HOLLY
STEAM COMBINATION CO.
(LIMITED)
LOCKPORT, N.Y.

THIRD ANNUAL ANNOUNCEMENT:
1880.

OFFICERS.
D. F. Bishop, M.D., President,
Ransom Scott, Vice-President,
Birdsell Holly, Consulting Engineer,
E. F. Holly, Supt. Engineer.

Rise and progress of the Holly system of supplying steam for heat and power in cities, comprising the experience of three years since its inauguration in Lockport, N.Y., in 1877.

LOCKPORT, N.Y.:
JOURNAL BOOK AND JOB PRINTING HOUSE.
1880.
THIRD ANNUAL ANNOUNCEMENT.

In this, their third annual "announcement" to the public, The Holly Steam Combination Company (limited), is justified by the successful results of four years' experience, in a more elaborate description of methods, and more positive assertion of results, than during the first years of trial and experiment, before the public had been educated to the uses of "the system," or the faith of the inventor had been confirmed by positive knowledge concerning the efficiency of his devices.

Thoroughly fortified in both particulars, the company believe it is now appropriate to explain more fully to the general public the value, importance and significance of an innovation upon established habits, so novel in its claims, wonderful in its results, and so altogether revolutionary in its methods, that it has required actual demonstration to convince skeptical scientists and obviate the unbelief of the people. The axiom that "history repeats itself," is eminently true of all inventions to ameliorate human conditions.

Familiar now with the safe, cleanly, economical convenience of gas, we are prone to forget the days of the tallow-dip or old mill-lamps, and accustomed to the use of the hydrant water-service system in cities, we scarcely remember the classic town pumps or traditional water-carts, and but few in cities recollect the pride and joy of "the old oaken bucket" that hung in a well of their own; yet precisely in the same manner as light and water are supplied, the Holly system brings your

FIRE TO YOUR DOORS IN PIPES,
as gas and water are, fulfilling every requirement of fire in dwellings, warm your apartments, cook your food, wash, dry and iron your clothes, run your steam-engines, clear the snow from the streets, heat and ventilate your school-houses and public buildings, and, in fact, do all and everything that either fire or water (for steam is both)
THE HOLLY SYSTEM OF STEAM HEATING.

may accomplish in the domestic economy of cities, at a cost below what you now pay for the uses of fire, and what is more especially interesting to cities where soft coal is used, without soot, smoke and ashes with their vestigial train of coal-buckets and ash-barrels.

All of this, and more, may now be confidently and positively asserted from the combined experience of its critical and practical use in fifteen cities and the adoption of the system in others preparing to inaugurate it during the ensuing winter. It is not inappropriate to remark, in this connection, that hindrances which have interposed in some cities whereby companies have been delayed, have proceeded solely from local, political or mercenary motives, and in no instance from opposition to the system, and it is not improper to state that its reception by the people in cities where it has been adopted has been a grateful enthusiasm amounting to an ovation. As the parties most benefited by a system which secures health, safety, cleanliness and economy, both public and private, immeasurably above any methods in use, are the taxpayers and consumers, and more especially the poorer classes in large cities, all should be made to understand it.

THIS IS A WONDERFUL AGE,

and of all people recorded either in history or tradition, it is now popularly believed that we are the wisest and most fortunate. By sea, of course, is meant the New World; this pushing, restless, inventive mixture of races, that, being content with nothing and resigned to but few human conditions as they find them, are continually inventing and contriving new ones. Impatient with the tedious interchange of thought by writing, they invent printing and the power-press; sympathizing with the "woman who sang the song of the shirt," the sewing machine appears; disgusted with the primitive toil of the scythe and sickle, the mower and reaper is made to do the work of one hundred men; wearied with the slow processes of transmitting thoughts, forthwith appear the telegraph and telephone. Horse power becoming too slow and man's muscle too valuable; steam is harnessed to the car of human progress and compelled to do man's work. It is not too much to assert that we have furnished the largest proportion of the material in the Temple of Modern Progress. Our historical reminiscences and traditions are not

numerous, perhaps, and we have no ancient history. We cannot compete with the nations of the Old World either in ruins or pictures, but in Yankee inventions to smooth the pathway of the toilers and enable man to get through the journey of life with greater ease and comfort to himself, we may fearlessly challenge any of the centuries heretofore. It is not improbable, however, that orators in every age were in the habit of exciting the self-esteem of their contemporaries by similar observations.

The Brahman Bible—the Rig Veda—the oldest book of which we have any knowledge—so old, in fact, that it is unknown when or in what language or for what people it was written, yet the Veda refers to an earlier people with all the luxuries and vices of long civilization, full of pride of their achievements and exhortations to better behavior.

The builders of the Pyramids, Hanging Gardens and Temple of Diana, and those strange pre-historic people, the Toltecs, who, it is believed, some 16,000 years ago, built the mounds and erected the cities of Uxmal and Palenque in this country, no doubt believed they knew it all, and were probably as ignorant of the boundless possibilities of science and art in the cycles of ages before their, as we are to-day of the advantages to be enjoyed by our posterity in the years to come.

Nevertheless, it may be a reason for self-congratulation that we were born late to enjoy the luxury of the telephone and steam heating, when we reflect that with all their pride the most favored of our revered ancestors possessed not even a street car to comfort them, and Solomon, in all his glory, had no Pullman palace car. It may take the fine edge from our vanity, however, to recall the weary and devious methods of our march of progress. We must not forget to remember with what vicious stupidity and persistent self-conceit we have uniformly opposed every effort to alleviate the ills of life and rescue mankind from the terrors of toil and time—by new inventions—and the less we have to say about our manner of treating the great innovators, upon any established habit or old method of thought, the better for our self-complacency.

Great as we believe our achievements to be, and proud as we are of them, every step of the way to their attainment has been a contest with the pride, superstition and ignorance of man. Viewed from
THE HOLLY SYSTEM OF STEAM HEATING.

The stand-point of modern art—in the electric light of advanced science—the amazing ignorance and self-conceit of our revered ancestors excites a smile of amused incredulity, and we wonder what we of this age would do if deprived of steam—with its long array of useful appliances of comfort and convenience—or should suddenly be cut off from all the luxuries which have been borne to man by those divine sisters, Science and Art, during the present century only. But, perhaps, the coming savages of more intelligent and cultivated age will be equally as much, and smile at our present crude pretensions quite as much.

LOOK AT THE FACTS within the memory of this generation, they are not gratifying to our self-esteem, but interesting.

It is just fifty years (1830) since abuse, contempt and persecution were heaped upon George Stephenson, by the rich and wise men of his day, for proposing to transport people, by steam, in cars running on iron rails, at the frightful speed of ten miles an hour. Had the bold mechanic lived until now, he might see 150,000 miles of railways in Europe, England and America, running cars at sixty miles per hour.

It must be a source of satisfaction to the venerable and venerated philanthropist, Peter Cooper, to remember that simultaneously with the trials of Stephenson in England, he built the first locomotive ever made in this country, and on the Baltimore and Ohio Railroad (first made for horses) conveyed the admiring and incredulous directors from Baltimore to Elicott's Mills at a speed of eighteen miles an hour. Many remember the learned dissertations and scientific demonstrations of experts to prove the utter absurdity and impracticability of running steamboats six miles an hour up stream.

The hostility to street railroads is not likely to be forgotten, since it is still exercised when any one seeks to extend an old road or build a new one.

All the wisdom we possess appears to have been forced upon us and hammered in by experience.

The retrospect of the conservative stupidities of the so-called wise men of the world is rather humiliating to our vanity, and when authors explain another of the

M ARVELS OF MECHANIC ART.

It may be unwise, perhaps, to cast unpleasant shadows upon the past, but we desire our readers to be acquainted with the whole story, and the romance of mechanical inventions is interesting if not instructive. When Mr. Winsor attempted to explain the practical utility of coal gas, in a lecture in London, in 1803, he was laughed at as a visionary of unusual and superior ignorance; and when Parliament, in 1809, refused to incorporate a company for a purpose so absurd as conveying gas in pipes for general use, the great Wilberforce pronounced the scheme "one of the greatest bubbles that had ever sought to impose upon public credulity," and the celebrated savant, Sir Humphry Davy, asked, with a sneer, "if they intended to use the dome of St. Paul's for a gasometer," yet to-day the thirteen gas companies of London employ a capital of $65,000,000.

It has been said of that protean philosopher, Dr. Lardner, who was also a distinguished opponent of gas and railways, that he pronounced ocean steam navigation impossible, when the first steamer was on its way to this country. If true, the fact does not appear in his lectures as printed.

It is related by the well-known scientist, Dr. S. Silsbee, of the celebrated chemist and astronomer, the late John Locke, of Cincinnati, that during his lectures in the winter of 1838-9, he exhibited a telegraph instrument, and after sending messages around the room, to the admiration of the students, closed with the peremptory remark that "the instrument was interesting as a philosophic toy, but, by reason of the known nature and properties of electricity, could never be made of any practical use whatever." Dr. Silsbee, who was Locke's assistant, lives to realize that over one million of miles of telegraph lines are working practically throughout the world. Twenty-five years ago five men, Peter Cooper, Cyrus W. Field, Marshall O. Roberts, Moses Taylor and Chandler White, associated themselves together to lay a telegraph cable across the ocean, 2,000 miles, and the seers, ill omens and opposition of the wise are not forgotten. The pity of friends and prophetic wisdom of the omniscient press were lavish upon the visionaries in vain, yet these men lived to see 70,000 miles of submarine cables working simultaneously both ways, and as arrangements are made for grants in-Japan.
and Sandwich Islands, will doubtless live to realize the girdle around the earth foretold by Shakespeare. "Who would blow out the fire "God kindles blows the ashes in his own face."

None can stay the march of human progress. A history of the rise and progress of modern art would be but a repetition of the same story with each new invention. But of all human expedients whereby science has ministered to the uses of life, ameliorated the conditions of man, converted brutalizing toil into attractive labor.

