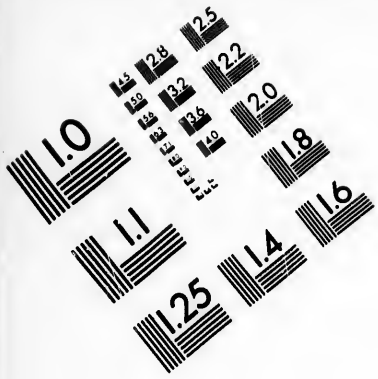

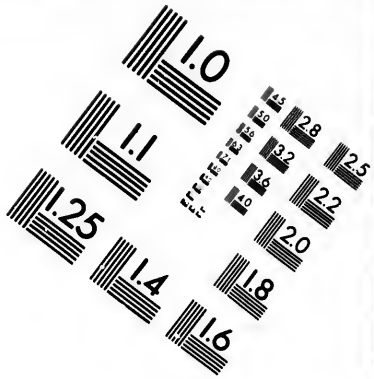

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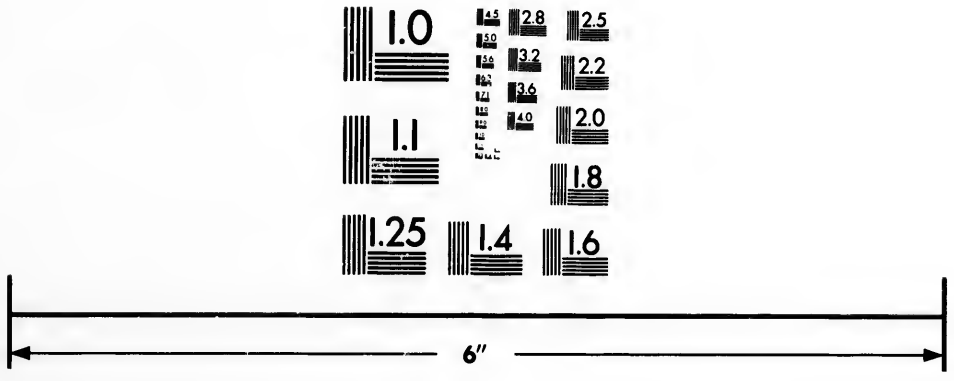

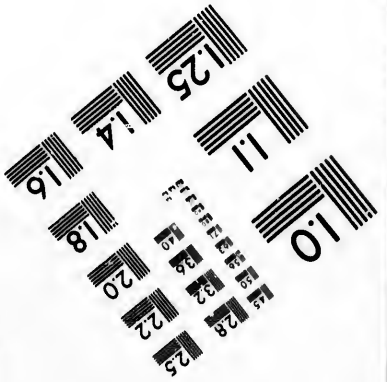

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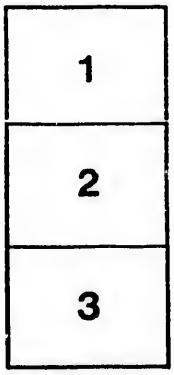

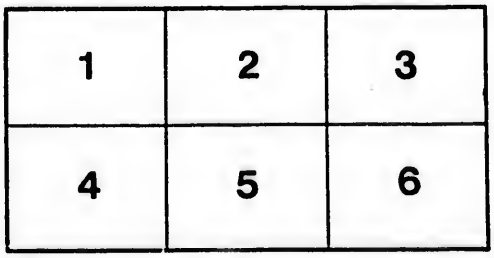

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ERICSSON'S

Caloric Engine.

SEWING MACHINE WITH ERICSSON'S POWER ATTACHMENT.

ERICSSON S

CALORIC ENGINE.

MANUFACTURED BY

CHARLES PIERSON,

NIAGARA, C. W.

ADDRESS

SAMUEL RISLEY, CONSULTING ENGINEER,

54 YORK STREET, TORONTO.

TORONTO :

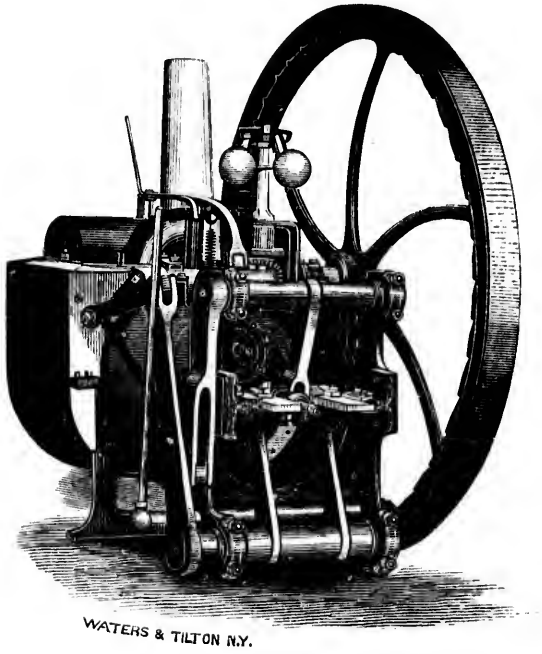
PRINTED BY LOVELL & GIBSON, YONGE STREET.

