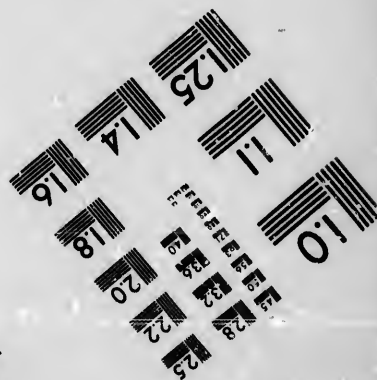
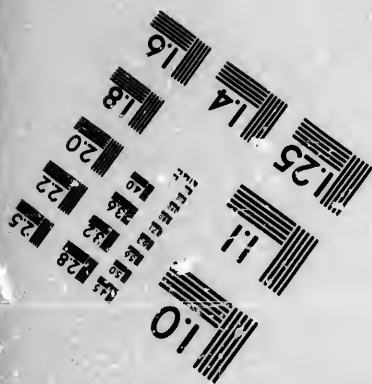
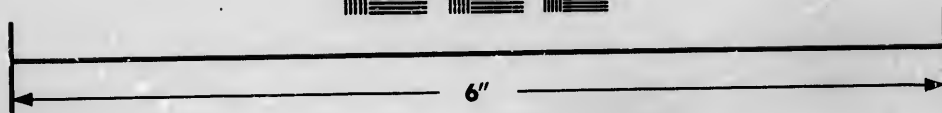
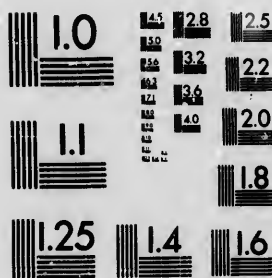


IMAGE EVALUATION TEST TARGET (MT-3)



Photographic
Sciences
Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14590
(716) 872-4503

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**



Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1985

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé la meilleure exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☒ Coloured covers/
Couverture de couleur
- ☐ Covers damaged/
Couverture endommagée
- ☐ Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/
Le titre de couverture manque
- ☐ Coloured maps/
Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- ☐ Bound with other material/
Relié avec d'autres documents
- ☐ Tight binding may cause shadows or distortion along interior margin/
La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/
Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.
- ☐ Additional comments:/
Commentaires supplémentaires:

- ☐ Coloured pages/
Pages de couleur
- ☐ Pages damaged/
Pages endommagées
- ☐ Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- ☒ Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- ☐ Pages detached/
Pages détachées
- ☒ Showthrough/
Transparence
- ☐ Quality of print varies/
Qualité inégale de l'impression
- ☐ Includes supplementary material/
Comprend du matériel supplémentaire
- ☐ Only edition available/
Seule édition disponible
- ☐ Pages wholly or partially obscured by errata slips, tissues, etc., have been refilmed to ensure the best possible image/
Les pages totalement ou partiellement obscurcies par un feuillet d'errata, une pelure, etc., ont été filmées à nouveau de façon à obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
						<input checked="" type="checkbox"/>					

The copy filmed here has been reproduced thanks to the generosity of:

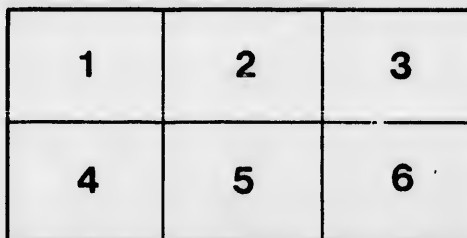
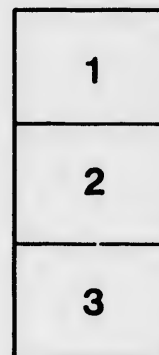
Seminary of Quebec
Library

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shell contain the symbol ➡ (meaning "CONTINUED"), or the symbol ▼ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left hand corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Séminaire de Québec
Bibliothèque

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole ➡ signifie "À SUIVRE", le symbole ▼ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

Joseph Hartman esq. M. & C.
211 art. of Montreal
Montreal Brass Foundry

**Plumbers, Gas & Steam Fitters,
BRASS FOUNDERS, COPPER SMITHS,
AND SILVER PLATERS.**

Bibliothèque,

Le Séminaire de Québec

3, rue de l'Université, MANUFACTURERS OF

**Quebec & QUEBEC, Pendants, Brackets, Beer Pumps, Globe
Valve Cocks, Water Gauges, Compression Cocks,**

AND ALL KINDS OF



**BRASS WORK,
PLUMBERS & GASFITTERS GOODS.**

SOLE AGENTS FOR CANADA FOR

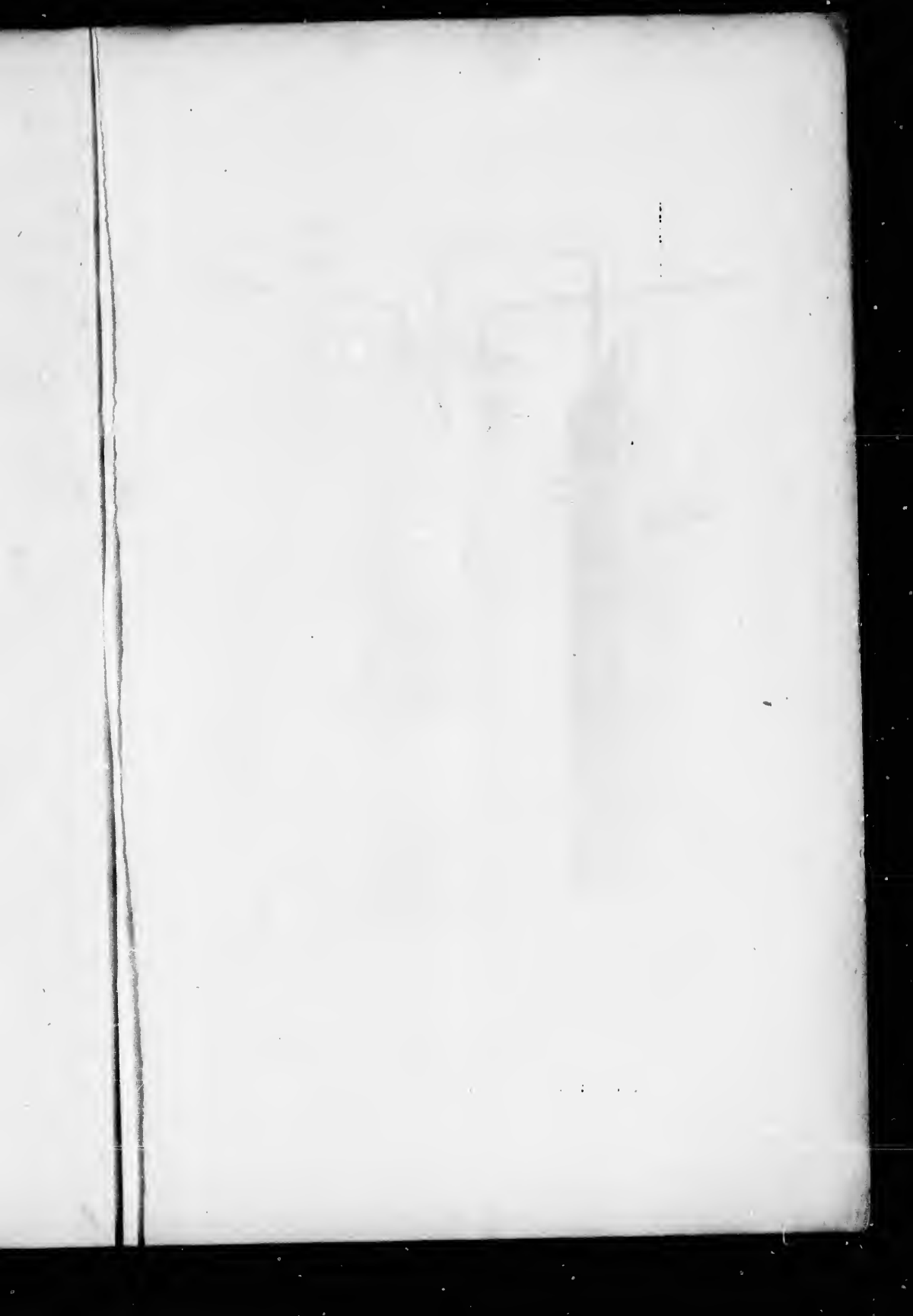
**Gold's System of Heating Buildings
by Steam.**

AGENTS FOR
HARRISON'S EUROPEAN KITCHENER
A COMPLETE COOKING APPARATUS.

WAREHOUSE, WORKSHOP & FOUNDRY,

Corner of Craig & St. Peter Streets,

MITCHELL, COCKBURN & CO.





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 taste 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.