The discovery and applications of

STEAM TAKES RANK OF ALL THE REST.

Merely to enumerate its uses would be to recount nearly every art and describe every appliance of human luxury, comfort and convenience. By the agency of steam

COAL, WATER AND AIR

are made to perform man's work by methods as innumerable as they are wonderful; annihilating time and space, overcoming the hitherto insurmountable; enabling man to traverse land and water with greater speed than the wind; bringing nations together from the furthest parts of the earth in fraternal and economical commerce; enabling man to multiply and disseminate knowledge; enthroning reason over savage force, and giving the pen supremacy over the sword. Habituated to the daily uses of steam in a thousand forms, but few pause to reflect that, in less than one hundred years,

STEAM IS THE MONARCH OF ART

and coal the master-spirit of the material world.

We do not build pyramids or carve sphinxes, because we don't want them. If we did, we could astonish those ancient geniuses more than their useless and stupendous extravagance ever interested us, and the achievements of antiquity would dwindle into insignificance before the modern exploits of steam.

The steam-engine increases population immeasurably by doing the innumerable works of man without consuming the food products of labor. One bushel of coal now performs the work of one hundred horses. One pound of coal and five pints of water will draw two tons one mile in two minutes, which would require four horses six minutes to do. By the old method of stage-coaches it required 200 men and 3,800 horses to transport 80 tons and 240 passengers over a route of 200 miles in 24 hours, by the best appointed stage lines in England.

Modern improvements, in the locomotive art, enable us to perform the same work in four hours with 20 men and the consumption of four tons of coal, and with less than 500 tons of coal we could convey the same train around the earth—25,000 miles—in thirty days.

The Great Pyramid is 700 feet square at the base, 500 feet high, and weighs 2,700,000,000 of pounds, and, according to Herodotus, required the labor of 100,000 men twenty years to build.

We could raise and place in position all the materials in that pyramid by the combustion of 480 tons of coal.

What facts in human history are more amazing than the triumphs of steam. It is safe to assert that the entire annals of the mechanic art furnish no parallel to it.

Watt first conceived the idea of a steam-engine in 1769, but was too poor to carry it into practice, and then, as before and since, and now, capital was too timid and too stupid to recognize the grandeur of the future in the visions of genius, and poor Watt closed his shop and worked for four years carrying an engineer's chain and level. He was not wholly without sympathizers, however, for the great Arago, in a speech before the Institute of France in 1769, thundered into the ears of the assembled savans the following prophetic tribute to the genius of Watt:

"I would point out to you, gentlemen, the creator of a machine destined to form an epoch in the world's history, undergoing patiently and without a murmur, the stupid contempt of capitalists; conscious of his exalted genius, yet stooping to the common labor of taking levels. * * * What shall be said of one who deprives his country, his fellow-citizens and his age of treasures a thousand times more precious than the products of the mine? I mean, gentlemen, his immortal invention, destined to become sources of the most noble and purest enjoyments of the mind, conferring upon labor those powers by means of which the products of industry
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would be multiplied in infinite proportion and with innumerable advantages to humanity and civilization, he would smooth away the inequalities of the conditions of man." Arago spoke more prophetically than he knew.

In 1769, Dr. Robeck, in consideration of two-thirds' interest, being a capitalist, assisted Watt in obtaining his first patent. His second patent was in 1775, for twenty-five years, Boulton being the largest party in interest—two-thirds as before.

It was in this year that Thomas Paine urged the introduction of the steam-engine into this country, predicting its future grandeur and success. Its triumph, however, far transcending the imagination of its most sanguine admirers, having enabled a single century to accomplish more to advance the material welfare of mankind than ages had ever before achieved. Such has been the multiplicity and variety of inventions for the use of steam, that their rapid accumulation confused the mind, and science has thus far only been able to predict.

THE TRIUMPH ACHIEVED

by Mr. Birdall. Holly of Lockport, N. Y., to whose genius the world is indebted for a novel and efficient application of steam to the uses and comfort of man, and it may be even more truthfully said

MORE ESPECIALLY OF WOMAN.

Mr. Holly is by no means the originator of the idea of general steam heating, for it has not only been hoped for and predicted by engineers for half a century, but many and costly efforts have been made in several European cities to introduce it without success. In a majority of all large cities, stores, dwellings and public buildings are successfully and economically heated by steam from local boilers, and in New York entire blocks are supplied with heat and power from central batteries of boilers. But when it has hitherto been attempted to transmit steam any considerable distance in order to supply heat and power, the results have not been profitable to the producer or safe or satisfactory to the consumer, and until Mr. Holly, the problem of general steam heating remained unsolved, and many self-concluded expert engineers have gone so far, as to

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assert, as Prof. Locke did in relation to the telegraph, that from the known nature and quality of steam, it never could be.

In fact, the obstacles in the way of a general system of steam service were more numerous and serious than would appear to the inexperienced who witness the apparent ease and precision with which

THE WONDROUS FORCE

is handled, directed and controlled by experts; but steam, with all its docility, is a willful force, and, like many animals, does man's bidding only on compulsion; powerful for good, while under wholesome restraint, but tremendous for evil when allowed free license; patient and tireless in its work when supported by its master-spirit, heat, but shrinking back into its original element, water, timid and sensitive before its remorseless enemy, cold.

CONDENSATION

was, therefore, the first great impediment to the transmission of steam through extended lines.

Science is able to calculate the precise number of heat units carried by steam under any given pressure, and will tell the exact amount of radiation, per linear foot, of pipe of any specified diameter; from such facts science acquires the habit of asserting positively that certain things can, and others cannot be done. In deference to the claims of science, people whose knowledge only reaches the conventional standards, either hesitate to accept or flatly deny the possibility of anything beyond the sphere of their own knowledge. It was not surprising, therefore, to hear the President of the Brotherhood of American Engineers in New York, during the application to the Board of Aldermen for permission to inaugurate the Holly system, make the statement before some two hundred members present, that "No one had ever conveyed steam one mile in "pipes, and what was more, that no one ever would do it. That he "was a practical engineer and knew what he was saying from expe- "rience."

This was said at a time when that still
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MORE PRACTICAL ENGINEER,

Mr. Holly was practically supplying steam for heat and power to three hundred buildings through nearly four miles of pipe, at a loss, by condensation, not exceeding five per cent. per mile, proving, beyond any doubt, that steam will not condense, but by means of the most common-sense devices, that he had been able to.

ARREST RADIATION

of the heat from the pipes and obviate the consequent condensation. Another stumbling-block in the way of the transmission of steam was the alternate

EXPANSION AND CONTRACTION

of metallic pipes by heat and cold, to which they would necessarily be subjected, sufficiently to cause them to bend and buckle, endangering the joints and breaking off lateral pipes taken from them. This obstacle was obviated by the simple device of a slip-joint in a junction-box from which service-pipes were taken.

Simple as all this appears now, it never seems to have occurred to the great army of practical engineers preceding Holly. In addition to these, there were very many mechanical details necessary in order to render a general system of steam supply successful, that is,

PRACTICAL, PROFITABLE AND SATISFACTORY TO ALL CONCERNED.

No meter for determining the quantity of steam consumed had been devised. It was necessary to originate some better and more reliable method of reducing steam pressure and regulating the supply in buildings automatically, whereby SAFETY AND ECONOMY could be secured independent of the discretion of ignorance or carelessness; simple and efficient traps for carrying away the water of condensation, means of regulating the temperature of rooms automatically, and some practical device for cooking at low pressure. These and other requirements met the

DARING MECHANIC

who should attempt to override the axioms of previous experience or tradition. But it is the ability to analyze, compare and classify that especially distinguishes

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MEN FROM ANIMALS

and the artist, philosopher or mechanic who is able to achieve this in the greatest degree, is marked as a genius. Merely to collect and heap together a library does not make a Shakespeare or a Bacon, nor does the collection of facts, in confused mass, aid in the march of progress.

When investigating and assorting the crude facts and materials presented by nature and experience,

UNWISE LEARNED MEN

are prone to adjust the focus of vision at too great distances in search of the wonderful and abstruse afar off, at the same time overlooking the more simple and obvious within easy reach. It is perhaps charitable to believe that this has been the case during the long-continued search of the learned after some practical system of general steam supply. Every age is apt to overestimate the amount of attained knowledge and undervalue the unknown. As Mr. Holly owed no allegiance to the schools, and is singularly devoid of the pride of self-derived intelligence, he was able to appreciate the determined facts of science at their value, and fully realizing the difficulties before him, had the patience and perseverance to sift out the useful experience of the past, select, combine, improve and invent. He had the genius to recognize principles and predict results, and what is still more important, the courage to apply his ingenious combinations and inventions to the test of practice, notwithstanding the adverse opinions of the learned and traditional experience of engineers. We are justified in asserting that the introduction of his system is but the inauguration of a complete revolution in the domestic economy of the civilized world, and this generation will live to see the Holly system of steam heating side by side with water and gas, or electric light, in every city that can afford either, and the name of Birdstall Holly will be enrolled among the

GRANDEST MECHANICAL MISSIONARIES

of the age. It is but justice to say that but few men have interpreted
with greater success or more devoted singleness of purpose than Mr. Holly. Perhaps not one in a thousand who read this description have ever heard of him, yet there is not one probably who has not seen some one or more of his inventions, over go in number, and all solutions of more or less intricate mechanical problems by methods the most simple and direct. His steam system having been in practical use by fifteen cities, and others, including New York, Brooklyn, Cincinnati, Columbus, Cleveland and Baltimore, are making active preparations for its introduction in the ensuing winter, it becomes apropos to explain more fully than hitherto the system by which the people are interested, and anti-smoke missionaries, taxpayers, domestic economists, and capitalists everywhere especially so. In this connection it will also be in order to inform the interested parties who BIRDSILL HOLLY is, while illustrating his position in the army of progress.