1860.

Mr. Pierson, having purchased the services of Mr. J. Ericsson, the Inventor of the CALORIC ENGINE, as "Consulting Engineer," has erected an Establishment for the exclusive Manufacture of this new Motor, at *Niagara*, C. W., where he is prepared to fulfil Orders for every description of Caloric Engine used in the United States or elsewhere.

Copies of all new designs for the application of the Caloric Engine, as the Invention progresses, will be immediately forwarded by Mr. Ericsson to Mr. Pierson, for his use.

Mr. Pierson has also made an arrangement with Mr. Samuel Risley, Consulting Mechanical Engineer, Toronto, from whom information relative to the application, powers, &c., &c., of the Caloric Engine, may be obtained.



EIGHTEEN INCH CALORIC ENGINE.

ERICSSON'S

CALORIC ENGINE.

THIS Motor may be confidently pronounced one of the greatest boons which the ingenuity of man has ever bestowed upon his race.

From the earliest ages, the unreliable and fluctuating powers of wind and water have been employed as motive agents. Recently the more certain, but dangerous, power of Steam, has been brought to labour for man.

But now, for the first time, the common atmosphere is practically employed in doing human drudgery, and in saving the sinews, limbs, and lives of the toiling millions. It is made to operate, a harmless, controllable, certain, and universal Motor.

ERICSSON'S CALORIC ENGINE is no longer a subject of experiment, but exists as a perfect, practical machine, daily at work in numerous and diversified uses, with undeviating success.

I. Within the limits claimed for the Motor, its power is certain, uniform, and entirely sufficient.

II. The Machine is not attended with the numerous perils that attach to the Steam Engine, and make it so uncomfortable and dangerous a servant; but, on the contrary, it is absolutely free from danger.

III. It requires no engineering supervision. Any person may take charge of it, or it may be kept in action by a few minutes' attention of the workman who is using its power.

IV. It consumes a very small amount of fuel—say 33 per cent. of the Steam Engine, and requires no water.

V. Does not raise the rate of Insurance.

It is employed for working printing presses; hoisting gear for warehouses, docks, and ships; mills of various descriptions; pumps of all kinds, from those used in raising water in houses for domestic use, and those employed at railway stations, mines, and for pumping ships; also for purposes of irrigation, and supplying villages with water. It has been tested with perfectly satisfactory results in the propulsion of boats and pleasure yachts; and is adapted to the supply of power for the various operations of farms and plantations, and for numerous mechanical employments.

Coppersmiths, workers in all the metals, and workers in all the forms of human industry, will find that the fuel which

warms their workshops, may, at the same time, perform labour for them in the most efficient manner, by being made to actuate the Caloric Engine.

Indeed, this Engine is of universal application, wherever a limited, economical, safe, independent, and self-managed motive power is desired.

Upwards of four hundred of these Engines, of the various sizes, are already in use.

CALORIC ENGINES IN USE

IN THE

UNITED STATES.

Amongst the Caloric Engines in use, we are permitted to refer to the following:

Messrs. Duncan, Sherman & Co.'s Bank.

The Metropolitan Bank.

American Exchange Bank.

The Bank of New York—each a 12-inch Engine, used for pumping.

T. W. Strong, Job Printer, and Proprietor of the *Yankee Notions* Newspaper, 24-inch Engine, used for working his presses; requiring about 5-horse power, and consumes 80 pounds of coal per day.

Alex. Shaw's Wire Establishment, 194, West 27th Street, 12-inch Engine for working his machinery.

C. C. Shelley, Job Printer, 68, Barclay Street, 18-inch Engine, working his presses.

Fitchburg R. R. Co., Boston, an 18-inch Engine, for pumping at Waltham Station. This Engine, which has displaced a Steam Engine, rated at 7-horse power, draws water from a pond 450 feet distant, and fills the reservoir at the station in one hour and ten minutes; the time occupied by the Steam Engine, in doing the same work, having been two and a quarter hours. They have also an Engine at South Groton Station.

JOHN ANDERSON, Esq., 8-inch Engine, used for pumping, at his residence in Madison Avenue and 38th Street.

JAMES H. STIMPSON, Esq., Baltimore, 24-inch Engine, used for driving machinery; and also a 12-inch Engine, for pumping.

B. B. NOSTRAND, Esq., Nostrand House, Sands' Point, 12-inch Engine, for pumping.

J. A. RONALDS, Esq., of Pelham, in the Caloric paddle-wheel yacht, named "Caloric," two cylinders of 18-inches each, in a boat of 50 feet in length. Also, Double 32-inch Engine, in a beautiful propeller yacht, 75 feet long.

FRENCH & WHEAT, 18, Ann Street, 24-inch Engine, for driving their printing presses.

STEWARD'S Warehouse and Storage, 15, State Street, for working hoisting machines.

Messrs. WASHBURN, Worcester, Mass., a 12-inch Engine, for driving a pump and light machinery, and a blower.