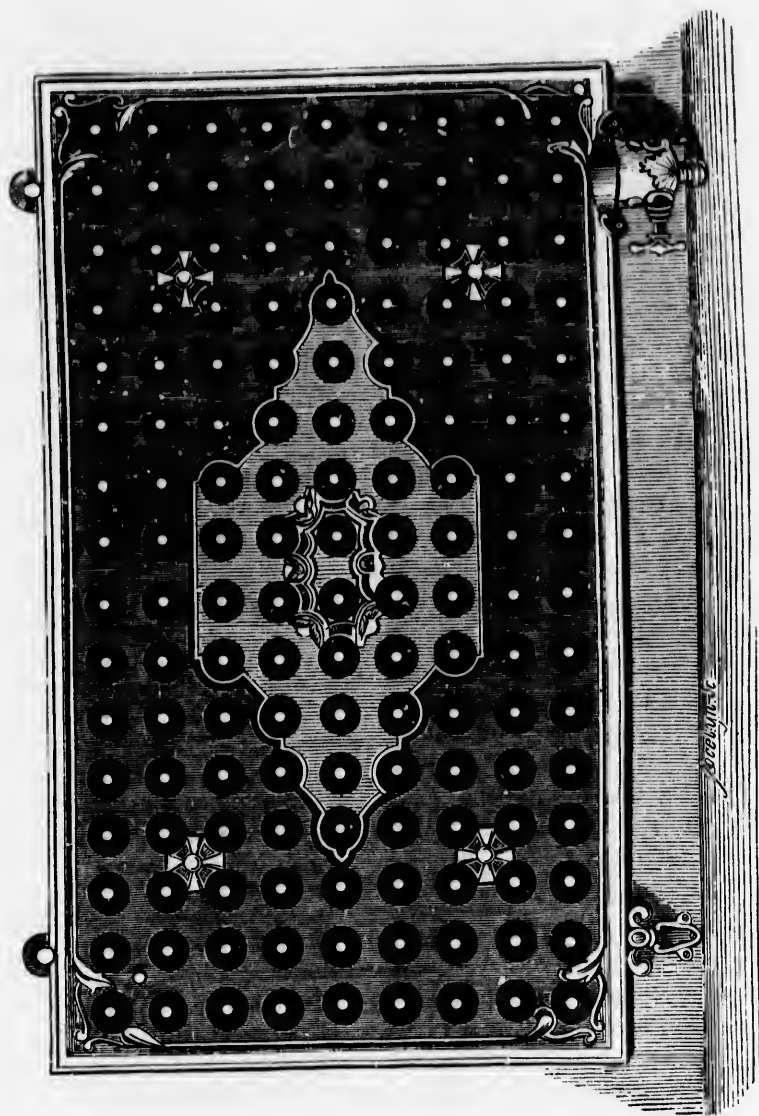
THE REGULATING ATTACHMENTS.

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

d
e
r-

t-
te
ll
n-
r,
m
to
is
er
ep

he
er
ars
ut
m
he
he
ed
it,
he
en
to
aes
to
m-
he
are
on-
the



Radiator.

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 exclusion 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 8 represents the single Radiator or heater, with its appropriate valves and attachments. This, for common use, is located on 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 17 and 25,) or as a marble mantel, (see page 33,) 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 may 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 wood-work 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 the 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.

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 dust 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 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 into 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 imperceptably 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 unburnt 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.

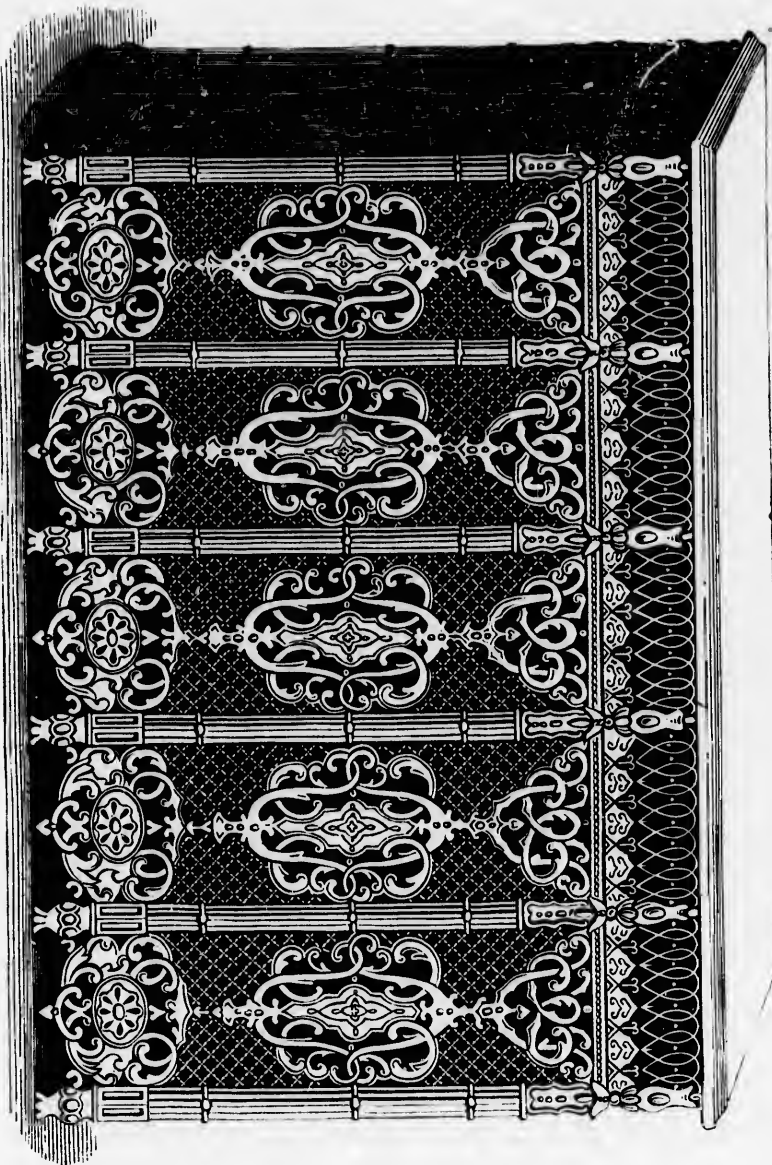
Having given a full description of this new method of heating, and spoken briefly of its prominent advantages, we will omit noticing the various modifications to which it is peculiarly susceptible, and submit to all interested in the subject, whether this apparatus does not supply the want so long felt 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 1st, 1858.

HILLS & BENTON:

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 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 engineer. 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, September 25th, 1858.

HILLS & BENTON:

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 up 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, October 4th, 1858.

HILLS & BENTON:

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 HAVEN, October 6th, 1858.

HILLS & BENTON:

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, 38x38, 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 this 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, 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.

NEW HAVEN, October 1st, 1858.

HILLS & BENTON:

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 pounds 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 HAVEN, Conn., October 12th, 1858.

HILLS & BENTON :

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 by 90 feet, my work-room 20 by 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.

CLINTON AV., BROOKLYN, July 12, 1859.

HILLS & BENTON:

DEAR SIRS:—Having been requested to give you the result of my experience with Gold's Steam Heating Apparatus, I very cheerfully bear testimony to the satisfaction imparted by last winter's trial of it at my house.

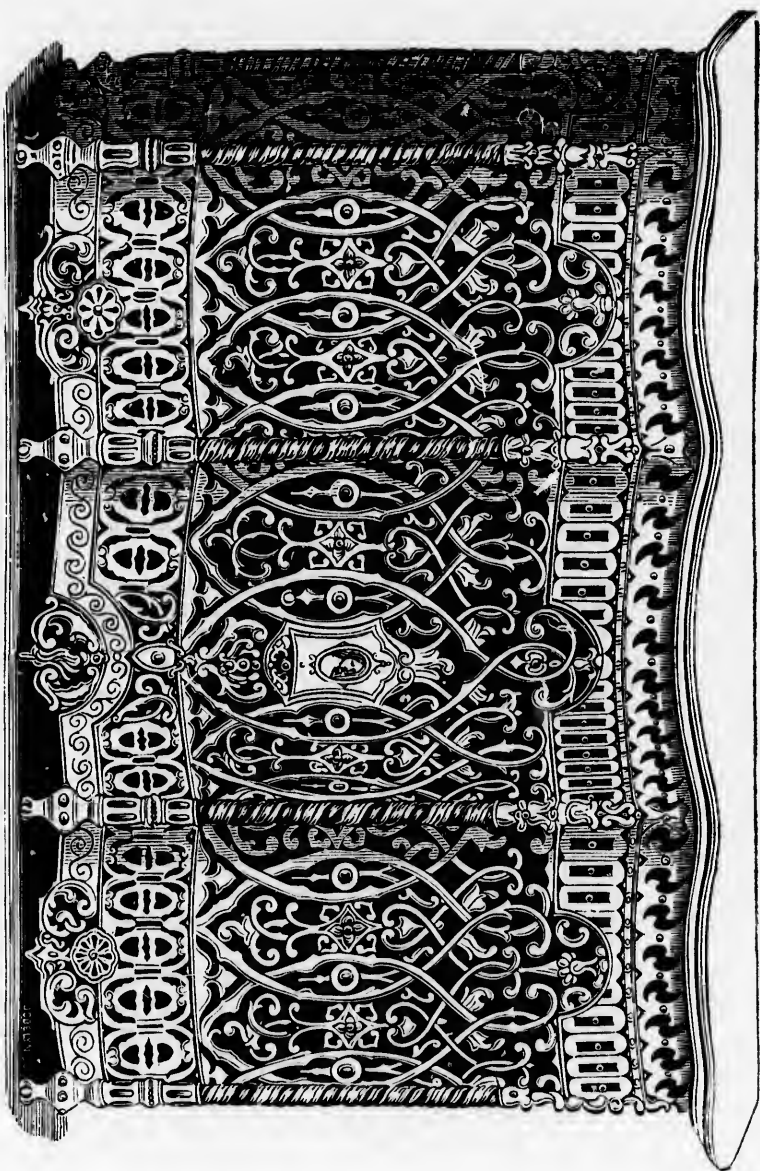
As compared with a Hot-air Furnace, the temperature produced is of a much more even and unvarying grade, and its self-regulating principle reduces the labor of taking care of it simply to putting on the fuel and taking out the ashes twice or three times in the course of twenty-four hours. The direct radiant heat is a very pleasant feature, and its influence is almost as cheerful as that of a fire in an open grate.

