evaporating water in a well-constructed steam-boiler. Anthracite coal (Lehigh) is regarded as the most efficient fuel that can be employed for this purpose, and it is perhaps a high average of the various experiments made by Johnson, Hayes, and others, on this subject, to state the quantity of water which can be evaporated by the complete combustion of one pound of anthracite at *ten pounds*, producing, of course, ten pounds of steam (equal in bulk at 212° to 596.7 cubic feet of steam), and capable of raising 1,030 lbs. of air to the temperature of 68°. But 1,030 lbs. of air are equal to more than 25,000 cubic feet; and we may therefore say that the complete combustion of 1 lb. of anthracite in a well-constructed boiler, is capable of raising 25,000 cubic feet of air from 32° to 68°. A result beyond comparison more economical than can be reached by any other mode of using fuel, and one to which a reasonably close approach can be made in actual practice by the proper use of steam.

It is a fact of the greatest importance with respect to the

economy of fuel and the proper use of a steam apparatus, that there is no manner of advantage gained by using steam *under pressure*, as a source of heat. As the pressure under which steam is generated increases, so does the latent heat of the vapor diminish and its sensible heat increase. There is a constant ratio between the latent and sensible heat of steam; these two quantities added together always give the same sum. Thus steam at 212° has latent heat equal to 972°, giving the sum 1,184°. Subtract the sensible heat of steam produced at any given temperature from the constant number 1,184, and we have the latent heat for that temperature, *e. g.* at 208° (about three atmospheres of pressure, or 45 lbs. to the inch), steam has a latent heat of 904°. Hence, both theory and experience unite in declaring that steam for heating purposes should be generated at the lowest possible pressure, and consequently in Gold's system the limit of pressure is fixed at only 1 to 1½ lbs. to the inch. The advantages of using steam at a low pressure are not merely its economy, but even more still, *safety from danger of fire.* It is well known that high steam will speedily char all sorts of combustible materials. Thus the felt coverings used to protect steam pipes conveying high steam are soon destroyed; and numerous cases have occurred of the firing of buildings from the contact of woodwork with steam pipes carrying high steam. No such danger exists with low pressure steam, and hence Gold's system is quite free from the risk which has, very properly, led the insurance companies to affix higher rates of insurance upon buildings heated by high steam. Indeed, no mode now in use is so free from all danger of fire as this. The hot-air flues of the common house furnace have destroyed many valuable buildings.

THE RADIATORS.

As the question is often asked why IRON is selected for the material of the RADIATORS IN GOLD'S HEATER, it is well to

state distinctly the fact, *that it is so selected because it is the best of all metals for this purpose.* Its radiating power (which is the same as its absorbing power) is greater than that of any other metal. Thus of all substances known, smoke or lampblack possesses the greatest radiating or emissive power for heat, and is therefore selected as the unit of a standard of comparison. Let us call it 100, its reflecting power being 0. The following table will show the relative value in this respect of some of the more common metals. It is taken from Silliman's Natural Philosophy:

Names.	Radiating and absorbing power.
Smoke—hyphur blackened surface,	100
Cast Iron, polished,	25
Wrought Iron, polished,	23
Zinc, polished,	19
Steel, polished,	17
Tin, polished,	14
Brass, dull,	11
Brass, polished,	6
Copper, varnished,	14
Copper, hammered,	7
Silver, polished,	3

As the Radiators in Gold's Apparatus are japanned with lamp-black, their emissive power is certainly doubled as compared with *polished* iron, showing the very great superiority of iron over all other metals, for the purpose of radiating heat. The only substances possessing a higher radiating power than sheet iron, are glass and writing paper, neither of which it is proposed to adopt.

The experience of five or six years, summer and winter, has shown no deterioration in these radiators from rust; when in use they cannot rust, because there is nothing in the vapor of pure water at a high temperature to rust them, and being closed vessels they cannot rust in summer. The heavy japanned surface protects the exterior completely from all atmospheric changes. The rapid destruction of iron in stove-pipes arises from the acid vapors given off in combustion, and also from the high temperature to which they are subject. Both

of these causes of injury are wanting in Gold's Apparatus; and the Company can most confidently and truthfully assure the public that they may place the fullest reliance upon the efficiency and durability of the radiators now used.

ESTIMATION OF THE VALUE OF GOLD'S HEATER.

Says one who is able to judge, and who has used the *Gold* Apparatus, in a large house in the country, from the first period of its introduction, "I am constantly better pleased with the 'STEAM HEATER OF GOLD.' It leaves me and my family nothing to desire in point of comfort, health, easy management, and economy of fuel. It is the only apparatus in use which is capable of maintaining a uniform temperature, without attention, for over twelve hours. I can arrange my fire in the morning, so that if I do not return again until evening, the steam is still up. If it is then filled up, and the upper door thrown open for the night, the fire continues in such a state that in the morning, say at 6 o'clock, five minutes after the door is closed, the steam is in every part of the house. Twice a week the cinders are raked out, and if the coal is good, the boiler may be run the whole season without dropping the fire; usually, however, it is better to drop the fire once a week, with ordinary management. Combined, as it always should be, with a good system of ventilation, it leaves nothing to be desired."

A NEW ERA IN WARMING BUILDINGS!

STEAM DOMESTICATED

AND ADAPTED TO

WARMING PRIVATE RESIDENCES.

SYNOPSIS OF ITS ADVANTAGES.

Cheapness in Construction.
Economy in Fuel.
Safety from Fire and Explosion.
Self-Regulation.
Simplicity and Ease of Management.
Freedom from Dust and Gas.
Cleanliness—Healthfulness.
No injury to Wood-work or Furniture.
Not liable to Freeze.
Occupies but Little Space.
Quickness of Operation.
Nicety of Adjustment to any required Temperature.
Freedom from Noise.
Adaptation of Appearance to all places.
Freedom from unpleasant Draughts of Air.
Even Distribution of Heat.
Simplicity.
Durability.
Automatic, Radiating, and Condensing.

THE PERFECTION OF ARTIFICIAL HEAT.