Messrs. CANBY BROS., Philadelphia, a 12-inch Engine, for pumping.

Messrs. TIFFANY & Co., 550, Broadway, a 12-inch Engine, for pumping.

J. R. CHEEVES, Esq., Savannah, 12-inch and double 24-inch Engines, for pumping, and other uses, on his plantations.

Messrs. PORTER & TOBIN, Baltimore, an 18-inch Engine, for driving their printing presses.

THE N. Y. CENTRAL RAILROAD COMPANY, five 18-inch Engines, for pumping water at various stations.

Messrs. ANGELL & Co., Packers, 158, Chambers Street, a 24-inch Engine, to drive their hydraulic pumps.

C. F. HALL, Esq., Cincinnati, Ohio, a 24-inch Engine, for driving printing presses.

GEORGE W. SLEEPER, Esq., Providence, an 18-inch Engine, for driving a large coffee-roaster and mill.

DRS. SMITH, Homœpathic Pharmacy, No. 484 Broadway, an 18-inch Engine, for driving sugar mills, and varied machinery.

Dr. WM. B. MOFFATT, Moffatt's Buildings, corner of Broadway and Worth Street, a 12-inch Engine, for pumping.

C. H. LILIENTHAL, Esq., a 12-inch engine, for pumping water, at his country seat, at Yonkers.

R. W. MONTGOMERY, Esq., a 12-inch Engine, for pumping water, at his country seat, High Cottage, Westchester County.

GEORGE LEWIS, Jr., Esq., Washington Heights, an 8-inch Engine, for pumping.

WM. H. TOWNSEND, Esq., an 8-inch Engine, for pumping, at his country seat, at Tarrytown, N. Y.

N. Y. JUVENILE ASYLUM, an 18-inch Engine, for pumping.

E. R. WEBB & Co., a 24-inch Engine, for driving machinery for making printers' materials.

KING & BROWN, an 18-inch Engine, for driving skirt making machinery.

JOSHUA J. HENRY, an 8-inch Engine, for pumping, in house in Fifth Avenue.

PESANT & BRO., 13 Engines, for various purposes, in the Island of Cuba.

E. A. WHARTON, a 24-inch Engine, for the *Brooklyn Daily Transcript*.

WHITHAM & LAWRENCE, an 18-inch Engine, to drive machinery in tobacco factory.

JEFFERS & BRO., 181, Broadway, a 24-inch Engine, for driving machinery.

M. KEIFFER & Co., Chambersburg, Pa., a 24-inch Engine, for driving printing presses.

D. DEVLIN, a 12-inch Engine, for pumping, at country seat.

JOHN A. HALL, a 24-inch Engine, for driving skirt making machinery.

G. A. SMITH, an 8-inch Engine, for pumping, at country seat.

B. E. CLARK & Co., an 18-inch Engine, for driving printing presses in bag factory.

Ship UNDERWRITER, a 24-inch Engine, for pumping, hoisting, &c.

GEO. S. CASE, Skeneateles, a 24-inch Engine, for propelling yacht.

DODGE & GRATTAN, 56. Gold Street, N. Y., an 18-inch Engine for driving printing presses.

UNION MUTUAL INSURANCE COMPANY, a 12-inch Engine, for pumping.

Hon. J. F. KUNKLE, Fredericks, Md., a 24-inch Engine, for pumping in mines.

DEMING JARVIS, Boston, "Twin" 24-inch Engine, for driving glass-cutting machinery.

J. ANTHONY & Co., Sacramento, Cal., a "Twin" 24-inch Engine, for driving printing presses in the largest printing office in California.

STIMPSON & NEILSON, a 24-inch Engine, for use in a pottery.

J. D. DEFREEZ, Indianapolis, an 18-inch Engine, for driving printing presses.

J. R. CHEEVES, Savannah, double 24-inch Engine, for propelling yacht.

DANIEL LOVEJOY, New York, an 18-inch Engine, for driving buzz saw, &c.

SACKETT, BELCHER & Co., 26 and 28, Pearl Street, double 32-inch Engine, for hoisting.

THE NEW MOTOR.

It is some eighty-six years since Mr. Boulton, at the great steam-engine works at Soho, made use of the memorable expression to Boswell, "I sell here, Sir, what all the world desire to have—POWER." The mechanical world has been occupied from that time to the present, with this problem of power, and mechanical ingenuity has tasked and exhausted itself with efforts to construct a machine that should prove an efficient auxiliary or rival of the steam-engine. And it is most extraordinary that, notwithstanding the amount of inventive genius and science that has been expended in this special field of labour, literally nothing had been accomplished of any practical importance till Ericsson produced the Caloric Engine, in the particular form and with the peculiar devices which distinguish it from all the engines actuated by heat, that have been built at such an enormous expense of time and money.