It would be doing your Apparatus injustice to omit to mention the freedom we experience from dust and gas, which I have found it impossible to prevent being introduced into the house, when using the best arranged Hot-air Furnaces. With steam, I find no difficulty in warming my dining-room, situated in a rear building, and into which I had not been able to succeed in carrying hot-air.

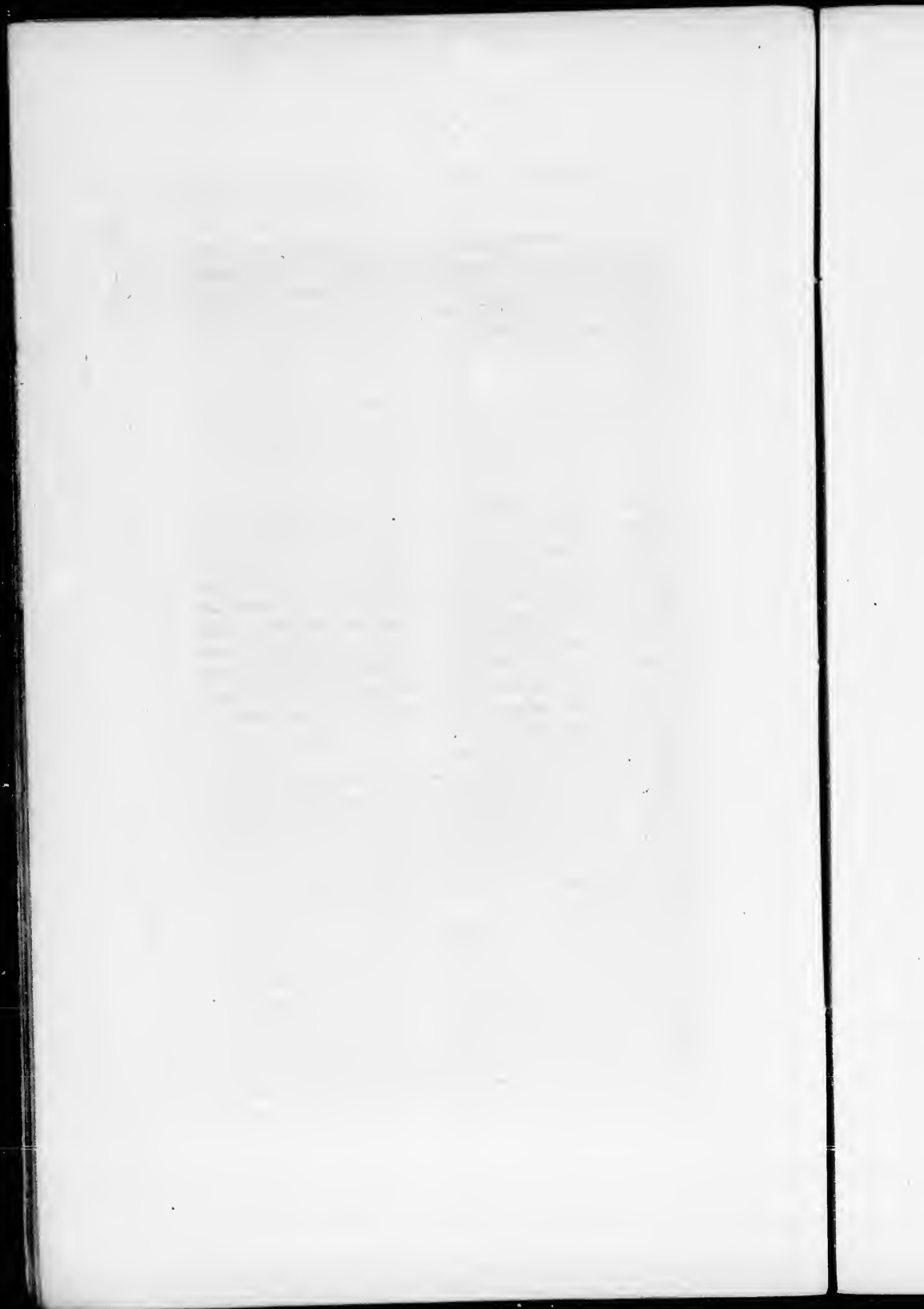
There are various other points in which I consider this method of warming superior to all others that have come under my observation, but as most persons who think of using it, will satisfy themselves by personal inquiry, of its advantages, I will not extend my remarks further on the subject.

Yours respectfully,

F. A. PLATT.



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



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 cost 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 one or two 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 would pay the same amount over again, rather than part with it.

[From CHARLES IVES, Esq., Attorney and Counsellor at Law, New Haven, Conn.]

NEW HAVEN, February 23, 1860.

MESSRS. HILLS & BENTON:

GENTLEMEN:—I very cheerfully, at your request, give you the result of my experience in regard to Gold's Steam Heater. It is due as a matter of justice to you, and as a good citizen, I owe it also to the public. I have had your heater in my house between five and six years. I consider it a necessary of life—as much so as a full supply of pure water. I would no more exchange it for a hot-air

furnace than I would the luxury of a good well for puddle-water. The air of a house warmed by a Gold's Heater, is so uniform, pleasant and healthy, and vastly superior to the air which has been burnt in a hot-air furnace. It is so entirely free from dust, gas or other noxious or disagreeable substances, that for health and comfort, it stands unrivaled, so far as I know. I am erecting upon Fair Haven Heights, in the suburbs of New Haven, a new house, and have just completed a contract with you for one of your Heaters. I am to pay you three times as much for the new heater as I paid for the old, as I shall require a much larger heater, but as you have made great improvements in your apparatus during the last five years, and as my old apparatus was put up at a price below what it could be afforded, I do not object to your present charge. It would be more satisfactory if the cost was less, but in a matter of so much importance to my family, I have felt that your heater was indispensable and must be had at any price. The seven or eight hundred dollars which I might save in first cost, by one or two hot-air furnaces, I should soon pay out in doctor's bills, and lose many times over in health and substantial comfort; such, at least, is my belief.

Perhaps, I should add that I have found your apparatus so automatic or self-regulating, that I have left the cook in charge of it with the same confidence that I have entrusted to her the boiler and water-back of the range. I never look at the apparatus in the cellar more than two or three times in the course of the winter, and when I make an examination I find it all right.

Yours truly,

CHARLES IVES.

TROY, N. Y., October 5, 1858.

HILLS & BENTON:

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.

156 MONTAGUE PLACE,
BROOKLYN, February 23, 1860. }

MESSRS. HILLS & BENTON:

GENTLEMEN:—The steam heating apparatus placed in my house last summer, has been in steady use during the past winter. So far as the capacity to heat a dwelling, the perfect control over the distribution of heat, and the quality and healthfulness of it are concerned, I consider this method far in advance of any furnace hitherto in use.

With reference to its economy, my experience during the winter thus far, would lead me to conclude that two tons of coal per month are requisite to keep the house warm. With the same consumption in furnaces, (two of which I had previously tried,) my house was never heated to my satisfaction.

Yours, very respectfully,

DANIEL AYRES.

BROOKLYN, February 24, 1860.

MESSRS. HILLS & BENTON:

GENTLEMEN:—Having had your apparatus in use in my house for the last five years, I am prepared to speak in the most positive terms in its favor.

I have had my house thoroughly warmed with it for the last five years, and during the whole time I have had an abundance of heat in the coldest weather, and in mild weather I have had no difficulty in regulating the heat to suit my wants and comfort; and the whole has been accomplished with a much smaller quantity of fuel than I ever before used with any other apparatus, and my house more thoroughly warmed.

The heat is of the most delightful kind—mild, efficient and easily distributed throughout the whole house. I consider the apparatus perfectly safe from fire or other accident, and is so easily managed as to give me no trouble or care. The longer I use it the more highly I prize it. I would not do without it, or exchange it for any other mode of heating now in use.

I consider your plan of heating private dwellings and public buildings a public benefaction, and have no doubt but that, if the people were thoroughly acquainted with its real merits, it would be the only apparatus used in all good dwellings or public institutions, and I really desire to see the day when your apparatus shall be introduced into our public schools, (as I have no doubt it will be,) when our

children not having to breathe a burnt and noxious atmosphere filled with dust and gas, can enjoy the comfort of an evenly and well warmed study-room, and be more healthy, vigorous and better scholars, and not be subject to loss of life or limb from the so often repeated *accidental* firing of the building from the hot-air furnace now in so common use.

I am entirely satisfied with my apparatus, and find it all that it is represented to be. Although mine was the first put up in the State and before many of the improvements were applied which you now have in use, making it more desirable. Five years ago we built three houses—in the one occupied by myself we put your apparatus, and in the other two we put hot-air furnaces. At the end of one year it cost us one hundred and fifty dollars each, to repair the houses in which the hot-air furnaces was used, while the one occupied by me needed no repairs; my house was well warmed, the other two were quite uncomfortable in cold weather, so much so that the water-pipes froze up and burst, doing much damage both to walls and furniture.

Yours truly,

R. T. WILDE.

BROOKLYN, February 25, 1860.