Born in Auburn, N. Y., in 1822, he was apprenticed at an early age to cabinet-making, and received only such education as a poor working-boy might glean from his surroundings. Wood-working furnishing too limited a field for his mechanical aspirations, he found at the age of twenty-two, in a machine shop of his own, manufacturing mining pumps, water wheels and mill machinery. In 1847 he became superintendent of a manufacturing concern at Seneca Falls. During this period he had invented many new and useful mechanical devices too numerous to describe. The most meritorious being the Holly Turning Mandril; the Holly Water Wheel; the Improved Power Loom, in use throughout New England; the Iron Beach Plane, used everywhere; the Celebrated Pitcher Pump, manufactured by thousands and in use throughout the world. So simple and cheap was this little device, shaped like a pitcher, that everybody made them and his patent became profitless to him. In 1859, when a member of the firm of Silsby, Race & Holly Island Works, Seneca Falls, he invented the famous engine and rotary pump used on the Silsbee Steam Fire Engines, now popularly known throughout the world. In 1859, Ex-Gov. Hunt, of New York, and the Hon. T. T. Flagler, Ex-Congressman from New York, recognizing the marked ability of Mr. Holly, induced him to take charge of their extensive machine works at Lockport, N. Y., now known as the

HOLLY MANUFACTURING COMPANY.

It was here, in 1863, that he invented and perfected the now celebrated system of water service already in use by 125 cities, and approved everywhere by engineers whose education permits any knowledge beyond the conventional reservoir or traditional standpipe. This peculiarity of education was manifested by the wise men of Lockport when Mr. Holly first proposed to supply that city with "water pumped directly into the mains in combination with any contrivance to regulate the pressure."—(This is the language of his patent.) He was opposed by experts, and the system denounced as absurd and impracticable by engineers. Capital refused to aid a project so costly and chimerical, and the expense of the experiment was borne by Mr. Flagler. The trial will long be remembered as an era in the history of Lockport. It proved an unequivocal success, however, despite the predictions of the wiseacres. Mr. Holly had promised to maintain a 27-inch stream 100 feet perpendicular height, and he did throw four streams 300 feet high. After his pronounced success, the experts, who believed they knew so much, came to the conclusion that it would be wiser, perhaps, to know less and know it better, especially when twenty-three cities, who adopted the system in defiance of Holly's patent, were brought to a realizing sense of their mistake of not remembering that the excellence of invention consists in its simplicity, upon the Supreme Court of the United States requiring them to pay damages and royalty.

In 1876 Mr. Holly consummated his dream of years by perfecting his present system of steam-heating, but in this, as in the water-works, the project appeared so novel that authority pronounced it visionary and experts denounced it as impossible. Capital again grew timid and preferred to wait, and Mr. Holly was compelled to test his invention by laying pipes on his own grounds and conduct his experiments at his own expense. His success was so unequivocal that the
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HOLLY STEAM COMBINATION COMPANY

was incorporated in January, 1877, and during the unusually hard winter of 1877-8, a critical test was made in Lockport on a large scale, the character and extent of which may be estimated by reference to

PLATE 1,

exhibiting a diagram of the boiler-house and location of mains and laterals. Two boilers, 5 x 16 feet and one upright, were planted and three miles of underground pipe laid, the largest being but four inches in diameter. Forty buildings were supplied with heat, comprising dwellings, stores, shops, hall and school-house, scattered along the line of pipes, and power was furnished to one elevator and one twenty horse-power engine.

The éclat of an enterprise so novel and bold, attracted the attention of engineers and scientists from all parts of this country, Europe and Canada, and the experiments were conducted throughout the winter with all the critical care and accuracy that science and experience could suggest. Regarded as a "new departure" from the beaten track of engineering art, the skepticism of experts gave the experiment more the character of an "inquisition" than a scientific test of a mechanical problem, but in the spring after the close of the long trial, the most captious mechanical infidel was compelled to admit

THE UNQUALIFIED SUCCESS

of the combination as a general system of steam supply to cities, and among the citizens of Lockport who had used the steam, one would seek in vain for a single person to condemn it even with faint praise, or a lukewarm opinion, for, as expressed in the report of a commission of New York City experts, "the enthusiasm of the Lockport people over the results is boundless,"

"THE LADIES"

"being by far the most emphatic and demonstrative in their encouragement, upon its superior cleanliness, comfort and convenience."

"PLATE 1."
THE HOLLY SYSTEM OF STEAM HEATING.

The meter had not been perfected, and in the absence of all previous experience as to the cost of manufacturing and distributing steam, the company supplied heat at a price equal to the previous average cost of coal to each consumer, with quite satisfactory results to all concerned. As an example,

THE SCHOOL HOUSE

measured 105,000 cubic feet of air space to be heated. The average annual cost of fuel, labor, repairs, etc., had been $649.00; of this $300.00 was for the item of coal. The company therefore agreed to maintain a temperature of seventy deg. from 8 o'clock A. M. to 6 o'clock P. M. for $300.00, and the warming and ventilation of the building gave entire satisfaction to the trustees and the pupils. It is proper to remark in this connection, also, by way of illustrating, that experience; thus far, rather tends to diminish than increase the expense of steam heating. The Company have reduced their charges for heating that school-house to $267.00 per annum, thus saving the city $402.00 per annum.

During the winter of 1878-9, the pipes were extended to over four miles and over two hundred buildings were warmed—the number being limited by the ability of the company to supply fittings. During that winter the system was fully and fairly tested by companies formed, in Detroit, Mich., Springfield, Mass., Auburn, N. Y., and the Soldiers' Home, Dayton, O, and the results confirmed previous experience concerning its safety, efficiency and economy. The combined experiences of that season developed

SOME INTERESTING FACTS

concerning its economy. It was regarded as no small item, by the first-years' consumers, to be saved the annoyance of handling coal, ashes, kindling, etc., also the expense of stoves and repairs; but further experiment led some steam companies to lump their charges for steam for $2.00 per thousand cubic feet of air space per annum, which was found to be a still greater economy, but upon the introduction of the meter made to register about that rate, a further saving might be effected by cutting off radiators in upper rooms, parlors, etc. when not in use, and paying only for the steam actually consumed. Its economy, when applied to cooking, may be estimated thus: A family will use twenty pounds of coal, together with the kindling necessary to make a fire, for cooking breakfast, and the coal is all lost; now 20 pounds of coal will convert 200 pounds of water into steam, which is enough to run from 10 to 20 steam cooking-stoves one hour. After the critical trial of the first season at Lockport, skeptics were compelled to admit that heating buildings could be satisfactorily accomplished, but still doubted the practicability of furnishing power to any considerable extent.

We are now justified from the abundant practical experience of the Detroit company during two seasons, and also of the Troy company during the past winter of 1879-80. That the results have been eminently satisfactory, and equally so in a minor degree in the cities of Milwaukee, Wis., Dubuque, Iowa, and Belleville, Ill. The Detroit company, through some 8,000 feet of six inch mains, supplied some thirty engines of various capacities with power. Among these we may instance the Detroit Free Press establishment, whose power account had been over $3,000 per annum, $1,500 of which was for coal. The company supplied power, day and night for the cost of coal, satisfactorily; but, having laid two miles more of six and eight inch pipes, were compelled to suspend supplies during last winter, for the reason that the Press office alone ran at night, and the increased extent of mains to fill rendered it unprofitable to the company.

It is an important fact that all cities that used the system in 1878, have extended their lines in 1879, and during the past year the system has been in actual and extensive use in fifteen places, including the celebrated Garden City of the late A. T. Stewart on Long Island and the Soldiers' Home, Dayton, O. It is, therefore, proper to assume emphatically that the system has passed beyond the sphere of experiment, and may be regarded as

AN ESTABLISHED FACT.

In regard to the Holly inventions and combinations which comprise the system, none are sufficiently absurd as to believe any mechanical device is so perfect as to be incapable of improvement, yet it is equally plain that Mr. Holly has overcome the obstacles in the way of general steam heating, by methods so extremely simple and
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Economical, that while devices may be invented to evade his patents, they can scarcely be made less expensive or more efficient.

At one time Mr. Holly was much interested in the idea of general heating by water, and it was during a series of careful and elaborate experiments with water that his steam system was developed.

It is known that water, under pressure, may be heated to any temperature, and upon passing it from a high to a lower pressure above 32° deg. of heat, it will be converted into steam. These facts, without further experience, lead to a belief that water would be a valuable, if not, perhaps, the best medium, for heating purposes. This supposition is corroborated by the simplicity and economy of the hot-water apparatus in use for warming greenhouses and dwellings in a small way. But the system cannot be extended to general purposes, for many and obvious reasons, although a cubic foot of water will carry more units of heat than a cubic foot of steam at the same temperature, there has been no means devised whereby they can be utilized. In order to maintain a water circulation, double lines of pipes must be laid, while in a 6-inch pipe, at 350 pounds pressure, it requires 165 horse-power to send the water from the boiler; it takes 325 horse-power to pump it back again for re-heating. Gen. Herman Haupt, after careful study of the subject, sums up the result as follows: "In conclusion, I will state as my "deliberate opinion in regard to the hot-water project, that a more "absurd and impracticable scheme for transmitting heat and furnish-

THE MECHANICAL DETAILS

ing power never entered the mind of man," and this was Mr. Holly's conclusion also. After long and patient experiment, he decided that it was safer, more efficient and economical to convert the water into steam at once; and

WATER FOR DOMESTIC PURPOSES.

In this system of heating it is desirable to have as few plants as possible placed at central points, as convenient as may be, to coal and water. Plate II (on the next page) represents the boiler-house at Lockport, and its relative location in the city may be seen by reference to Plate I. As the profit to those who supply the steam will depend upon its economical production, it will become of the first importance to omit nothing known to modern engineering art that will secure the largest amount of evaporation of water, at a minimum cost for coal, as steam is used merely as

A CARRIER OF HEAT.