Motive engines of a moderate or even small power play a very important part in the economy of human life. The frightful horrors of the slave-trade, the scarcely less frightful horrors of the traffic in Coolies, nay, the haggard features and jaded limbs that, in our great cities more especially, speak so distinctly of over-wrought human labour, and cry out so emphatically for relief—all these demonstrate that a compact, manageable, safe, and economical motor, adequate to the work of a *single* slave, or cooly, or over-tasked white man or white woman, would do more to mitigate the suffering and diminish the drudgery of mankind than any other conceivable invention.

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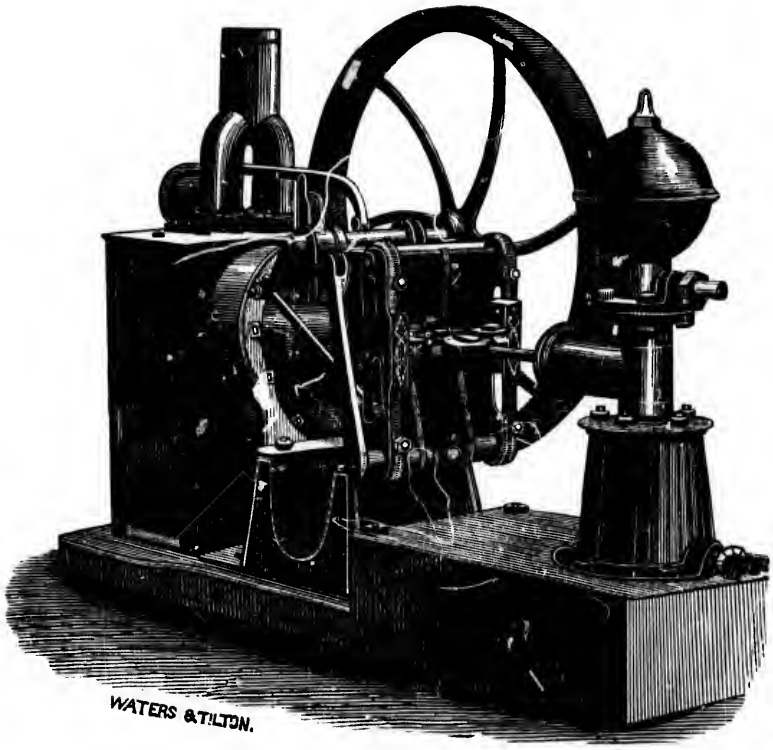


CALORIC HOUSE PUMPING ENGINE.

After all the enormous accumulation of steam-power, water-power, wind-power, and horse-power, and their vast achievements, by how much the larger amount of power exercised in the world is the aggregated result of individual force applied to the thousands of little things that occupy the human family in the daily routine of life! Combine these forces, and what a stupendous whole they exhibit! Make an available motor that shall be of one-man power, and what a result is obtained! Make a motor perfectly safe, easily kept in order, requiring no water, and consuming but little fuel, of the power of a single horse, to what an extent the aggregate result is augmented, and what an importance in human affairs such a machine assumes!

If Ericsson's Caloric Engine, then, claimed to be nothing but such a motor, it would be a subject well deserving the most earnest and serious investigation; but the proof is accumulated, of a nature that compels belief and defies contradiction, which demonstrates the existence in this engine of a power entirely sufficient for all but a very few of the thousand uses for which power is required.

It is not material to our purpose to indulge in any retrospective review of Ericsson's labours. It is well known that this grand invention has occupied thirty years of his life, during which he has built many engines of the largest size, and uncounted experimental engines of smaller power. Two or three engines of sixty and seventy-inch cylinders were standing in the iron works of his friend Mr. Cornelius H. Delemater, from whom Captain Ericsson has received the material aid that has enabled him to perfect his invention, at the time that Mr. B. Kitching laid the foundation of his present extensive traffic, by advertising to furnish engines of six, eight, and twelve-inch cylinders for pumping purposes and small mechanical uses. The first engine sold for a specific use was put up by Mr. Kitching in the banking house of Messrs. Duncan, Sherman

& Co., for the purpose of supplying the upper stories of that fine edifice with water. Its success led to the introduction of the engine into other banks, and into stores and private dwellings, where it is now extensively used. The first engine applied to pumping water at a railroad station was erected at Waltham, on the Fitchburgh Railroad, in Massachusetts. This engine was put in operation in October, 1858. The water at this station is drawn from the river through a three-inch iron pipe, 500 feet in length, to a height of about 21 feet, and is then forced up about 20 feet over the top of the tank. After eight months' use the Superintendent reported that it had proved perfectly successful; that it was readily worked by an ordinary labourer, required no more time or attention than a common coal stove, and burned but comparatively little fuel. This engine was one of 18-inch cylinder, furnished by Mr. John B. Kitching.

We have seen an official statement in relation to an engine put up about a year since to supply the locomotive at the South Groton Station, on the same railroad. From April, 1859, to April 1860, this engine pumped 1,600,000 gallons of water, at an expense to the company for fuel and oil of $25, and for an "engineer," $25; and has not cost one cent for alteration or repairs.