MESSERS. HILLS & BENTON:

Your note requesting my experience and opinion as to the qualities of your heater can be briefly answered.

My house has not before been comfortably warmed in severely cold weather, because of its unusual width, although provided with a first class hot-air furnace of very large size.

With your heater, which was put in last autumn, I have been supplied with heat in a manner as convenient and efficient as that with which the Gas-works furnish me with light—that is, I have it *when* it is wanted, *where* it is wanted, and to the *degree* desired. My rooms are not overheated on mild days, nor am I driven to the occupancy of two or three rooms, because of the incapacity of my furnace, on very cold days.

Annoyance from coal-gas escaping through hot-air pipes, or the still worse smell from a dry evaporating pan, or quantities of dust from the street by a large cold-air tube, is no longer experienced.

The atmosphere of my rooms is almost as pleasant as when warmed by the sun, and gives no peculiar impression of having been heated by fire or hot iron.

Beyond all these advantages, however, I regard the immunity from

danger by fire as the most valuable. It was this which first led me to select your heater, and I have had no reason to regret the choice.

My consumption of fuel is a little less than formerly, but the number of rooms comfortably warmed is much greater.

I regard it also, as no slight advantage that this apparatus can be managed perfectly well by ordinary servants, of whom nothing is required but to put on the coal and remove the ashes, the consumption of fuel being perfectly controlled by the use or disuse of the Radiators.

There is none of the noise which attends the use of steam at high temperatures, and danger from explosion or collapse is impossible.

So far as my observation extends, it is the best mode of warming dwellings now in use, and with a system of ventilation with which it may be readily combined, seems to be absolutely perfect.

Respectfully yours,

C. L. MITCHELL, M. D.

FROM PROF. E. E. SALISBURY,

YALE COLLEGE, NEW HAVEN.

The subscriber, having used in his house in this city, for several months past, a Gold's Steam Heating Apparatus, with Hills' improvements, is happy to express his entire satisfaction with it. When once well put up and adjusted, it seems not liable to get out of order, and is easily managed, and perfectly efficient for any degree of cold, if there be enough of radiating surface provided. With proper attention to ventilation, the atmosphere produced is like that of a mild summer's day, free from dust and all other impurities, exceedingly agreeable, and, as I know from personal experience in my own house particularly suitable for a conservatory. The fixtures attached to the radiators distribute the heat very conveniently, wherever it is wanted, and regulate the activity of the fire according to the amount of heat required. The screens with marble tops, used to enclose clusters of radiators, form convenient and not inelegant wall-tables. I cannot say that the actual consumption of coal is less with this than with other warming apparatus, though I am decidedly of opinion that it is more efficient than any hot-air furnace consuming the same amount of coal. It was substituted, in my house, for two hot-air furnaces and one hot-water apparatus, and more than supplies their place.

EDWARD E. SALISBURY.

NEW HAVEN, February 27, 1860.

[The following letter from JAMES M. TOWNSEND, Esq., President of the City Savings Bank,
New Haven, Conn.:]

PROSPECT HILL, EAST HAVEN, near }
NEW HAVEN, February 28, 1860. }

MESSRS. HILLS & BENTON :

GENTLEMEN :—With great pleasure I give you the result of my experience in regard to "Gold's Steam Heater," which I consider, is the "Eureka" (found at last) for heating houses. You are well aware how strong my prejudices were against your mode of heating houses, until I was forced to confess that yours and no other was the best; I had considerable experience with hot-air furnaces, and had, I believe, the best that were ever made, but with them all I never knew what comfort, real comfort was until I experienced the gentle summer-like heat which your apparatus diffused in and about the entire length, breadth and height of our house. You are well aware that our residence is on one of the hills which overlook the city of New Haven, the Harbor and Long Island Sound, necessarily exposed to the cold and high winds of winter, (having no neighboring houses to break off the winds, or protect it from the cold,) which is a severe test for our heating apparatus, to say the least, but notwithstanding that, we have had a delightful summer heat inside our house the whole winter through, and the only fires we had were in the range and in your apparatus. You know we have quite a high tower, into which water is carried, and from which it is carried to different parts of the house; when the house was being built, old and experienced builders prophesied that we would have trouble with our water-works by the freezing and bursting of the pipes, and only a day or two since, one of our best and most experienced master builders (who was one of those who predicted the freezing up) enquired "How about the water-pipes?" and when I told him that not so much as the first appearance of frost had been seen in or about any portion of the pipes or apparatus, he said "I am astonished! I expected to hear (your house being so high, and in such an exposed situation) that you were all froze up—that your pipes had burst and your walls ruined." He acknowledged that if we had had a hot-air furnace, we should have been frozen up, as no hot-air furnace or any two could have given sufficient heat to have protected our water-pipes. If for nothing else, I consider for that, your heater has been invaluable. With hot-air furnaces, some members of my family were very much troubled with headaches, &c., but with your Steam Heater they are entirely free from pains in the head, and are not troubled with those bad feelings which hot-air furnaces always gave them. As I mentioned before, I was at first very much opposed to

your mode of heating, 1st, because I was told I must get an engineer to 'tend it, or I would be blown up, that it was a very intricate and difficult thing to manage; 2d, that it could not be made tight, but that it would be leaking all over the house; 3d, that it made constantly, such a horrible noise; 4th, that I would be suffocated as there was no ventilation, and a hundred other stories were told me, all of which I have found to be false. In answer to the first I would say I have not been blown up, and I am not compelled to hire an engineer, neither am I obliged to look after it even myself, as it *takes care of itself*; all the attention it requires is—the servant made a fire in the fall and has at intervals thrown on coals and raked down the ashes. Your admirable self-regulator attached to it is a perfect success. 2d, We find no trouble from leaks. 3d, It is *not* making constantly a horrible noise. 4th, We are not suffocated, but have all the ventilation that one could wish, as this apparatus permits us to have the inside doors of the house open, which gives a free circulation of delightful, soft, warm air throughout the entire house, perfectly free from gases and dust, and such a thing as coal gas we *never* have. I like it so much that if I were to build another house, and the best hot-air furnace ever made were offered me gratis, I would not accept of it, but would be willing to pay almost any price for your heater rather than not to have it. We all know how much healthier it is to sleep in a cold room, and how pleasant to dress on a cold winter morning in a warm room; with your heater, we can do both, viz: just before retiring, if you want it very cold, turn off the heat, then throw up your window a few minutes and you have a cold room; say fifteen minutes before you wish to dress turn on the heat, and in less time than it takes to write, you have a delightful, warm room, the atmosphere of which is very like a June morning. In conclusion, I would say I consider Gold's Steam Heater, with L. M. Hills' improvements attached and put up by Messrs. Hills & Benton, as *perfect*. I cannot see how any person can be content without one. I believe that for health, comfort and economy it stands unsurpassed. I am well aware that the first cost is considerable more than a common hot-air furnace, but in a term of years I believe it to be the cheapest. Judging from the character of your work, and the excellent materials which you use, I do not see how you can furnish them at any less price, where any one wishes a large and thoroughly heated house; but for any one who wants four to six rooms heated, I should think your Portable Furnace and Heater, upon the same plan, only of less capacity, would be the thing as it costs so much less, the price being within the province of any one (who can build a house) to have. I give you my experience cheer-

fully and with much pleasure, and would add that I have seen many who have, and are using your heaters, and I have never seen the first person who disliked them.

Very respectfully yours,

JAMES M. TOWNSEND.

GREENWICH, Conn.

MESSRS. HILLS & BENTON:

GENTS:—Agreeable to your request, it gives me pleasure to state my experience in the use of Gold's Steam Heating Apparatus in warming my dwelling; I would say in a word, *it is an entire success*. I consider it one of the grand improvements of the age, and *needs only to be known to be generally adopted*. When I erected my dwelling some three years since, I confess it required a good degree of faith to erect a costly house minus chimney grates, &c., but being convinced they were entirely useless, if your Heater was what it was represented to be, I proceeded accordingly and am happy to say, (after three winters' use) the heater has fully answered all it proposed to do in every particular, not the least thing having been out of order during the whole time, and it would require much space to enumerate all the advantages it combines. In a word, I cannot see where any improvement could be made or desired. I will mention only one or two of its many advantages, and in regard to fuel, I find when houses (the size of mine) are warmed by hot-air furnaces requiring 14 to 16 tons of coal my house is warmed and made comfortable with a most agreeable temperature all through with 8 tons of coal a year, and with comparatively little attention and perfectly free from all dust or smell. I have often run the fire 2 and 3 weeks without rebuilding it.

Very respectfully and truly yours.

A. E. MATHER.

[From Rev. J. TRUMBULL BACKUS, of Schenectady, N. Y.]

SCHENECTADY, 29th February, 1860.

MESSRS. HILLS & BENTON:

The Steam Heater more than meets my expectation, although I had become convinced of its preferableness after much inquiry, and experience in regard to other modes of heating. It promises to be as economical as it is convenient and healthful. I infer from my

trial thus far through the winter, that 15 rooms, some of them the largest size, and two halls can be heated with about ten tons of coal; and my plant room, which is much exposed, has been kept above 50°, when the air outside was more than 20° below zero.

By hot-air furnaces and other necessary aids, all this could be heated with not less than 24 tons of coal, then not so effectively and agreeably. Deduct then, the cost of other apparatus, and my conclusion is that the Steam Heater, (its first price notwithstanding) must more than save the interest of the investment.