It is of course, unnecessary to say that the best and most economical boilers should be selected, and the most careful and competent engineers and assistants obtained. It is by no means an unimportant fact to be considered by cities with reference to this system, that the dangers and annoyances of boilers will be confined to a few localities, and their objectionable features obviated in cities, like New York, St. Louis and Cincinnati, where thousands of boilers are distributed through the city, and every sidewalk is a furnace, within which is an element of

DIRT AND DANGER

in charge in many cases of engineers ignorant, faithless and reckless. Inasmuch as the economical production of steam is of the very first consequence to parties about to inaugurate the Holly system, a few notes from the extended experience of the Holly company will be appreciated. Understanding the general process and products of combustion, it would seem that the production of steam, and economical combustion of fuel, should be among the plainest of scientific problems. Whereas it is in point of fact among the most obscure, and each year for half a century, the patent office has groaned with inventions to save fuel, abolish smoke, evaporate water and utilize steam, each, perhaps, some improvement upon the last, but still leaving a great need unsupplied. Believing that whatever
THE HOLLY SYSTEM OF STEAM HEATING.

device was able to utilize, for the purpose of evaporating water, the largest results from the most perfect combustion of fuel, would be the desideratum in steam-heating, the company have welcomed every plausible improvement, and conducted the most extensive and careful tests at vast expense, and with absolute impartiality, among many others, their attention was called to a report of U. S. Government experts, upon what was called the

MURPHY SMOKELESS FURNACE.

shown in Plate III (on page 24), and subsequently by the report upon it as a smoke consumer by the Cincinnati Industrial Exposition of 1879. Procuring a furnace and boiler with the self-feeding attachment, and a year's experience proving quite satisfactory, a complete furnace and boiler, with automatic feed and stoker attachments, was put up, and during six months of severe critical test was found to be by far the most cleanly, economical, and durable furnace of any yet used, and the companies have adopted them in Milwaukee, Detroit, Burlington, Denver and Chicago Stock Yards, and they are rapidly gaining favor elsewhere. The perfect combustion and consequent total abolition of smoke from bituminous coal, and relative economy in the production of steam, are not the only points of superiority, as its cleanliness, ease of management and saving of labor are equally important. By reference to the plate it will be seen that the stoking resolves itself merely into dumping the coal into the bin above the fire-box in front of the boiler, and occasionally pulling it toward the feed. The little engine on the left carries it into the coking chamber, dumps it at the proper time on the grate-bars, and by means of levers moving the shake-bars to and fro, slowly, clear the bars of ashes. The doors are never opened, and one attendant, without a fireman's skill, will manage a battery of six boilers worked by the same power. It is these advantages, in part, that give precedence to the Murphy furnace over any now in use. The tests made of materials and boilers, during the past year, may be summed up as follows:
THE HOLLY SYSTEM OF STEAM HEATING.

BOILER TESTS.

By B. Holly, F. D. Waltz and Dr. Pierce. Many of these tests were made with the Pierce boilers in order to ascertain the relative values of fuel.

<table>
<thead>
<tr>
<th>Exp.</th>
<th>Boiler</th>
<th>Fuel</th>
<th>Hours</th>
<th>Pressure</th>
<th>Steam at 70 lbs</th>
<th>Feed Water</th>
<th>Feed at 70 lbs</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1</td>
<td>Pierce</td>
<td>Tar and Coal</td>
<td>$\frac{2}{3}$</td>
<td>32</td>
<td>70.24 lb</td>
<td>26 deg</td>
<td>6.72 lb</td>
</tr>
<tr>
<td>No. 2</td>
<td>&quot;</td>
<td>Tar</td>
<td>$\frac{3}{4}$</td>
<td>32</td>
<td>10.17 &quot;</td>
<td>51 &quot;</td>
<td>6.72 &quot;</td>
</tr>
<tr>
<td>No. 3</td>
<td>&quot;</td>
<td>B. Slack</td>
<td>4</td>
<td>37</td>
<td>17.2 &quot;</td>
<td>53 &quot;</td>
<td>14.74 &quot;</td>
</tr>
<tr>
<td>No. 4</td>
<td>&quot;</td>
<td>B. Slack</td>
<td>$\frac{3}{4}$</td>
<td>36</td>
<td>10.15 &quot;</td>
<td>47 &quot;</td>
<td>6.47 &quot;</td>
</tr>
<tr>
<td>No. 5</td>
<td>Old Murphy</td>
<td>&quot;</td>
<td>14</td>
<td>34</td>
<td>8.45 &quot;</td>
<td>44 &quot;</td>
<td>7.12 &quot;</td>
</tr>
<tr>
<td>No. 6</td>
<td>Holly</td>
<td>Oil</td>
<td>13</td>
<td>39</td>
<td>8.45 &quot;</td>
<td>46 &quot;</td>
<td>12.83 &quot;</td>
</tr>
<tr>
<td>No. 7</td>
<td>Pierce</td>
<td>Tar</td>
<td>$\frac{1}{2}$</td>
<td>28</td>
<td>14.05 &quot;</td>
<td>46 &quot;</td>
<td>12.83 &quot;</td>
</tr>
<tr>
<td>No. 8</td>
<td>&quot;</td>
<td>Tar and Coal</td>
<td>10</td>
<td>36</td>
<td>14.43 &quot;</td>
<td>47 &quot;</td>
<td>12.37 &quot;</td>
</tr>
<tr>
<td>No. 9</td>
<td>&quot;</td>
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<td>10.72 &quot;</td>
<td>48 &quot;</td>
<td>9.29 &quot;</td>
</tr>
<tr>
<td>No. 10</td>
<td>&quot;</td>
<td>Tar and Coal</td>
<td>12</td>
<td>37</td>
<td>10.65 &quot;</td>
<td>45 &quot;</td>
<td>9.10 &quot;</td>
</tr>
<tr>
<td>No. 11</td>
<td>New Murphy</td>
<td>Tar and Coal</td>
<td>12</td>
<td>31</td>
<td>10.93 &quot;</td>
<td>45 &quot;</td>
<td>9.37 &quot;</td>
</tr>
<tr>
<td>No. 12</td>
<td>&quot;</td>
<td>B Slack</td>
<td>13</td>
<td>30</td>
<td>9.25 &quot;</td>
<td>46 &quot;</td>
<td>8.2 &quot;</td>
</tr>
<tr>
<td>No. 13</td>
<td>&quot;</td>
<td>Mixed Slack</td>
<td>12</td>
<td>29</td>
<td>9.71 &quot;</td>
<td>47 &quot;</td>
<td>8.33 &quot;</td>
</tr>
<tr>
<td>No. 14</td>
<td>Holly</td>
<td>Sack Coal</td>
<td>17</td>
<td>27</td>
<td>8.92 &quot;</td>
<td>47 &quot;</td>
<td>7.6 &quot;</td>
</tr>
</tbody>
</table>

A remarkable advantage of the Murphy furnace is its peculiar facility for coking and burning bituminous dust or slack, the economy of which will be appreciated by engineers. For example: the cost of steam for heating 1,200 cubic feet of space 200 days of 16 hours, with coal at $5.00 per ton, is $20.12, including four per cent. loss by condensation, while with slack coal at $3.00 per ton, the cost would be $21.65.

During the course of experiment, INJECTORS have been found to be false in theory and useless in practice, the gain in heat being compensated by loss in power. But experiment has also led the way to

A STARTLING DISCOVERY

which may lead to an economy in steam-heating that will surprise engineers more than any mechanical proposition yet made by Mr. Holly, although his inventions, for the most part, have been a succession of surprises. It may not be the correct method of stating it, but it is

PLATE III.
Murphy Smokeless Furnace with Automatic Feed.
THE HOLLY SYSTEM OF STEAM HEATING.

To take out the power and leave in the heat of steam for purposes of warming buildings. Suppose seven boilers in a manufacturing district, 70 pounds pressure, carried in boilers and put 20 pounds required for heating, we would have 90 pounds to use in engines, which would give 45 horse-power for each boiler, or a total of 315 horse-power, or 26 run of stones, and to run such a mill would require 44,000 pounds of coal per day of 24 hours. Now, 1 pound of steam, at any pressure, contains 1.147 units of heat, and 1 cubic inch of water converted into steam, contains 42 units, neither more nor less; its bulk may vary with pressure, but not the heat units. If we compress 6 cubic feet into 1, we have 75 pounds pressure, 6 x 42 = 252 units. If we put that 1 cubic foot at 75 pounds pressure and let it expand in the cylinder of an engine down to the pressure of the atmosphere, the expansion develops a power equal to raising 1,000 pounds 20 feet high, or 20,000 feet pounds; and we have 6 cubic feet of steam in the cylinder, each foot containing the original 42 units of heat, the same as when it left the boiler, less the loss by radiation only. When it contains less than 42 units, it ceases to be steam. Authors claim that heat is power, and the power of an engine is in proportion to the heat used up and carried off, which is palpably an error. The amount of power obtained from the point of cut-off is in proportion to the reduction of the temperature from the point of cut off to the end of stroke, and has no reference to the units of heat; every unit of heat that left the boiler remains in it so long as it remains steam at any pressure.

Again, suppose that a heating company should plant 25 boilers, with intend to warm a city, at 20 pounds pressure, in mains. Suppose they carry 75 pounds in boilers, and should erect a flouring mill, or other manufacture, at their works; 75 pounds at boiler, would leave 55 pounds to drive the mill and 20 pounds for heating. Now, each boiler will work to 50 horse-power, and do the warming, also, equal to 1,250 horse-power, equal to 104 run of stone, which requires 60 tons of coal per day of 24 hours; that is, excepting about 1 per cent. loss by radiation. A mill of 1,250 horse-power could be run by the increased pressure of steam, and the units of heat after using the power utilized for warming purposes, without ad-

ditional cost of production, and at the lower pressure of 20 pounds, many small manufactories, elevators, printing-presses, hatters, dyers, soap-makers, laundries, distilleries, etc., could be supplied, especially in summer, when the warming is not required. This is, in brief, an outline of Mr. Holly's proposition which will be tested during the coming season.