A result more important in view of the number of engines employed is exhibited on the New York Central Railroad, on the line of which there are now some twenty of these engines in daily use. Mr. Chauncey Vibbard, the Superintendent of that road, reports, over his official signature, after several months' experience with a number of those engines, that they perform an "incredible" amount of labour "for the small quantity of fuel consumed." One of them, he says, for 36-000 of a cent per hour, does the work formerly done by four men, at an expense of $25 each per month. Another of the same size, at the Savannah station, at an expense of eleven

cents a day, does the work of five men, who received $125 a month. Other engines have been erected on several other railroads for pumping purposes with the same favourable result.

The second application of the caloric engines was to the driving of printing presses. The first trial of the engine for this purpose was made in the office of *The Hartford Times*—the first that was entirely successful was made in the office of T. W. Strong, No. 98 Nassau Street, in this city. The next engine built was set up in the office of Messrs. French & Wheat, No. 18 Ann street, and the third in the office of Mr. C. C. Shelley, a job-printer in Barclay street. The result has been the adoption of the engine in numerous job-offices in every part of the country. There are now no less than forty daily papers in the United States printed by Ericsson's engines, most of them of 24-inch, but three or four of 12 and 18-inch cylinders. One of the most recent testimonials to its value is from the proprietor of *The Savannah Evening Express*, who states that he regards it as the most perfect and economical motive power ever applied.

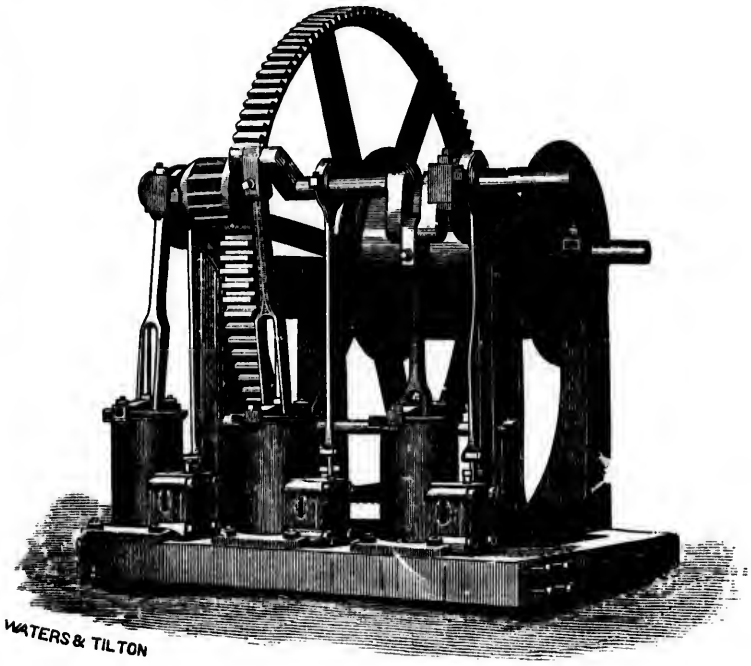
The increasing demand for the engines for miscellaneous purposes induced Mr. Kitching to make arrangements with the long established engineering house of Messrs. Clute Brothers of Schenectady, which have resulted in the almost exclusive appropriation of their foundry to the manufacture of Ericsson's engine. As they were the earliest in the field, they have constructed many more engines than any other house, having now nearly 200 in actual operation, and being under contract to supply Mr. Kitching with 10 engines, from 8 to 24-inch cylinder, every week.

Sometime in the Summer of 1858 a license was issued to Mr. Joel Nourse, of the well-known agricultural-implement house of Boston, and Mr. A. H. Caryl of South Groton, Massachusetts; and, under their auspices, the Massachusetts

Caloric Engine Company entered upon the manufacture of the engines at South Groton. Towards the close of 1858, Messrs. I. P. Morris and Co., of Philadelphia, the oldest establishment in that city engaged in the manufacture of machienery, applied to Capt. Ericsson for a license.

It has always been a favorite idea with Captain Ericsson, that by the introduction of his engine he was to materially diminish human drudgery. When it was suggested to him, therefore, that it might be advantageously applied to sewing-machines, he devoted himself with great interest to the subject, and soon devised an arrangement that has proved in practice completely successful. His plan is to employ the engine to pump air into a tank or reservoir, from which it is transmitted by tubes to each sewing-machine, by a simple mechanical attachment which actuates the treadle and graduates its speed at the will of the operator. This arrangement dispenses entirely with the use of the foot and leg of the operator, the action of which during the long hours of the working day is always painful, and in some cases insupportable. The operator is thus enabled to devote her exclusive attention to the material she is employed upon, and the guidance of her needle, so that she accomplishes in a given time a much larger amount of work. The new motor has been applied to some forty machines in the extensive clothing establishment of Messrs. Carhart & Payan in this city. There is no doubt that it increases the effective force of the operator fully fifty per cent.

Still more important is the application of the engine on board of large ships, where it is used for pumping, loading and discharging cargo, warping ship, handling the anchors, setting up rigging, and for many other purposes now requiring manual labour. After the use of one of these engines on board of the ship Underwriter for several months, Captain Roberts reports that it is a money-saving machine, and gives it as his opinion that four-fifths of the vessels that put back leaky, would find



ERICSSON'S AIR HOISTER.