Yours, &c.,

J. TRUMBULL BACKUS.

HILLS & BENTON:

GENTS:—I am very much pleased with your Steam Heating Apparatus, and most willingly add my testimony to that of others who have tried it, as to its superiority.

It is the most perfect heating arrangement I have ever seen, and does all that can be expected from it. We have no dust nor gas from it, as from hot-air furnaces, but it is perfectly clean—the heat created by it is delightful—very evenly distributed—under perfect control, and during the coldest weather this winter, my house has been thoroughly warmed from basement to attic.

Yours truly,

JOHN W. MASON.

120 Hicks street, Brooklyn.

FEBRUARY 29, 1860.

Extract from the Message of Governor B. Magoffin to the Legislature of Kentucky, December, 1859. In speaking of the Deaf and Dumb Asylum, at Danville, Ky., he says:

"The house is heated in part by steam, by Gold's Heater—a successful, economical, and most comfortable mode of warming it. The one half of the house is warmed by one fire, which consumes only a cord of wood per day, and which, if the apparatus was extended, would heat the whole building."

He then asks for an appropriation of \$2,500 to finish putting in Heating Apparatus upon Gold's Plan.

BROOKLYN, March 1, 1860.

MESSRS. HILLS & BENTON:

GENTS:—During the past fall and winter, I have used "Gold's Low Pressure Steam Heater," for warming my house, and take great pleasure in recommending it as an excellent heating apparatus.

I have paid particular attention to its operations and I find that it requires much less care than an ordinary furnace, on account of its self-regulating power. The air is agreeable, pleasant and healthy, and entirely free from dust or gas. Considering the space warmed, the consumption of fuel is much less than is required for a hot-air furnace. In short I consider it the very best apparatus for warming dwelling-houses or other buildings, that I have ever seen, and the longer I use it the more satisfaction I experience in its use.

Respectfully yours,

N. SOUTHWICK,

122 Hicks street.

MESSRS. HILLS & BENTON:

GENTLEMEN:—Having for the last six months used one of your heaters in my house, I deem it but just to say to you that I am perfectly satisfied with its operation, and I am of the opinion that no other mode of heating, now in use, will compare with it. For economy of fuel, for safety and cleanliness, and I think, taking it altogether, it stands without a rival as a good, reliable heater.

Respectfully yours,

GEO. P. SMITH.

CLEVELAND, Ohio, March, 1860.

FORT HAMILTON, L. I., March 3, 1860.

MESSRS. HILLS & BENTON:

GENTLEMEN:—In answer to your enquiry in relation to my experience with your Steam Heating Apparatus, it gives me pleasure to say that I have found it all that I anticipated, or that you recommended it to be. We have had all the heat we could desire in the coldest of weather, and in mild weather it is readily adapted to just our wants. We find the heat mild, yet efficient; giving a sensation of a mild summer heat, entirely free from dust, gas or noise. We feel a perfect

freedom from danger from fire or other accidents not to be realized in the use of any other heating apparatus. In economy of fuel it is all that you represented, and yet our house has been more thoroughly warmed than we have ever had it before. The self-regulation and ease of management, makes your apparatus especially desirable, as it can be efficiently managed by anybody of ordinary intelligence, and I have no doubt but when your apparatus shall become more generally known, it will be considered an essential part of every good house. With assurance of my entire satisfaction with the heating apparatus, believe me,

Yours truly,

RICHARD R. BENNETT.

REFERENCES.

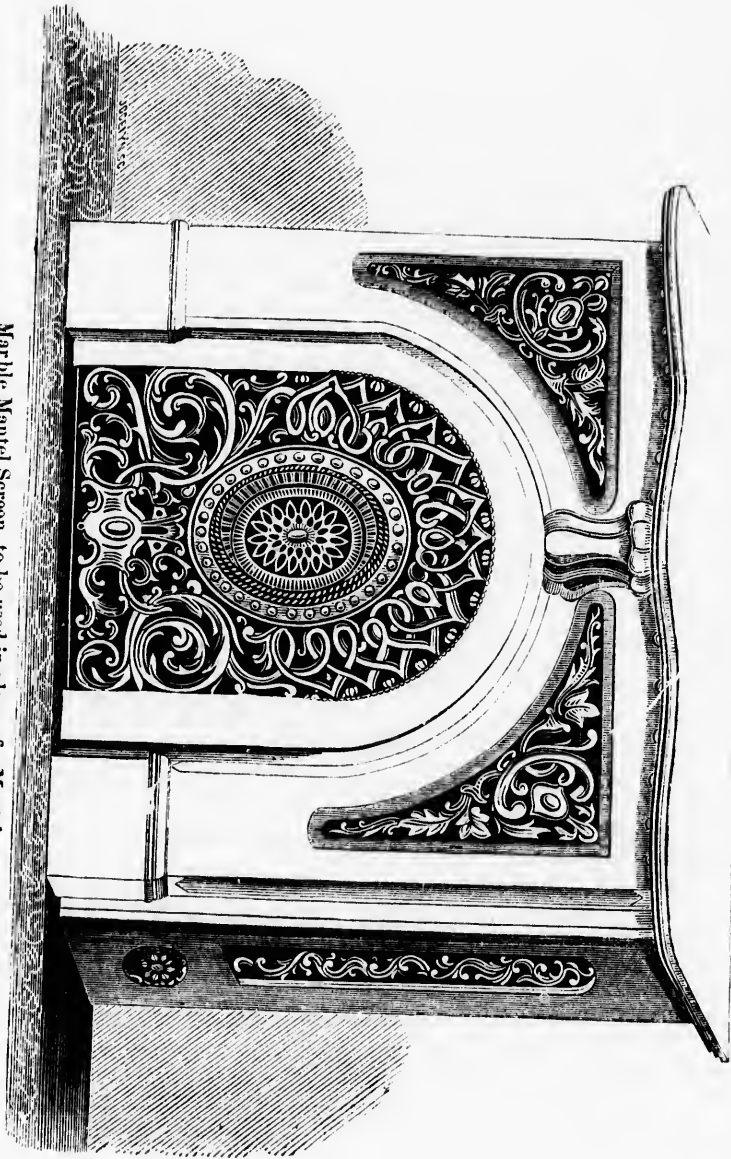
E. W. Dunham, Esq., 35 West Warren street,.....	Brooklyn, N. Y.
F. A. Platt, Esq., Clinton avenue,.....	"
R. T. Wild, Esq., 106 State street,....	"
Dr. C. L. Mitchell, 77 Montague street,.....	"
Dr. Daniel Ayres, 156 Montague street,.....	"
Dr. T. L. Smith, 118 Joralemon street,.....	"
Dr. T. C. Durant, 17 Strong Place,.....	"
Nathan Southwick, 122 Hicks street,.....	"
J. W. Mason, 120 Hicks street,.....	"
H. Messenger, 42 Willow street,.....	"
Richard Field, 109 Willow street,.....	"
J. H. Cunningham, New York avenue,.....	"
Wm. Evans, Schermerhorn street,.....	"
Thos. L. McElrath, Bay Ridge,.....	Long Island.
Richard R. Bennett, Fort Hamilton,.....	"
Brown & Brothers, Bankers, 49 Wall street,.....	New York.
Atwood & Co., Bankers, 104 Broadway,...	"
Corn Exchange Bank, 13 William street,.....	"
Phoenix Bank, 45 Wall street,.....	"
Bowery Savings Bank, 130 Bowery,.....	"
Great Western Insurance Co., 33 Pine street,....	"
Continental Insurance Co., 16 Wall street,.....	"