In this connection it is also apropos to suggest that if the

EDISON ELECTRIC LIGHT

should ever become of general practical utility, it must be with the aid of the Holly system of general steam circulation, for the simple reason that he requires steam power in order to generate electricity for his subdivided lights—it has been authoritatively stated, about one horse-power to eight lamps. If this be true, the multiplication of boilers and engines necessary to light a city would prove a serious and costly hindrance to its general adoption. But with the Holly steam-pipes laid in the streets, innumerable small engines could be placed in vaults under sidewalks or convenient basements, and made to work the electric generators. One man could easily attend to fifty engines in a district, while he would find it difficult to manage even five boilers satisfactorily without the aid of firemen—to say nothing of the dust, labor and danger of boilers. The exhaust steam from each engine could be used for warming the building whose basement was employed.

From the boilers the steam passes into

THE MAINS AND LATERALS.

The material used after experiments with cast iron and other substances, is the ordinary lap-welded, wrought iron steam-pipe. These are always tested by the manufacturers to a tension far above any possible use, for example: a 1-1/2-inch pipe of this kind 3/4-inch thick, has a tensile strength of 60,000 lbs., and would bear a pressure of 5,500 lbs. to the square inch, as no pressure exceeding 100 lbs. will ever be required in this system.
DANGER FROM EXPLOSION

of pipes can never become a subject for discussion, but condensation

For unless steam can be transmitted to considerable distances

without too great loss by condensation, all devices to use it in build-

ings, however ingenious, would of course be useless. Condensation

being caused by the radiation of heat from the pipes, the

SUGGESTION OF COMMON SENSE

would be to arrest the radiation, that is, keep in the heat by inclos-

ing the pipes in the best non-conducting material that is attainable,

and cheap enough. There is nothing new about it. Wool, hair,

charcoal, brick dust, ashes, plaster, cotton, saw dust, gypsum, etc.,

have been used in various ways ever since metal pipes were used to

convey steam, although not perhaps so extensively and effectively as

by Mr. Holly.

The pipe is placed in a lathe and wound about, first, with asbestos,

followed by hair felting, porous paper, manilla paper, finally thin

strips of wood laid on lengthwise and the whole fastened together

by a copper wire wound spirally over all. This is thrust into a

wooden log, bored to leave an intervening air-chamber between the

pipe and wood, and of sufficient size to leave from three to five

inches of wood covering. The elasticity of the wrappings permits

the free expansion and contraction of the pipe irrespective of the

wood log which is securely anchored and made immovable. The

whole is placed in a trench a short distance below the surface with- 

out regard to frost. At the bottom of the trench is laid an earthen

mile drain to carry off any earth moisture, and in order further to

insure the continuous dryness of the wood log inclosing the pipe,

if desired, one and one-half inch plank are fastened around the log

leaving an air space, and the whole daubed with coal tar and covered

with earth never again within the experience of this generation to be

disturbed.

WE SAY NEVER.

because the mains are never tapped for the attachment of service

pipes, as in the case of gas and water mains, and because the pre-

cautions taken to secure the wood against alternations of dryness and

moisture will, according to experience, preserve it indefinitely. It is

also believed that, by the dryness of the earth surrounding the mains

and consequent neutralizing of miasm, their use will come to be

regarded as a

POSITIVE SANITARY ADVANTAGE.

Pipes prepared in the manner described have been thoroughly tested,

and it is proven beyond doubt that condensation can be reduced to

a point that renders the general transmission of steam not only prac-

tical, but profitable. At the risk of being tedious, we will quote, for

the benefit of the curious, a well-attested experiment of Mr. Holly.

In 1,600 feet of three-inch pipe, laid on a descending grade of

20 feet, the lower end trapped for water, steam pressure constant at

20 pounds at both ends, during 12 hours, water of condensation

carefully weighed, amounted to 82 pounds per hour. The Holly

boilers, accurately tested, evaporated 9 pounds of water per pound

of coal. 82 pounds of water therefore represented 9 pounds of coal,

or 27 per cent. More clearly thus: Each pound of steam above

212° contains 966 units of heat; the heat units lost in the condensa-

tion of 82 pounds of water were 78,720, or at the rate of 1,312 units

per minute. Now the capacity of a three-inch pipe at 20 pounds

pressure is 765 cubic feet per minute, containing 27,044 units of heat,

of which only 1,312 were lost, viz., 27 per cent. Experiment and

practice, since verified in 15 cities, show that the most economical

pressure to be maintained in the mains is from 40 to 60 pounds,

although in some cities 70 pounds has been used. Experience with

large mains is yet limited, eight-inch being the largest in use. By

calculation, the condensation at 60 pounds pressure is, in 3-inch

pipes, per mile, 2.6; in 6-inch pipes, per mile, 1.0; in 12-inch pipes,

per mile, 0.7. The condensation in large pipes is greater, but the

relative percentage less.

The experience of Detroit demonstrates the fact that 60 pounds

pressure could be maintained in four miles of 10-inch and 6-inch

pipes, against the drafts for power and heat along the line. The

capacity of a 6-inch pipe at 60 pounds pressure may be estimated

thus: A 6-inch pipe at 60 pounds pressure will discharge 102 cubic
feet per second. A horse-power is one cubic foot of water, or 113 cubic feet of steam, or 427 cubic feet of steam per second. Therefore a 6-inch pipe at 60 pounds pressure will supply 216 horse-power per mile, and the same amount of steam will supply

3,000 CONSUMERS PER MILE,
averaging 11,000 cubic feet of air space to be heated.
The next serious obstacle was found in the

EXPANSION AND CONTRACTION

of metallic pipes between the extremes of temperature, say 32°, and the heat of steam at 60 lbs. pressure, 307°. The expansion of wrought iron is 1/4 of its length, about 44 inches in 100 feet. It was the inability to obviate this, that defeated the efforts to inaugurate a general system of steam-heating in European cities. This difficulty was completely overcome by the ingenious device of,

THE JUNCTION AND SERVICE-BOX,

seen in Plate IV. These are placed at convenient intervals along the line of 100 to 200 feet. The arriving-pipe from the boilers is inserted by a nickel-plated extension or telescopic joint, made steam-tight by passing through a stuffing box. The departing pipe is immovably attached to the box, so that one end of each 100 feet of pipe is fast and the other movable, affording free-play to the expansion and contraction.

All service-pipes are taken from the junction-box, which is securely bolted to the masonry, and anchored to the pipes. The bottom of the box being placed lower than the pipes, all water of condensation is carried forward and deposited in it, to be taken up subsequently as

ENTRAINED WATER,

and reconverted into steam, at lower pressure, as the steam passes through the reduction valve. The adjustable hoods are for the purpose of regulating the passage of dry or moist steam.
THE HOLLY SYSTEM OF STEAM HEATING.

e junction-box provides for the expansion of mains, the attachment of service-pipes and reception of water, no water is ever found thereby in the mains, and no provisions for trapping off water are required. The boxes are accessible by man-holes in the street, and easily kept in order; from the junction-box, the steam passes to another ingenious and useful contrivance called

THE REGULATOR (PLATE V.),

by means of which the pressure of steam is reduced, and the supply to the building regulated automatically and with unerring precision. This is accomplished by two diaphragms of rubber packing, acted upon by weighted-levers, and moving two slide-valves. The first valve is weighted to 10 lbs., and the second to 5 lbs., or 2 lbs. if required. So delicate is this instrument, that it will determine the pressure as weighted, regardless of the change of pressure on the other side of the diaphragm. When the steam arrives at the first valve of the regulator, it contains, suspended in minute particles, all the water which has been condensed in the mains, and brought forward to the junction-boxes. This is known as entrained water, which, under 60 lbs. pressure, cannot become steam, but does so at a lower pressure of 10 lbs., and any further moisture remaining is further converted into steam, at a still lower pressure of 3 lbs., whence it passes at a uniform pressure through

THE METER,

placed, as seen in the plate, above the regulator. This is regarded by experts as the most novel and ingenious device in the series, and is, perhaps, the first actual steam measure yet produced. It resembles, and in fact is, the movements of a 55-day Yankee clock; as the steam passes, the movements are made to rotate a screw, upon which hangs a pointer moving along a dial, each revolution registers an arbitrary unit, the value of which has been previously ascertained by weighing the water. The clock marks the time and the register the quantity, both of which being always uniform at any given pressure, absolute accuracy may be obtained. In fact its extreme excellence and delicacy have proved an objection to its practical use in
THE HOLLY SYSTEM OF STEAM HEATING.

The exposed situations where the regulator is usually placed, and Mr. Holly is now perfecting a more robust and durable instrument, though not more correct. Passing the regulator and meter at a given and automatically regulated pressure, an accident from steam within the building, even in the most ignorant and careless hands, is not nearly so liable to occur, as from a tea-kettle.

The next duty of the steam is in

 **THE RADIATORS,**

seen in plate VI.

As the subject of warming and ventilating dwellings has occupied the attention and ingenuity of man ever since dwellings were devised, it will be interesting to know wherein steam-heating differs from or is better than other methods.

In the days of cheap wood fuel, our forefathers and mothers were quite content with the huge, open fire-place in which the enormous back-log furnished the glowing perspective to the vast pile of blazing wood, whose cheerful flames lighted and warmed the family circle around the evening board of apples and doughnuts. Those bygone days of good neighbors, when the pendant crane, Dutch oven, iron spider, and tin kitchen rendered any further invention in the culinary art unnecessary. But alas for those days of primitive simplicity! Advancing luxury soon introduced the

**TEN-PLATE STOVE,**

and finally the effeminate cooking stove, inaugurating at the same time the toilsome career of another innovation, the saw and buck, which the youth of those days (like others whose self-interest and personal comfort is affected by the march of progress) soon learned to hate. Then commenced the long list of stove patents, at the very enumeration of which arithmetic stands aghast.