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it unnecessary with a Caloric engine on board. An engine of this description on the ship Wild Pigeon excited so much attention by the work it performed in port at Caldera, in Chili, as to lead to several orders for engines, to pump and hoist at the mines in that vicinity.

We have already alluded to the engine put in operation by Messrs. Nourse & Caryl at Groton in 1859. It was about eight weeks from the time that engine was started before these gentlemen found another customer, who united the discernment requisite to appreciate the engine with the courage to buy one. In the first seven months of their manufacture of these engines, Messrs. Nourse & Caryl sold but ten of them. During that period, they were visited by thousands of persons, many of whom declared themselves in want of just such a power as the caloric engine would give them. But they failed to buy—some because they were fearful of being "humbugged;" others, because they were dissuaded by the advice and influence of interested parties; others, through a want of confidence in their own judgment.

During this long period of popular distrust, Messrs. Nourse & Caryl continued to manufacture the engines; and at the beginning of the last winter they had standing on their floor, more than twenty engines finished and ready for market. They say in a letter not intended for publication, but from which we have been permitted to make an extract:

"Since then we have kept our men constantly at work on caloric engines, and to day our orders are in excess of our ability to supply. Our machine shop, which is exclusively devoted to them, is 60 × 100 feet; this is independent of our forge shop and sheet iron shop. We have room enough, tools enough, and can procure men enough to put up an engine every day, and we believe we shall ere long be called upon to do so, certainly we shall if our trade continues to increase for a few weeks as it has the past three. Our sales now for a single month are larger than they were during the first seven. But the above is not all that we find encouraging in the business. We have the satisfaction of knowing that every caloric engine that we have sold gives entire and complete satisfaction to the purchaser."

The application of the engines made by Messrs. Nourse & Caryl have been quite miscellaneous. Their second sale was of a 24-inch engine to Mr. Ashbel Waite of Charlestown, who uses it to drive a morocco-polishing machine, and a mill for fulling goat-skins. Another engine of the same size they set up in the cabinet manufactory of Mr. S. A. Parker at Reading, where it drives machines for cutting off rough boards, splitting up and squaring off stuff, gig-sawing and grooving, and planing with a side-jointer. In the Fall of 1859, Mr. E. B. Phillips purchased one of the same power, to drive the machinery in his shoe-manufactory at Natick, and he is satisfied that it is the most economical power he can employ. A similar engine was set up in the currier's shop of Mr. U. R. Williams at Salem, where it drives a leather-splitting and finishing machine at the same time with perfect ease. They have also furnished engines to the proprietor of *The Maine Farmer* at Augusta; for a bakery at Wilmington; for a bookbinder's shop at Providence; for Dr. S. G. Howe's Asylum at South Boston to drive a fan for purposes of ventilation; for cotton grinding at Corpus Christi; for picking hair at Beverly; and for glass cutting at Sandwich. Other engines put up by Messrs. Nourse & Caryl are in operation at Thomas Wilkin's lace-manufactory at Dorchester, in the sash and blind factory of the Messrs. Taft at Fitswilliam, and are driving the paint-mills of Allan Lucas & Son at New-Bedford, and the printing-presses of Knowlee, Anthony & Co., at Providence.

We have mentioned the house of Messrs. I. P. Morris & Co. of Philadelphia. They have been engaged about fifteen months in the manufacture of these engines. Besides engines for domestic and Railroad pumping, and for printing, they have set up engines in the warehouses of the Pennsylvania Railroad Company at Parkersburg and the Bird-in-Hand Stations, for elevating grain from the cellar to the second stories and distributing it into bins. They have also furnished a single twenty-four inch engine to Mr. Henry Carlisle of Philadelphia,

who employs it in his comb manufactory to drive three buffs of 28-inch diameter at a speed of 700 revolutions a minute, a grindstone, a lathe, and a drill. Mr. Nelson J. Wemmer of Philadelphia also employs one of their 24-inch engines, by which, at an expense of 2½ cents an hour, he runs two lathes, one routing machine at 5,000 revolutions a minute, three 8-inch saws at 2,500, and one 14-inch saw at 2,000 revolutions. Messrs. Jones & White of Philadelphia have employed a double 24-inch engine of the Morris manufacture for upwards of six months, to run three mills and three mortars for grinding quartz, spar, and colouring materials used in the manufacture of porcelain teeth, one rolling-mill, four small lathes, and one grindstone; and report that they are perfectly satisfied with its operation.

A few months since, Messrs. Wm. Kidd & Co. of Rochester, an establishment extensively and favourably known for its manufacture of steam-engines, and of all articles of iron required for the use of railroads, had their attention drawn to the caloric pumping-engines for locomotives at railroad stations, and were so much struck by their singular adaptation for this purpose that they applied to Capt. Ericsson for a license to build them. They commenced immediately upon the 18-inch engine, which is the size most generally called for by the railroad stations, and which is abundantly powerful for all their pumping purposes.