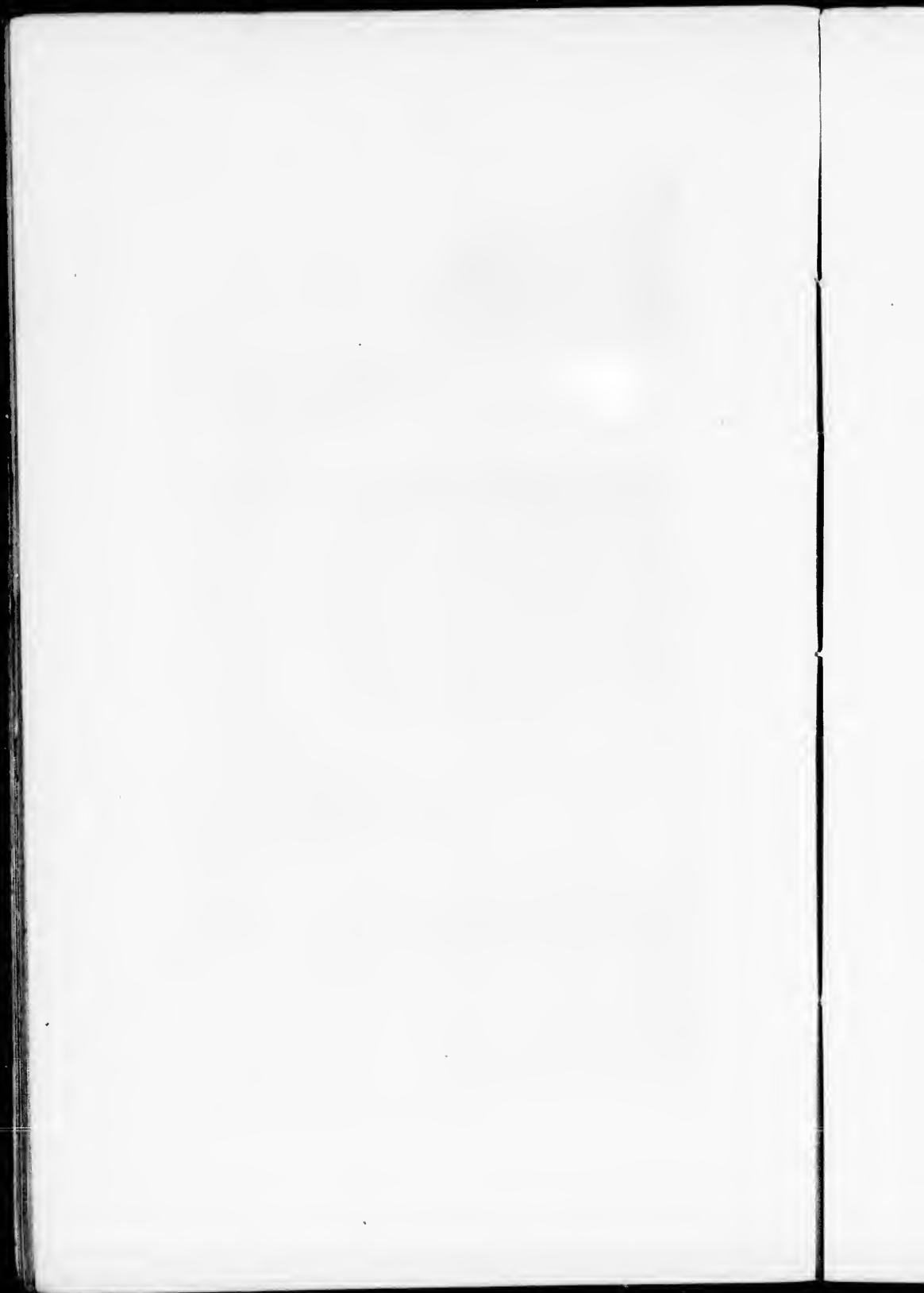
New Amsterdam Insurance Co., 14 Wall street,....	New York.
Columbian Marine Insurance Co., 14 Wall street,...	"
Arctic Insurance Co., 16 Wall street,.....	"
Orient Mutual Insurance Co., 2 and 4 Merchants Ex.	"
Homestead Insurance Co., 136 Nassau street,....	"
Ward School, No. 16, 13th street, 7th av., 9th Ward,	"
R. T. Wild, Esq., 251 Broadway,.....	"
St. Vincent's Hospital, 11th street near 7th avenue,	"
Bowen, Holmes & Co., 320 and 322 Broadway,...	"
Eno, Roberts & Rhodes, 324 Broadway,.....	"
Patton & Co., 341 Broadway,.....	"
Edward T. Riley, 11th street, cor. University Place,	"
B. Steward, 150 Fifth avenue,.....	"
Dr. Edward Bayard, 6 West Fourteenth street,....	"
John Gray, 6 West Thirty-second street,.....	"
J. P. Rogers, 6 Phelps Place, East Thirtieth street,.	"
J. B. Devoe, cor. First avenue and Eleventh street,.	"
J. B. Smith, 85 West Eighteenth street,	"
Felix Steinhart, 279 East Fourteenth street,.....	"
Rev. J. Lewis, Clifton,.....	Staten Island.
Everitt Clapp, Esq., Yonkers,....	Westchester Co.
J. T. Warring, Yonkers,.....	"
Cyrus Townsend, Peekskill,.....	"
Dr. C. Dunham,.....	Newburgh.
Dr. C. H. McLellen,.....	Poughkeepsie.
Joseph Bartlett,.....	"
Rev. J. Trumbull Backus,....	Schenectady.
Prof. B. Silliman, Jr., Yale College, New Haven,...	Connecticut.
Prof. E. E. Salisbury, " " " " " " " "	"
Prof. F. Shephard, " " " " " " " "	"
Wells Southworth, Esq., President City Fire Insur-	"
ance Company, New Haven,.....	"
James M. Townsend, City Savings Bank, New Haven,	"
Philemon Hoadley, New Haven,.....	"
Willis Peck, New Haven,.....	"
Charles Ives, Esq., Attorney and Counsellor at Law,	"
New Haven,.....	"
Win. A. Ives, New Haven,.....	"
Riley Blakeslee, New Haven,.....	"
James F. Babcock, Esq., Editor New Haven Pal-	"
ladium, New Haven,.....	"

R. F. Lyon, New Haven,	Connecticut.
T. B. Carpenter, New Haven,	"
Stafford Building, New Haven,	"
Seymour Bradley, New Haven,	"
Dr. Phillips, Water Cure, New Haven,	"
Amos Munson, New Haven,	"
Rockville Bank, Rockville,	"
Geo. Kellogg, Jr., Rockville,	"
A. E. Mather, Greenwich,	"
Thos. Barrows, Jr., Rockville,	"
Samuel Russell, Esq., Middletown,	"
Daniel Russell, Esq., Portland,	"
C. H. Carter, Esq., Waterbury,	"
J. D. Alvord, East Bridgeport,	"
N. A. Baldwin, Milford,	"
W. H. Dayton, North Orange,	New Jersey.
Court House, Cleveland,	Ohio.
George P. Smith, Cleveland,	"
James Pannell, Cleveland,	"
George A. Stanley, Cleveland,	"
William Case, Cleveland,	"
Nelson Munroe, Cleveland,	"
Geological Museum, (Sir William Logan, Peer, Montreal,	Canada East.
Harrison Stevens, Montreal,	"
Joseph McKay, Montreal,	"
T. M. Bryson, Montreal,	"
Lewis Renaud, Montreal,	"
Elisha Lane, Montreal,	"

Use one mantle screen, to be used in place of a Mantel.

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,
WITH
L. M. HILLS' IMPROVEMENTS,
BY B. SILLIMAN, JR., M. A., M. D.,

PROFESSOR OF GENERAL AND APPLIED CHEMISTRY, IN YALE COLLEGE.

DISTRIBUTION OF HEAT.

How Heat is Distributed.—From an open fire, or stove in an apartment, heat is distributed in two ways: 1st, by *radiation*, or the direct emission of heat in rays, as the heat of the sun is distributed; and 2dly by *conduction* or *immediate contact* of the air of the apartment with the heated surfaces of fuel or of iron. The distinction between these two modes of communicating heat is fundamental and important to be borne in mind, when weighing the claims of various modes of artificial heating.

In all open fires 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 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, most of the more potent forms of modern apparatus are decidedly inferior to the open fire. Without *radiant heat* from some source, no apartment is properly warmed.

Hot-Air Furnaces give no Radiant Heat.—In the hot-air furnace, so much used, the effect of radiant heat is lost. The extended surfaces of hot cast-iron communicate heat to the air, in its passage through the hot chamber, chiefly by immediate contact of the air with the heated iron surfaces.

The *radiant heat* given out from these hot surfaces of iron is absorbed by the enclosing walls of the hot-air chamber, and partly lost, and partly returned by secondary radiation to the first source, the air in its passage through the chamber to the apartments being heated only by direct contact with all these heated surfaces.

Why Hot-Air Furnaces Injure the Air.—They do so chiefly in three ways, viz:

1st, By burning the minute particles of organic matter always present in the air, viz: dust, filaments of vegetable substances, &c., &c., and which coming in contact with the highly heated iron surfaces in the hot air chamber, are burnt, producing a disagreeable odor and an unwholesome atmosphere in the apartments.

2d, By unduly increasing the capacity of the air for moisture: the effects of this 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 cham-

ber of the furnace, a practice which also introduces new evils, without fully remedying the old.

3d, By the leakage of sulphurous and other irrespirable and noxious gases from the joinings of the flues, when these are cooled below a certain pretty elevated point. This is a principal source of annoyance and injury in the use of hot-air furnaces, and one which rapidly increases with their age. Continuous contractions and expansions will loosen the best joinings, in the several parts of the iron work, while the warping effect of continued heat on cast iron is well known.

The loss of heat in the use of the best constructed furnaces, is always very considerable, 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 here noticed, which becomes intolerable if the iron flues are unduly extended.

Why Heated Air cannot supply the want of Radiant Heat.—It is notorious that an apartment warmed by an open fire, is comfortable when at a lower temperature by the thermometer than in case of an apartment warmed by heated air. Experience has shown that it is 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, (from whatever source) 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, even by people of sedentary habits; while 72 to 80 degrees is the average temperature demanded by those who uses hot-air furnaces. The difference is like being in the sunshine and in the shade. The cause is found in the total absence of all *rays of heat* from the heated atmosphere blown through the registers of a hot-air furnace. An apartment warmed only by heated air blown through

it is like a warm air bath. In such an apartment the human body is hotter (98°) than any other source of heat there present, and is constantly cooling by its own radiation; while in presence of an open fire or of radiant heat from steam, the body receives direct rays of heat from a source hotter than itself. Hence, with radiant heat, a lower temperature in the surrounding air, is consistent with greater comfort.

This point is far from being appreciated, even by persons well acquainted with scientific principles, and their application; but the more it is considered, the more obviously true and important it appears in its application to artificial warming.

The same objections hold (in the absence of rays of heat) to the distribution of the heat from steam, when the attempt is made, as is sometimes done, to apply this agent solely to the heating of air in an air-chamber to be subsequently distributed by flues as in the common hot air furnace. *Such an arrangement may be an important auxiliary in a good system of ventilation, but can never supply the want of direct radiant heat in the apartments to be warmed.*

Notwithstanding the frequent adoption of the hot air system for 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 the present system of heating by steam.