The first ten of coal mined in this country sold in Philadelphia in 1815, for $21.00. The coal products of Pennsylvania now amount to over $50,000,000 per annum at less than $3.00. Which the cause and which the effect, the coal or the cooking stoves, is not now under discussion. We cannot discuss either the sanitary or economical
THE HOLLY SYSTEM OF STEAM HEATING.

features of the primitive methods, for the early log cabins were usually well ventilated, and wood was too cheap to have a rival. The comparative economy of the coal stove with the cheerful and more healthful open grate might be considered, but as no successful methods have yet been devised to secure cleanliness or economy in either, they may be regarded rather as models of extravagance, upon which improvement is desirable. Surrounding stoves with a jacket, first employed in school-houses to prevent children from burning themselves against the stove, foreshadowed and suggested

THE HOT-AIR FURNACE,

when some Yankee school-master thought of conducting currents of fresh air from the outside to the inside of the jacket, since which time the accumulating number of patents bids fair to rival stoves. By the air furnace a purer air is obtained than with stoves and abundant heat, with less dirt and ashes and greater convenience, but there are no facts offered by their advocates from which to infer economy, and they are liable to grave objections, among which is the unpleasant dryness of the air and almost constant impurity from the deleterious gases consequent upon the burning of animalculous, vegetable and mineral matters, conveyed in the air from without and brought in contact with the heated iron, besides which there is still the annoyance of soot, ashes, coal-bins and ash barrels, and the cost is far greater than with steam. Five dealers in as many patent furnaces in New York, were unable to state the cost of running their furnaces per day, week or month, although each asserted, positively, that his particular furnace was better than either of the others. The smallest consumption of coal claimed was two tons per month, twenty-four tons per annum, or at the rate of one ton for each 1,000 cubic feet of air space for the season—say in a house of 20,000 cubic feet space 20 tons. Under the steam system, a dwelling of this size would require 8 tons per annum, and by the aid of the indirect method a further saving of 20 per cent. would be effected.

PRIVATE STEAM HEATING

by boilers on the premises may be regarded as among the best and latest methods of heating, and has been largely adopted in all modern

THE HOLLY SYSTEM OF STEAM HEATING.

cities throughout the world. Its advantages, in respect to cleanliness, comfort and economy, have been satisfactorily tested by experience. The mechanical contrivances to facilitate and cheapen this method of warming buildings have been numerous and ingenious, but none have devised means of ventilating or regulating the temperature and steam supply automatically, and by many the system is deemed gravely defective, and by not a few absolutely injurious, in consequence of the high temperature and impure air. These objections are all and absolutely obviated by the Holly system of

DIRECT AND INDIRECT HEAT

which furnishes a remedy for the evils of impure air, excessive heat and bad ventilation, and also wholly obviates the annoyances of dust, soot, ashes, with their vexatious train of coal-buckets, ash-pan, barrels, bins, etc.

With a system of pure, warm air at a uniform temperature, which regulates itself automatically, colds, neuralgias, rheumatism and the host of disorders produced by admitting drafts of cold air into overheated rooms, in order to cool or purify them, will be diminished and perhaps abolished. Nothing is more common than to open windows in order to purify the air while sleeping, and under the present methods it is perhaps choosing the lesser evil, but it is a mistake to suppose that we should sleep in cold air.

IT IS PURE AIR WE NEED

We take cold while sleeping more readily than at any other time. In sleep we are less fortified against atmospheric changes than when awake. It is when we sleep, therefore, and, more especially young children, who become restless from the nervous excitement of the day, and throw off the bed-clothing, that abundance of warm, pure air, at a moderate but uniform temperature, is required. In buildings already supplied with steam fittings, but few alterations are required to introduce the Holly system. The boilers, pipes and radiators being all used, as also the range boiler, if the storage of hot water is required. While any radiator may be used
THE HOLLY SYSTEM OF STEAM HEATING.

THE ATMOSPHERIC RADIATOR

designed by Mr. Holly has many advantages that deserve careful attention. It is so named for the reason that it is used at atmospheric pressure, but when made of wrought iron can be used at higher pressure also. In this radiator, steam is admitted at the top in such quantity as desired, the bottom being open, the amount of radiating surface being determined by the amount of steam; thus a little steam will occupy the upper portion of the tubes, the lower portion being cool, the amount admitted being controlled by an inlet valve, so adjusted that the temperature of a room may be maintained at a low degree or raised to the full capacity of the radiator, and is easily controlled by the thermostat.

The advantages of this radiator is its economy, ease of graduating to all weather, and cheapness, as they may be made of tin, galvanized iron or Russia-iron of any required height and ornamental design, and japanned, gilded and decorated to any taste; a small portion may be made hot, while the remainder is cold. The steam and water of condensation give off all their heat, and the water being cold the return-pipe needs no protection, and there being no valve in return-pipe and no pressure, there is no cracking and spattering noise as in pressure radiators. A 1/4-inch pipe will supply radiators for 6,000 cubic feet, while it requires 1 1/4-inch pipe by the old method to warm the same space. As no trap is necessary it is applicable in shops, stores and houses where there are no basements.

The radiator, however, given very general satisfaction, is made of light wrought-iron tubes, merely pressed into base and ornate cap and bolted in place. No. 2 in plate; this admits steam at top and may be used with or without pressure.

Before completing the tiresome journey of steam from the boilers, a few calculations as to the expense of steam-heat by radiation are not inappropriate.

One cubic inch of water makes a cubic foot of steam, which will warm a cubic foot of air, 70 deg., for 16 hours. To make this more clear: One cubic foot of air requires seven-tenths of one unit of heat to raise its temperature from 32 deg. to 70 deg. Now a cubic foot of steam contains 42 units of heat, which is enough to heat the air 50 times in 16 hours. Again: one pound of coal will convert 9 pounds of water into steam furnishing 1,000 heat units per pound. One pound of coal represents, therefore, 9,000 units of heat. On this basis, a building containing 12,000 cubic feet of air space would require 504,000 units of heat, representing 56 pounds of coal per day.

Holly's atmospheric radiator yields 360 units of heat per hour for every square foot of surface, enough to raise 534 cubic feet of air from 32 to 70 deg. In order to raise the temperature of 12,000 cubic feet of air from 32 deg. to 70 deg., 150 square feet of radiating surface would be required. From these data steam fitters may readily estimate the size and number of radiators needed, allowing for the difference of exposure and purpose for which rooms are to be used.

Regulating the temperature of rooms has heretofore been effected by means of the Holly diaphragm valve, attached to each radiator, but as this requires the attention and discretion of some one, a practical method of doing this automatically has long been desired.

A METALLIC THERMOSTAT

invented by Dr. S. Simms, and used successfully on his superheating cooking-stove, is proposed for this duty, and if it be found to fulfill the promise of the experimental tests, the chain of usefulness in the Holly system will be completed. The thermostat is so arranged as to open and close the valves, admitting steam to the radiators, and may be set to operate within any ten degrees of temperature, so that the heat of a room may be automatically maintained at any point desired.

Now, let us follow the steam, or rather water (for after losing all this heat it becomes water at 32 deg. of heat), we cannot afford to lose the heat and we want the water. It is conducted in protected pipes from all parts of the building where steam has been used, back into the basement through the trap into coils of pipes set in a brick chamber; into this chamber cold air is admitted from outside of the building as in the air-furnace, and coming in contact with the coils of hot water abstracts the remaining units of heat and passes up through the registers into the rooms above. Warm, pure air, while the water, now cold, passes into the well for future use, if required.
THE TRAP

Plate VII is a simple and most effective device to permit the escape of the water of condensation, while retaining the steam. By reference to the plate, its operation will be at once apprehended; an inner bucket is balanced when full of water, but when the overflow fills the outer vessel, the bucket rises, and the water below escapes. Its extreme simplicity excites a smile among engineers, but it has been found as durable and unerring as it is simple. We have followed the steam from the boilers to the well, but are not quite done with it yet. The Holly system proposes after once entering a building, with all this array of pipes, boxes, meters and paraphernalia of devices, to leave nothing undone that can be accomplished by steam, and to do it so effectually, that fires for any purpose may be wholly dispensed with. Ample provision is made to maintain a constant supply of pure hot water for

BATHING AND LAUNDRY

purposes, for which the boiler of a local steam system, or of the range, may be brought into use, coils of pipe arranged in any suitable or convenient closet, furnishes the best possible

DRYING-ROOM FOR CLOTHES

Hot water for instant use may be had at any moment, day or night, by means of a novel apparatus like the sprinkler of a watering-pot, attached by a rubber-tube to any radiator or pipe in the house, and in an incredibly short time, any quantity boiled; without the least noise or stop, for example, a bucket of water in three minutes, and sufficient for a bath in ten minutes. From its peculiar power of creating silence from materials so noisy, this little device has been aptly named,

THE ANTI-THUNDER BOX

and such is its convenience and efficiency, that in many dwellings the apparatus for storage of hot water is omitted. As a matter of economy, buildings completely fitted will require
THE HOLLY SYSTEM OF STEAM HEATING.

THE ACCUMULATOR,

by means of which

GREENHOUSES AND CONSERVATORIES

may be heated directly with steam, or by the hot water of condensation. Water can be conveyed to all the rooms of a dwelling, either by atmospheric pressure or by direct application of steam, or by the use of the range-boiler or an accumulator pipe. Water can be forced by steam-pressure to a tank in the attic, either hot or cold, and thence distributed through the building in the usual manner. These matters are usually left to the discretion of owners and steamfitters, but the Holly devices, to supply every probable requirement of a household, are all simple and efficient.