But, rapid as has been the progress of the new motor in the United States, it has advanced with equally rapid strides both in Sweden and in Cuba; a fact that must set at rest the objection that the engine does not operate as well in warm weather as in cold. In Sweden, the *Aftonbladet*, the leading journal of Stockholm, of the 15th of March, transfers to its columns THE TRIBUNE'S article on the Ericsson engine of the 11th of February, and adds:

"All this from THE N. Y. TRIBUNE of the great progress which the caloric engine is making in the busy land which the inventor has selected

for his sphere of activity. Let us now take a glance at the progress of the invention in his native country. It is now about a year since we first heard of Capt. Ericsson's last and successful solution of his life's problem, and about nine months since the first of the perfected engines was here exhibited. The great interest it has excited, and the numerous enquiries which are daily received, show clearly that the invention here, as in America, was wished for, and that it is destined to supply a want long felt."

Our Swedish contemporary then enumerates the peculiar advantages of the invention in a Scandinavian point of view, and proceeds:

"A proof that speaks for itself in regard to the existing desire to obtain caloric engines, is the fact that already *nineteen* mechanical establishments in Sweden have applied for and obtained licenses and working plans for building the same. Among these Finspong, Brasaholm, Brefven, and Hellefors have already commenced to deliver engines; while Trollhattan, Gefle, Branninge, and others are manufacturing them."

The various uses to which the engines already delivered have been applied, are then stated, such as to printing, soda-water manufacture, bone-crushing, malt-mashing, towing, pumping in various localities. A pumping engine for freeing the works of the harbour now in progress at Carland, on Lake Wenern, in Varmland, is particularly noticed. Grinding cutlery at Eskilstuna, the Sheffield of Sweden, is also mentioned among the applications of the new motor.

It also appears that two establishments in Denmark have obtained licenses; another in Christiania, the capital of Norway, and another at Abo, in Finland.

In the month of June last, the first experiment with the caloric engine in Cuba was made in the Palace at Havana, in the presence of Captain-General Concha, and other high functionaries and persons of distinction. This trial was made under very curious circumstances. The engine was in the charge of a person who understood little about it. Desirous of showing it to the best advantage, he determined to apply it to a cotton gin—cotton planting and ginning being then in high favour in the island. Not being aware of the power

necessary for such work, he ordered a large gin of 72 saws to be transported to the palace, and caused it to be geared to a single small caloric engine, only 18 inches in diameter.

When everything was up and in good order, the evening previous to the morning on which the trial was to be made, an old American engineer, who had long experience in working cotton gins, seeing the whole apparatus, declared that the little 18-inch engine could not do the work, since a gin of such a size required at least from seven to eight horse power to work it. Here was a dilemma. The invitations to witness the experiment had been given; the persons invited were too important to be disappointed; and there was no time to make any different arrangement in the machinery.

In such an emergency it was determined to try it forthwith. A good fire was made in the engine, and in half an hour's time the person having charge of it saw, to his great surprise and delight, that it turned the gin in the most beautiful manner. Of course the cotton was fed to the saws with the utmost care; but when, the next morning, the experiment was repeated in the presence of the Captain-General and other invited persons, it was a most successful one, and elicited the admiration of all present.

Since then Ericsson's engine has been applied in Cuba to many purposes. The distinguished Dr. Torrado, of Trinidad, led the way by purchasing four engines, two of 24-inch cylinder, which he is now applying to an aqueduct of his own construction, and the others of 18-inch diameter, for the purpose of irrigation. The presses of the Government printing-office at Havana are moved by two 24-inch caloric engines, displacing a steam-engine which formerly did the work; and in the large military hospital of the same city, the Government has also adopted Ericsson's engine for driving a large mangle that is constantly at work in that immense establishment. In the *Iris* printing-office, another 24-inch caloric engine is doing the work that formerly required several strong negroes. There

are other engines employed in mincing tobacco, hoisting, driving corn mills and wood-working machines, pumping water, &c.; but by far the most important application that has been made in that island, of the caloric engine, is to the grinding of sugar cane on the plantations.

The introduction of such a motor was one of the prime necessities of Cuba. The old ox mills were utterly insufficient for the large modern sugar estates; and besides, their labour was very exhausting and costly. It required a great number of men and oxen, and the juice of the cane was but imperfectly expressed, the best part being thrown away with the *bagasse*. The steam engine obviated these difficulties, but it created others of great magnitude. The Island being destitute of coal beds, wood is used to supply the great consumption of fuel required by the steam-engine, the consequence of which has been that in less than twenty years immense forests of the finest kinds of timber have been completely destroyed. Besides, on account of the great scarcity of water in many parts of the Island, it is enormously expensive to procure the quantity necessary for feeding the steam-boilers. On some plantations the cost of water for the purpose amounts to thousands of dollars annually. The expense for engineers is also great, as they all have to be imported from some foreign country.