EFFICIENCY OF STEAM HEAT.

Earlier Plans of using Steam.—Since the distinguished chemist Dr. Joseph Black, of Edinburgh, in

1764, first 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. Several plans for the employment of *high* 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 all plans for heating by high steam have been only partially successful, and not often adopted in domestic use, 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 involves the sense, and, indeed, the reality, of danger, both from fire and explosion. Indeed, such an apparatus as has been before used for this purpose, requiring a pressure from twenty to one hundred pounds per square inch, 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, when used at low pressures, at once the safest, most manageable, and most economical mode of distributing heat, it is proposed here to consider these laws and reason very briefly, and in the plainest manner possible.

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

Peculiar Power of Water and Steam to Store up Heat.—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, is 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 observers, 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 in different substances is described by the terms *specific heat*, or *capacity* for heat. Thus 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 weight of air, to raise it to a certain temperature, can be stored away in a much less weight of water, being, as it were, accumulated or condensed in it.

The Heat in Steam.—When *steam* is made the means of communicating heat, this advantage is much more sensible than it is in the case of water. This important fact is thus explained:—On passing into the state of vapor, water absorbs nearly six times as much heat as is required to raise it from 32° to 212° . This increase of heat would render a solid body *red hot* by day-light, and still the steam produced by it has only 212° of sensible heat. This quantity of heat is $20\frac{1}{2}$ times as much as an equal weight of air can contain, and is consequently capable of heating to the same point $20\frac{1}{2}$ times its own weight of air. But the instant the steam is condensed, by re-conversion into water, this enormous quantity of heat (essential to

its condition as steam) is liberated, and becomes available to heat the surrounding air, both by radiation and conduction, or by immediate contact. Hence it is plain why steam is so prodigiously energetic as an agent for the rapid transportation of heat, and its safe and rapid delivery at the points where it is wanted, losing on the way to its destination, only such portions as the radiation from the pipes permit. When it is important to redeem this loss by the pipes in transit, they are so packed in non-conducting substances as to reduce the loss to a very moderate part of the sum total.

A few figures will make the heating power of steam more evident. A pound of steam at 212° , sets free, by its return to the state of water, (condensation,) sufficient heat to raise the temperature of $5\frac{1}{2}$ pounds of water from 32° to 212° . This quantity of heat will raise twenty times as much air to 212° (3.746×5.5), or it will raise 103 lbs. of air from 32° to 68° . Since a cubic foot of air weighs only 0.037 lbs., it follows that a pound of steam at 212° , by condensation to water, sets free heat enough to raise 2,533 cubic feet of air from 32° to 68° . Water is 770 times heavier than air. At 32° , 24.6 cubic feet of air weigh 1 pound. At 212° steam weighs 0.622, where air weighs 1, and 100 cubic inches of steam weigh nearly 15 grains.

Why the Heat of Steam is called Latent Heat.—

The thermometer indicates only 212 degrees of heat in steam at the atmospheric pressure, and still it is in full proof that the steam has really absorbed five and a half times as much heat in becoming a vapor, as the water from which it arose, absorbs in passing from 32° to 212° . That the steam really retains this prodigious quantity of heat, (essential to its condition as a vapor) we see from the facts above stated. But it is stored away, so to speak, in the steam in a perfectly hidden and insensible manner, and hence it has been very significantly called *latent*

heat of steam. But it becomes sensible heat again 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 itself the limit of 212° .

Experimental Proof of the amount of Heat latent in Steam.—"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, $25^{\circ} \times 40 = 1000^{\circ}$. 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, as already stated, 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° ."

Application of these Principles to the Practice of Warming.—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 radiators of iron, or what amount of such condensation will be required to warm a given bulk of air to a certain temperature.

But in practice there is always a loss of effect due to a variety of causes, and the actual results are never as high as the conditions of the laws set forth would require.

It is commonly stated as the result of experience in the use of the old form of steam heating apparatus, (viz:—coils of small pipes,) 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 air to the degree named. Much depends, however, for the amount of boiler capacity, as well as on the construction of the boiler. Experience leads us to the conviction that such a boiler as is figured in this pamphlet, will accomplish more work than would be implied in the numbers just quoted, with no increased 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. 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 nearly equal in condensing power 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 low pressure Steam Heater.

ECONOMY OF FUEL IN HEATING BY STEAM.

Heating power of Anthracite.—The means universally resorted to for testing the relative value of differ-

ent 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 vapor,) and capable of raising 1,930 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. Count Rumford's experiments proved that one part of Carbon in burning raised 78 parts of water from 32° — 212° . Prof. W. R. Johnson, in his experiments on the heating power of coals, determined that about 86 per cent. of the total heating power of good anthracite were expended in evaporating water, while about 14 per cent. of the total was lost in the products of combustion. Of the total heating power, by calculation, about 26 per cent. were lost in practice, as deduced from the experimental effects stated in his tables.

It is a fact of the greatest importance to be understood with respect to the economy of fuel and the proper use of steam apparatus, that there is no manner of advantage gained by using steam *under pressure*, (or high steam,) 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.

COMPARATIVE ADVANTAGES OF HIGH AND LOW STEAM.

Constant ratio of Sensible and Latent Heat.—

Experiment has proved that at all temperatures and pressures, steam contains the same absolute quantity of heat. The latent and sensible heat of steam taken together give always the same sum, and while, as is well known, the sensible heat of steam may be carried by high pressures to any desired degree, even so high as to fire tow or shavings, as was shown by Jacob Perkins, with his Condensor; still, this was done at the expense of the latent heat. The latent and sensible heat of steam together, amount in round numbers to 1,184 degrees above the freezing point of water. Thus, a certain weight of steam at 212° when condensed into water at 32° gives out

Sensible heat,.....	180°
Latent heat,.....	1,000°
	<hr/>
	1,180°

And the same weight of steam heated to 400°, will, when condensed to water at 32°, give out

Sensible heat,.....	368°
Latent heat,.....	812°
	<hr/>
	1,180°

But while the absolute quantity of heat in the two cases is unaltered, the attendant circumstances are most seriously influenced as respects safety from explosion and fire.

Steam at 212° exercises only one atmosphere of pressure, *i. e.* a boiler filled with steam at that temperature; is under no more pressure than if filled with common air of the usual tension, while at 400° the pressure is equal to sixteen atmospheres or 240 lbs. to the inch. But taking a more common pressure for high steam, say 75 to

100 lbs. pressure, we still find a temperature of 308° to 330°, sufficient to char wood in no long time and to endanger buildings as well from fire, as in the risk of explosion.

In the following table are given the temperatures, corresponding to pressures from one atmosphere to twenty atmospheres.

HEAT IN DEGREES. FAHRENHEIT.	PRESSURE.		HEAT IN DEGREES. FAHRENHEIT.	PRESSURE.	
	ATMOSPHERE.	LBS.		ATMOSPHERE.	LBS.
212°	1	15	308°	5	75
220°	—	17.7	320°	6	90
230°	—	21.5	332°	7	105
240°	—	25.8	342°	8	120
250°	2	30.9	351°	9	135
260°	—	36.1	359°	10	150
275°	3	45	393°	15	225
294°	4	60	418°	20	300

It is manifest from what has been said, that every motive of *safety*, *economy* and *efficiency* favors the use of low pressure over high pressure steam for warming buildings.

FREEDOM OF GOLD'S SYSTEM FROM DANGER FROM FIRE.

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 wood-work 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 from fire as this. The hot-air flues of the common hot-air furnace have destroyed many valuable buildings.

THE RADIATORS.

Why Sheet-Iron is preferred for Radiators.—As the question is often asked why SHEET-IRON is selected for the material of the RADIATORS IN GOLD'S HEATER, it is well to state distinctly the fact, (in addition to what has been said on page 43,) *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 of 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.

Names.	Radiating and absorbing power.
Smoke—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 enameled with a black or dark surface, 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, aided by the high temperature to which they are subject. In summer stove-pipes perish more rapidly than when in use, because the salts contained in the dust and soot attract moisture from the air, and lining the inner surfaces with a concentrated saline and acid solution, soon destroy the pipe. Both of these causes of injury are wanting in Gold's Apparatus; and the manufacturers 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.

Montreal, April 5, 1860.

Mitchell, Cockburn & Co.

Gentlemen,

I have much pleasure in giving my testimony to the satisfactory working and heating of the apparatus which you have placed in my residence, Belle River, St. Mary Street, known as "Gold's System of Heating Buildings by Steam."

I deem it quite safe from danger of Fire or explosion, diffusing a gentle and summer-like heat, and governing itself according to the temperature of the atmosphere: requiring no more attention than an ordinary coal-stove, with less frequently replenishing of the fuel, and yet sufficient to heat a house of ordinary size.

It is a neat and convenient apparatus, perfectly free from smoke and dust, and the cold drafts, inseparable from other systems.

I think the amount of fuel it consumes is very little for the results; and in a word, that it much surpasses all the old systems of heating I am acquainted with, as regards comfort, economy, and that greatest of blessings, Health.

Your most obedient, &c. &c.

J. PAPINEAU.

P.S.—April 30th 1860. I find that I have consumed last winter but seven tons of Coal, to maintain a uniform temperature night and day of 65° to 70° of Fahrenheit throughout my house, from cellar to garret. It was the best Lehigh, procured from Mr. King, of St. Francois Xavier Street.