In order to solve the last of the series of steam-heating problems, and complete the mechanical revelation whereby the entire domestic economy of a people shall be improved and elevated, it was necessary to provide some practical method of

COOKING BY STEAM,

not only as a step in the progress of improvement in the culinary art, but in order to enable steam-heating companies to furnish steam supplies with advantage during the summer as well as the winter months. It has long been believed that if some one in some manner would devise a method of using steam heat for cooking purposes, that it could no longer be said that food has a divine origin, but cooks have not. Innumerable steam stoves for stewing, boiling and frying, at atmospheric pressure, have long been in use, and the steam tables of southern steamboats, made of iron with depressed compartments surrounded by steam at high pressure, have been used for keeping food hot, and cooking hashes, meats, etc. All of these devices have been common and popular. Since both animal and vegetable food can be cooked at the temperature of boiling water, or above, but in brown meats, braised beefsteak and form the crust of bread, required a temperature of not less than 300 to 400 degrees of heat, being an amount due to a steam pressure of 60 pounds to 150 pounds.

THE HOLLY SYSTEM OF STEAM HEATING.

In Germany, bread is baked in ovens heated by steam at high pressure, and French cooks have long been in the habit of preparing their nighest broils of delicate game by high pressure steam, but the danger of such a system among ignorant and careless servants, even had inventive genius provided efficient means, would be an effectual bar to its general use. Stoves designed to cook with pressure have been invented and are in use in several public institutions where neither time nor economy is usually considered, but similar principles applied to household stoves proved to be awkward, inconvenient and inefficient, and none had yet been devised by which the required temperature could be attained under the low pressure maintained by the Holly system in dwellings. The problem began to assume the mysterious dignity of a paradox, when it was proposed by Dr. Silsbee to superheat the Holly steam, for purposes of baking, boiling and roasting, and the result is the handsome, convenient and thoroughly practical stove shown in plate VIII. (Page 44.) This stove is made of iron encaised in wood—single and double ovens, and various styles. The ovens and top are used precisely as in other stoves. The stewing, boiling and cooking of vegetables is conducted with the Holly steam at low pressure, but when it is desired to

BAKE, BROIL AND ROAST

or heat flat-iron, it is only necessary to cut off the Holly steam and light an argand gas burner, or in the absence of gas a gasoline or coal-oil lamp, and in a few minutes, without precaution or other preparation, the steam that already surrounds the ovens at 212° of heat becomes superheated to any temperature desired, as indicated by a thermometer, and the cooking is done in the usual manner as in other stoves and ranges. In order to leave nothing to the ignorant or careless discretion of an attendant, an

AUTOMATIC THERMOSTAT

is arranged to control and regulate the temperature. Every provision is made to ensure cleanliness, safety, convenience and economy. Superheating is only resorted to for the purposes named— all other culinary and domestic processes being conducted at the low pressure; superheated steam being absolutely without any pressure whatever.
THE HOLLY SYSTEM OF STEAM HEATING.

The only danger possible is overcooking, which is automatically eliminated. The company have tested this stove carefully and critically, and believe it performs all the duty of the best cooking stoves in use, without their inconveniences and annoyances, with more satisfactory results and in less time. For example, the hotel rule for roasting meats is 20 minutes to the pound, while the average time by superheated steam is 12 minutes. Bakers require 30 to 40 minutes for 18-pound loaves, which by the superheater is done in 20 minutes. A 2-pound steak is broiled in 8 minutes; mutton chops in 4 minutes; oysters broiled in 4 minutes; a 12-pound turkey required 2 hours; an 8-pound roast beef 1 hour; a gallon of coffee from cold water 8 minutes; light biscuit or buns in 8 minutes; potatoes baked in 28 minutes, and so on through the entire list of edibles.

This appears to be the missing link in the chain of unparalleled triumphs in this last achievement of steam. It marks an epoch in human progress, as the

SILSBEE SUPERHEATED STEAM STOVE

is probably the first successful attempt to force this attenuated and mysterious heat bearer into the service of the cook. The next generation will, doubtless, regard our present crude system of cooking much as we do the primitive Dutch-oven plan. It is manifest destiny that when steam-cooking shall become universal, new and superior methods will be created that will supersede all previous practices of the cuisine. Old axioms will be reconsidered, and new theories developed from novel experiences; prejudice and ignorance will be dissipated before stubborn demonstration, and the new culinary art will be able to illustrate positively "the proof of the pudding."

We have been thus tedious in detailing the history and progress of "the system," because the public desire such information, and it seems to be the most desirable and satisfactory way of replying to the questions daily asked from all parts of the world. It is difficult to enumerate or to overestimate the advantages to be derived by the general adoption of steam-heating in cities, and more especially those using soft or bituminous coal for domestic and manufacturing purposes. In many cities the annual loss to works of art, fine goods and merchandise would pay for laying pipes. Housekeepers will appreciate the
THE HOLLY SYSTEM OF STEAM HEATING.

CONSPICUOUS ABSENCE

of fires with their long train of vexatious annoyances and profitless labor, and none will regret the final departure of coal-bins and ash-barrels. Meals may be cooked in less time, and far better, than by any other known method, without waste of fuel or loss of time. Dwellings may be kept at any temperature required and thoroughly ventilated at the same time. Pure hot and cold water is supplied in abundance, without extra cost, for the heat in steam pays all expenses.

MANUFACTURERS

may run machinery of all kinds without the expense, annoyance and care of boilers and furnaces.

STEAM FIRE ENGINES

may dispense with furnaces and boilers altogether. Snow may or melted at a cost of about six cents per ton:

SCHOOL HOUSES,

churches and public buildings of all kinds may be warmed and ventilated more perfectly than by other methods at far less cost, and cities where the system is generally adopted will be saved almost the entire expense of removing ashes.

Impetus will be given to mechanic arts, laborers will find employment in new avenues of industrial art, and large amounts of money distributed annually among the working classes.

TO CAPITALISTS,

and companies contemplating the use of the Holly system in cities, it is proper to state that the numerous devices and ingenious combinations, to which the success of "The System" is to be attributed, are fully and strongly secured by several patents, comprising twenty-seven distinct and important claims. While the company have and will continue to welcome any useful improvements, they are also determined to defend their rights against infringements. That the simplicity and excellence of their devices have thus far given entire satisfaction is, perhaps, no proof that improvement is impossible, but it may also be truthfully affirmed that the mechanical devices invented to evade the Holly patents have in no instance proved to be improvements or successful.

APPENDIX.

In order to illustrate the extent of experience attained in the practical use of "The System," we append a list of cities wherein it has been adopted and in practical general service from one to three years, supplying heat and power through pipes varying from one to five miles, and we are justified in saying that the success has been absolute and unequivocal. In fact, we have yet to hear an unfavorable comment upon its economy, safety, cleanliness or convenience. In many cities, by affording cheap and convenient manufacturing power, it has enhanced the value of property, and in all diminished fire dangers and reduced the rates of insurance, and the advantages will be further multiplied hereafter by the introduction of the safer, cleaner and entirely satisfactory system of cooking afforded by the "superheated steam stove."

Lockport, N. Y., has 4 miles of pipe and 300 consumers, and an experience of nearly 4 years—1 of experiment and 3 of practice.


Troy, N. Y., Dubuque, Iowa, Belleville, Ill., Milwaukee, Wis., London, Ont., Clifton Springs' Sanitarium, House of Refuge, Rochester, N. Y., Insane Asylum, Binghamton, N. Y., the D. L. & W. Railroad offices, Syracuse, and A. T. Stewart's, Garden City, L. I., have had it in successful and satisfactory use during the past season.

In addition to which the following cities are under negotiation, thorough investigation having been made by committees, and in
THE HOLLY SYSTEM OF STEAM HEATING.

many ordinances have already been obtained and companies formed, and in some work already commenced, viz.:

New York City, N.Y. St. Louis, Mo.
Brooklyn, Kansas City.
Albany, Burlington, Iowa.
Buffalo, Des Moines.
Syracuse, Louisville, Ky.
Rochester, Toronto, Canada.
Baltimore, Montreal.
Rock Island, Ill. Providence, R.I.
Chicago, New Haven, Conn.
Jacksonville, Hartford.
Springfield, Bridgeport.
Bloomington, Newark.
Cincinnati, Ohio. Jersey-City, N.J.
Columbus, Denver City, Colorado.
Cleveland, Leadville.
Toledo, Georgetown.
Dayton, Minneapolis.

TESTIMONIALS.

The following, among numerous testimonials, may serve to answer the questions of many, and perhaps to solve the doubts of some, concerning the general working of "The System."

LOCKPORT, N.Y., March 25, 1880.

To whom it may concern:

The system of conveying steam in pipes laid below the surface of the streets in this city, for heating and motive power, introduced by the "Holly Steam Combination Company," during the past year, has been under my observation while in construction and subsequent use, up to the present time.

So far no serious inconvenience to the public in the use of the streets has been occasioned while in process of construction. And since completion I am satisfied no damage or injury can result any more than would be the case with gas or water pipes.

As far as I am informed, all users of the steam are entirely satisfied, and their expectations more than realized; in the abundant supply of heat, with the perfect control of the same, as well as with the amount it costs.

S. F. GOODING, City Surveyor.

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THE HOLLY SYSTEM OF STEAM HEATING.

LOCKPORT, N.Y., March 25, 1880.

To whom it may concern:

I hereby state, for the encouragement of citizens, companies, and corporations who contemplate adopting the heating system of the Holly Steam Combination Co., of Lockport, that the manner of laying street mains by this company does not materially interfere with the affairs of a public street, and when the work is completed the streets are in their former good condition.

JOHN W. REEK, Supt. of Streets.


I regard the manner of laying street mains and laterals adopted by the Holly Steam Combination Company, of Lockport, for advantage in the street in which they are laid, for the reason of their drainage. All pipes are laid on a grade over drain tile, and with frequent connection with the sewer, thus securing a dry condition of the earth at all times.

JULIUS FREHSE, C.E. and Surveyor.

LOCKPORT, N.Y., March 26, 1880.

To all parties interested:

Having used steam to heat my residence, corner of Walnut and Pine streets, during the past three winters, delivered by the Holly Steam Combination Company, through its system of street mains, I take pleasure in saying that the service has been rendered in the most satisfactory manner.