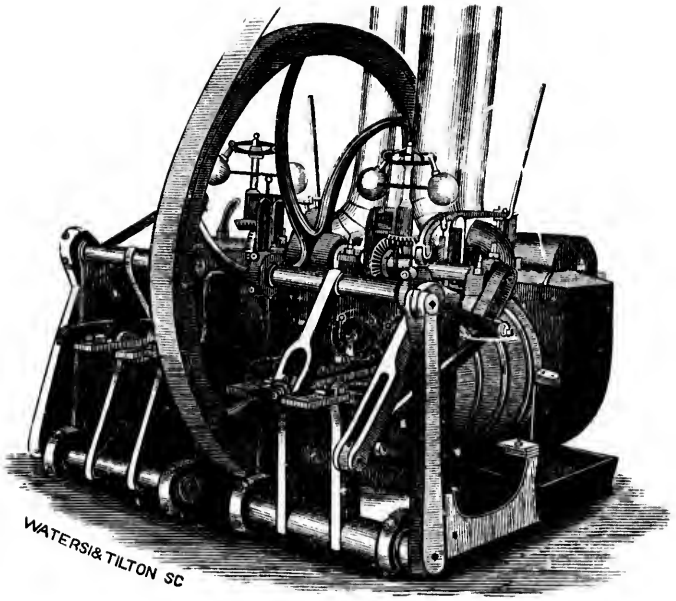
The advantage to be derived from the application of Ericsson's engine to the grinding of sugar canes were first appreciated by Messrs. Anguera and Martinex, wealthy merchants and planters at Havana, persons endowed with enlarged views and a progressive turn of mind. Desirous of doing away with the old ox-mill in the *ingenio*, "*La Sierra*," a beautiful sugar plantation situate near the port of Mariel, and at the same time unwilling to suffer the ruinous wasting, and many dangers and inconveniences of the steam engine—one of which in Cuba is the unavoidable necessity of an engineer—they determined to try the Caloric Engine. Accordingly they ordered the

construction of a twin engine of 48-inch diameter, with a mill of corresponding size; but the season being far advanced, and this size of engine being much larger than any before built—(the largest till then being only 32-inches diameter)—it was impossible to have it finished in season to take in this year's crop. When Messrs. Anguera and Martinez became aware of this fact, being determined at any rate to try the Caloric engine, they ordered the largest engines that could be procured with a mill of a corresponding size, to be sent to them immediately. There was at that time at the Delemater Iron Works of this city, a twin caloric engine of 32-inches diameter, which was used for driving a trip-hammer, a fan-blower, several lathes, and other machinery. Mr. Delemater was reluctantly prevailed upon to let this engine go, but Capt. Ericsson declined to allow it to be sent to Cuba, for the purpose of grinding sugar cane, until it was thoroughly tested here, *with the same kind of work.* When Messrs. Anguera and Martinez were apprised of this, they sent immediately a considerable quantity of sugar cane; meanwhile, the only mill that could be procured in this city was one with rollers 26 inches long by 16 inches diameter. This was geared to the engine at Mr. Delemater's works, and the actual experiment with the cane was made in the presence of many persons on the 11th of January last, with the most complete success. The engines were immediately taken down and sent,—the rapidity of the operation and the facility with which the caloric engine is set up being such that the cane was shipped on board of the steamer Quaker City in Havana on the 5th of January, brought to this city, the trial made, the engines and mill taken down, packed and shipped on the same steamer, taken to Havana, there transported from the steamer to a sailing schooner, taken to the port of Mariel, and there landed and transported by land and over very rough roads to the plantation, and there set up, both mill and engine; the whole having been completed, and the engine and mill working

satisfactorily on the 5th of February, just one month from the time the cane for the trial was shipped at Havana.

The success of the engine was perfect. The old mill was driven by twelve oxen, which were changed every two hours. For this work there were one hundred oxen set apart, of which number many died every year of exhaustion and fatigue, and the rest were in very poor condition at the end of the crop. These twelve oxen required four negroes to drive them, and three or four others were constantly employed taking care of the rest, and driving the changes from the pasture ground to the mill, and vice versa, and yoking them for the work. The rollers of the mill were 36 inches long and 24 in diameter, and with the greatest exertion the ox-mill could only turn out 12 boilers or pans of juice in a day, the *bagasse* leaving the mill with a great quantity of juice in it. When the Caloric Engine and its mill were set up, all those men and oxen were dispensed with, and more work was done in the same time, reaching to 15 pans of juice; while the cane was so thoroughly pressed that it rendered 30 per cent. more sugar than by the ox-mill; and the *bagasse* in two days of exposure to the sun was ready for the fire of the trains, while drying that of the old mill required full two weeks.

We have left ourselves but little room to speak of the construction of the engine itself. It is enough for our present purpose to say that its power is produced by common atmospheric air being introduced into the engine, and then expanded by means of heat generated in a small furnace placed in the interior of the machine. The heated and expanded air acts upon a piston, by the force of which the fly-wheel is actuated, in the same manner as in the steam-engine. When at rest, there is no pressure kept up within the caloric-engine, and the power is developed at each successive stroke of the piston.



DOUBLE TWENTY-FOUR INCH CALORIC ENGINE