L. J. A. PAPINEAU.

Montreal, 12th January, 1860.

Messrs Mitchell, Cockburn & Co.

Gents,

In answer to your enquiries respecting the working of your "Gold's Steam Heater" I can say that it has given me great satisfaction; my house is very pleasantly and evenly heated; it is very simple in its arrangements, and the Dampers being self-regulating requires but little attention. It appears to be economical in fuel, and I think perfectly safe. From my own experience I can recommend your "Steam Heater," and feel confident that it must soon be very generally used in all public and private buildings.

I am, yours, &c.

GEO. HAGAR.

Montreal, Jan. 12, 1860.

Messrs Mitchell, Cockburn & Co.

Dear Sirs,

At your request, I may say that I have used in heating my dwelling house, for the last two years, "Gold's Steam Heating Apparatus", which has given me satisfaction in producing ample genial heat, and in being, as I believe, perfectly free from all danger of fire; and on the whole I consider the improvement as a valuable one for the purpose of heating public or private buildings. There is also

economy in fuel, in my opinion, of fully one-third over heating through the aid of hot air.

In conclusion I will say that with the exception of some little trouble I have had with leakage where the pipe connects with the radiator, that the apparatus has given me entire satisfaction.

I remain,
Your obedient servant,
H. STEPHENS.

Montreal, 11th Jan. 1860.

Messrs Mitchell, Cockburn & Co.

Gentlemen,

The apparatus for warming buildings known as "Gold's Patent," which I have in my dwelling house, I find to give satisfaction, excepting a short period in which the draft board in chimney under smoke pipe had fallen down; but on being replaced the difficulty disappeared, and have now no trouble in heating the house thoroughly; and although my experience of the merits of the system extends only a few months, I have confidence in the principle, as well as pleasure in the immunity from Stove Pipes, smoke, labor, and risk from fire; and, in my opinion, from accident, which I think could only occur from (if at all possible) wilful neglect. I may also state that among its best features is the healthful and uniform quality of the heat.

Yours truly,
T. M. BRYSON.

Messrs. Mitchell, Cockburn & Co.

Dear Sirs,

In answer to your enquiry as to how I am satisfied with your "Gold's Steam Heating Apparatus," I am happy to be able to testify to its perfect efficiency in producing an agreeable, healthy atmosphere, such as I have never experienced in houses heated either by stoves or hot air furnaces. Its chief advantages appear to me to consist in the simplicity of its management, cleanliness, and freedom from dust or smoke, facility of maintaining an even temperature in both slight and severe cold, (with a proportional consumption of fuel) and perfect safety in working. The most essential item towards ensuring the above appears to be a thoroughly good draught for the furnace; but with that, and a good system of ventilation, in the different parts of a building, I consider it the best mode of artificial heat for this country that has hitherto come under my notice.

Yours respectfully,

FRED. LAWFORD,
Architect.

1, Ottawa Place, Montreal.

I have much pleasure in confirming the foregoing statements in reference to the steam-heating apparatus, having had similar experience and found it perfectly satisfactory.

CHAS. A. LOW,

2 Ottawa Place, Montreal.

To Messrs. Mitchell, Cockburn & Co.

Montreal, January 11, 1860.

Messrs. Mitchell Cockburn & Co.

Dear Sirs,

I have had "Gold's Patent Steam Heating Apparatus," put up by you in use since 1st November last, and have no hesitation in stating that it has worked admirably, and given perfect satisfaction.

Yours truly,

D. R. WOOD.

Montreal, 5th Dec. 1859.

Mitchell, Cockburn & Co.

Gentlemen,

From my experience in the Steam Heater you have put into my house, I am confident it is the best system of heating buildings that has come within my knowledge, and must be especially prized where there are children or invalids, imparting that salubrity of atmosphere which must be highly beneficial to those whose vocation obliges them to be much confined to house; it is easy to manage, and does not consume much fuel for the amount of heat it radiates.

L. RENAUD.

To the Honorable John Rose, Commissioner Board of Works.

*Gold's Steam Apparatus in the New Building of the
URSULINE CONVENT.*

Messrs. Mitchell, Cockburn & Co. are at present applying to me for a recommendation of "Gold's Steam Heating Apparatus," as we are using it since November last in one of our Buildings, which is 83 x 53 feet, and three stories high.

In strict justice I do consider the whole system as a great improvement, entirely safe from fire, and economical.

The Religious Ladies of the Convent complained of cold in the severe weather we have had lately; but, in my opinion, the cause most likely came from a want of experience on the part of the nuns in the proper way of keeping up a sufficient fire.

Messrs. Mitchell, Cockburn & Co. have done the work with great care in my opinion, and although they were bound to give us but a sufficient quantity of radiating surface, still I am under the impression that we have one fourth more than required.

GEO. L. LEMOINE, Ptre.

Chaplain.

Ursulines of Quebec, }
Jan. 16, 1860. }

Montreal, 12th Jan. 1860.

Messrs. Mitchell, Cockburn & Co.

Gentlemen,

In answer to your letter respecting the "Gold's Steam Heater," which you have placed in my house, I have pleasure in saying, that I consider it has all those essential qualities that are claimed for it. It is automatic in its working, and it radiates an even temperature throughout the building; it is free from all dust, ashes, and gasses, is quick in its operation, and makes or reduces the steam according to the atmosphere; it is altogether free from the accident of fire, and being low pressure I consider it impossible to explode. The atmosphere is healthful and invigorating, surpassing everything I am acquainted with; it burns less coal than the hot air or high pressure systems; it should be introduced into our schools, churches, public and private buildings.

B. BREWSTER, jr.

Montreal, April 16th, 1860.

Messrs. Mitchell, Cockburn & Co.

Gentlemen,

Having fully tested "Gold's Patent Heating Apparatus," I am convinced it is the safest and most economical way of heating either public or private buildings. I use the hot air Apparatus at my store, consequently I have experience in the different modes of heating, and have no hesitation in saying that "Gold's Patent" is far superior to any other that has come under my observation.

Yours truly,

BENJAMIN LYMAN.

P.S.—I used about five tons of Coal during the first winter, about the quantity that I used in my hall stove the winter previous.

B. L.

Montreal, 30th April, 1860.

Messrs. Mitchell, Cockburn & Co.

Gentlemen,

The "Gold's Steam Heater" which you built in my dwelling house has answered all my expectations, as giving out a soft and genial atmosphere, safe from fire or explosion; and it being automatic in its regulating attachments, requires very little attention. I have not experienced gases, cold drafts, ashes or many other annoyances inseparable from the wood or coal stoves, or the hot air apparatus.

NORTON B. CORSE.

REFERENCES.

**Gold's Steam Heater built for the following
Gentlemen by Mitchell, Cockburn & Co.**

Geological Museum, Sir Wm. Logan.....	Montreal.
Harrison Stephens, Esq.....	"
Joseph McKay, Esq.....	"
T. M. Bryson, Esq.....	"
Hon. Louis Renaud, Esq.....	"
L. J. A. Papineau, Esq.....	"
C. A. Low, Esq.....	"
Fred. Lawford Esq.....	"
N. B. Corse, Esq.....	"
Benjamin Brewster, jr.....	"
Edmonstone, Allan & Co.....	"
Benjamin Lyman, Esq.....	"
J. Bouthier, Esq.....	"
D. Russ Wood, Esq.....	"
George Hagar, Esq.....	"
Peter Robertson, Esq.....	"
Savings Bank, Place D'Armes	"
Ontario Bank, do do	"
Liverpool and London Insurance Company.....	"
Mrs. J. E. Mills.....	"
H. Lionais, Esq.....	"
Alexander Walker, Esq.....	"
Robert Wood, Esq.....	"
Hon. L. H. Holton	"
Ashley Hibbard, Esq.....	"
Ursuline Convent, Rev. G. L. LeMoine.....	Quebec.
Victoria Hotel, W. H. Morrill, Esq.....	Ottawa City.

Elise Lane, Montreal	
A. Poinsonault,	10 ^c
David Davidson,	10 ^c
Chas. Paton	10 ^c
H. H. Whitney,	10 ^c
Samuel Mason,	10 ^c
Henry Beckwith	10 ^c
Chambers Brown	10 ^c
John M. Young	10 ^c
Bank of Montreal	10 ^c
S. H. May	10 ^c
John Ross	10 ^c
Chas. D. Blackwell	10 ^c
John Brass	10 ^c
J. H. Springle	10 ^c
Arthur Simpson	29
Prince of Wales Hotel	29
Bella Flint, Belleville C. N.	

8

9

10

11

12

13

14

15

16

17

18

19

20

21

22

23

24

25

26

27

28

29

30

There are,

11,

**GOLD'S PATENT LOW PRESSURE
SELF REGULATING
STEAM HEATING APPARATUS,
FOR WARMING**

*Private Residences, Stores, Churches, Hospitals,
Public Buildings, Greenhouses, Graperies, &c. &c.*

**HARRISON'S PATENT KITCHENER,
OR,
EUROPEAN RANGE,**

**Adapted to the wants of Private Families, Res-
taurants and Hotels.**

**Harrison's Kitchenier will Save 50 per cent.
in Fuel,**

*And do more work than any other range before the
public.*

MITCHELL, COCKBURN & Co.

SOLE AGENTS FOR CANADA.