The same Company, in addition to heating a large number of private residences, and running two engines, one of them half a mile away from the heat-house, are also heating one of the largest public schools buildings of the city.

In my official capacity, I have given the subject critical attention, and can say that this building has been more perfectly warmed and ventilated than ever before.

On the score of comfort, health, convenience, and economy, I regard Mr. Holly's system, as in practice here, superior to all other plans or contrivances for heating residences and other buildings in cities and villages.

JAMES JACKSON, Jr., President Board of Education.


To the Chairman of the Committee of the Board of Aldermen, Cincinnati, O.:

We have the Holly system of steam-heating in successful operation in this city, and it gives general satisfaction to all concerned. We have over 100,000 feet of main and 340,000 feet of laterals. When the project was first broached here, many of our citizens looked upon it with suspicion, if not disfavor; but all prejudice is giving way before its practical working, which is entirely satisfactory. The system is daily gaining friends, as well as new consumers.

(Signed.)

P. I. MASSY, Pres't.
THE HOLLY SYSTEM OF STEAM HEATING.

OFFICE ATURN STEAM HEATING CO., Dec. 11, 1879.

H. H. St. John, Cincinnati Committee of Aldermen, Cincinnati, O.

Dear Sir: This company commenced operations with the Holly system of steam-heating in August, 1878. We have one mile of pipe, and applied fifty consumers, heating 200,000 cubic feet of space during the winter of 1878-9. This season we have extended our mains, and began by supplying eighty consumers, and warming 1,000,000 cubic feet of space. We have thus far been quite successful in giving our consumers the heat they want, and there is but one opinion about it—all are satisfied. We are running three boilers, each 5 x 15 feet, 79 3/8 inch tubes. The space at present heated is 6,000,000 cubic feet.

J. H. Osborne, Treasurer.

OFFICE, DETROIT STEAM SUPPLY CO., Dec. 10, 1879.

Hon. Benj. Egleston, President City Council, Cincinnati, O.

Dear Sir: In reply to your query, we have laid about 12,000 feet of pipes, say 5,000 feet of 6 inch, 2,000 feet of 8 inch, and balance of 4. 5 x 2 1/2, and 1 inch. We have 4 boilers 14 x 5 feet; 1 boiler 16 x 5 feet. We can run all together, or drop off two, four, or more if we wish. We get our feed water direct from the river. We have about fifty consumers, and, besides heating, are furnishing steam for elevator power, etc. The opinion here is altogether favorable, and we are adding new consumers daily. We commenced operations in December, 1878, and have been running continuously since that time.

Yours truly,

P. J. PINGREE & SMITH.

OFFICE, SPRINGFIELD GASLIGHT CO., March 10, 1880.

Hon. Benj. Egleston, President City Council, Cincinnati, O.

Dear Sir: In reply to your query, asking results of our experience with the Holly system of steam-heating, I say that it has during two seasons been entirely satisfactory in every particular. Our consumers appreciate the absence of smoke and deleterious gas in their houses, and the comfort of a delightful temperature and pure air in their rooms at all hours of the day or night, without the labor, care and responsibility of fires, as under the old system. It has actually advanced the value of real estate on the streets where used, and reduced the cost of insurance. I am not aware of the existence of a single dissatisfied consumer. We consider it an economical and final settlement of the problem of general steam-heating in cities, and if all cities were gased by our system, it would become universal.

Respectfully,

Geo. Dwight, Supt.
THE HOLLY SYSTEM OF STEAM HEATING.

ing purposes, the Holly steam heating becomes at once a luxury to be appreciated. As this Institution is a pioneer in the adoption of the Holly Steam System of Heating, I have been almost daily called upon for my views upon this subject; I have therefore deemed it proper to embody them in a printed form that I may readily respond to such questions. For the details of the system, you are respectfully referred to B. Holly, Esq., Engineer; or, The Steam Combination Company (Limited), Lockport, N. Y., New York.

E. F. BROWN.
Governor.

TROY, N. Y., April 10, 1880.

Holly Steam Combination Co. (Limited), Lockport, N. Y.

GENTLEMEN: In answer to your inquiry, we are happy to state that your System of Steam Heating, in operation by us the past winter, has given universal satisfaction to the consumers, and the result to us as a company has fully met our anticipations. We are constantly adding new customers, and have quite a number of contracts on hand to fit up new buildings. We have had about 5 miles of pipe, the largest being 8 inches in diameter and smallest 3 inches. We have 6 boilers of about 500 horse-power which, through the means of our patent setting, hot blast and appliances, we have been enabled to run in an economical manner. Our demands have not required but the use of 4 boilers at any time, and sometimes only 3. We heated the past winter 6000 cubic feet of space, including two of the largest buildings in the city. We furnish power to run 21 engines, the largest of which is 16 horse. It is the universal opinion, in regard to this branch of our business, that the power is better than can be furnished by consumers themselves, from the very fact that we furnish a uniform pressure, and, furthermore, it is ready at all times. It is also economical to the consumers, saving the expense of boiler and enabling many to use a small engine when it would not pay them to go to the expense of boilers, engines, etc. It is also of advantage on the score of insurance, a reduction being made on the rate of insurance by doing away with the boiler.

We consider the system a success, not only to the consumer, but also as a business enterprise on the part of the company. While we cannot give data and figures in a letter to be used publicly, yet we are willing to furnish to any interested parties in steam heating all the facts in our power, or to allow full inspection of our works.

Yours truly,

THEO. E. HASLEHURST, Treasurer.
At Belleville, Ill., the Holly Steam System was purchased and introduced by the enterprise of Jacob Brosius & Co., who are meeting with the most gratifying success. We append extracts from a recent letter, and also a copy of report in Belleville daily paper, of Steam Fire Engine test, just made three-fourths of a mile from the boilers.

BELLEVILLE, ILL., April 24th, 1886. Mr. B. D. HALL, Sr.,—Dear Sir: Your favor of the 19th inst. in hand, making inquiries regarding the success of the Holly Steam Heating System here, and in answer, wish to state, that so far it is a success beyond our most sanguine expectations. I have not the least trouble here, and our line works just as smooth and nice as a line can work. There have been several parties from abroad, who state that the line here is the best they have seen, and they were quite surprised at the dry steam we have, and no leakage on the mains, and also at the easy firing we have at the boiler houses, where we are doing our work with three boilers, at present.

We are doing a great variety of work,—running an engine which draws the coal from our mine to the boiler house, 100 feet away, and pumps water for a city, and one common pump which takes the water out of the mine. Then I am heating my own and other private residences and greenhouses. Next I have a large engine at the Oil Mill which has been running all winter, day and night, at 70 to 90 lbs. pressure. A barber shop and bathing establishment heats 14,000 lbs. of water at a time, in fifteen minutes. Then there are a number of small engines for every variety of work.

I send you enclosed copy of Steam Fire Engine test made here. We also wish to state that all the private houses, saloons, and County Jail have the steam also for boiling water. We are now fitting up the Court House. We find no trouble in getting consumers, and think next Fall we will have as much work to do as we possibly can in fitting up houses. In laying main pipe we use no wrapping at all. We lay the iron pipe in the isolated box, and depend upon air spaces, which are the cheapest and best non-conductors. We have one fireman for the day and one for night.

I remain, yours truly,

JACOB BROSIUS & CO.

BROSIUS STEAM WORKS.

The city of Belleville does not now realize the extent of its indebtedness to the enterprise of Mr. Brosius. From the time he first began his work of heating the city by steam, there have been those who have been not only waiting to see what it would amount to, but who have predicted failure. Some months ago it was announced that he was running his oil mill engines with steam from his boilers a quarter of a mile away. Then the Exeter and Raploquet manu-

facturing engines were connected and all their machinery run by steam made the same distance away. And then the mains were extended up Main street and several other small engines attached, and several offices and rooms heated by steam radiators; but still there were those who waited to see whether the thing would work.

Meanwhile Mr. Brosius kept digging up the hard macadamized street, gradually brought his large street mains up towards the public square. On Monday night the workman had reached High street when a junction box was put in, as they are at every street intersection, and yesterday the firemen brought out the steamer, but no fire was made up in it. It was taken up to the Thomas House street cistern, and a rubber hose one and a quarter inch diameter, inside, was attached to safety valve of the steam drum and then connected with the main steam pipe from the steam works, and steam was turned on. The boiler of the steamer at once filled, showing a pressure of 45 lbs., precisely the same as at the boiler three-fourths of a mile away. Steam was at once let into the engine, and it began to work, drawing water from the cistern and forcing it first in one stream and then in two, above the top of the Thomas House, four stories, the highest building in the city.

This test must be considered a most remarkable one. The steam feed pipe to the engine was a small rubber hose; the boilers supplying the steam was three-fourths of a mile away, and from the same mains, steam was running three large engines, driving the Oil Mill and Grain Drill Shops besides heating houses along East Main Street more or less, the entire distance, and yet in less time than it takes to raise steam in the boiler of the steamer the connections were made and two streams of water sent to a height of seventy-five feet.

A vast crowd assembled on the street to witness this exhibition, and it is not too much to say that most of the doubters were convinced. Mr. Brosius first went to work and made a beautiful pond, itself an ornament to the eastern part of the city. He then sunk a coal shaft, then put up his extensive boilers. He has his water and fuel at the very doors of his boilers. His boiler room is so arranged that new boilers can be added to meet any demand. He now has, we believe, six in position, which are sufficient for the present.

There can be no question but all the houses in our city can be economically heated by the sufficient extension of this system. Not only this but all the cooking, washing, &c., can be done and done better; the heat being always ready and under perfect control. It is not only the convenience that may be considered, but the system will bring to our homes a more even and a more healthy warmth.

It will obliterate dust, dirt and smoke, and add innumerable ways to the comfort of life. Another winter will see our people in a future of anxiety to get within the steam district, or to have the steam district extended to them.—Belleville (Ill.) paper.