FACTS ABOUT

PEAT

PEAT FUEL AND PEAT COKE

HOW TO MAKE IT AND HOW TO USE IT—WHAT IT COSTS AND WHAT IT IS WORTH

WITH BRIEF NOTES CONCERNING ITS USE AND VALUE FOR NUMEROUS OTHER PURPOSES

By T. H. LEAVITT

ILLUSTRATED

BOSTON
LEE AND SHEPARD
1904

Published January, 1904.

FACTS ABOUT PEAT.

Norwood Press
J. S. Cushing & Co. — Berwick & Smith Co.
Norwood, Mass., U.S.A.

PREFACE

YEARS ago I operated works at Lexington, Massachusetts, for the manufacture of peat fuel, and for the perfecting of machinery for its production, in which I was successful.

During that time I prepared a volume of upwards of three hundred pages, entitled "Facts about Peat" — probably the most exhaustive treatise upon the subject which has been published.

It was published by Lee & Shepard, and passed through several editions, but is now out of print, the plates having been destroyed by fire.

In the recent revival of interest in the peat-fuel question, which is very apparent, the demand for this book, which, of course, cannot be satisfied, has been considerable.

The present volume, therefore, under the same title, is prepared as a substitute for that,

with a view to affording information of a practical character to parties proposing to manufacture or use the fuel.

In order to give some indication of the importance attached to the subject by practical men, the reliability of the "Facts" presented in my former volume and reproduced with additional and more recent data in this, the value of the material in its crude state, its largely increased value when manufactured and put in merchantable condition, the methods by which it can be put in that condition and its superior fitness for certain classes of service, I shall give in an Appendix quotations from a few of a multitude of opinions expressed by the press and by practical men who have carefully and thoroughly investigated the whole subject, which may be of no less interest than the facts and data which are given in the body of the work.

T. H. LEAVITT,

735 Old South Block, Boston.

January, 1904.

CONTENTS

ILLUSTRATIONS

Following page 96

FACTS ABOUT PEAT

THE prime object of this book is to invite attention to the matter of Peat Fuel, — what it is; where it may be found; how to manufacture it; how to use it; what it costs, and what it is worth; and to offer such facts and information, derived from my own experience and observation during a series of years, with other data from trustworthy authorities, as may be of practical interest to every one who has use for fuel of any kind, for any purpose.

WHAT IS PEAT?

PEAT is decomposed vegetable matter, the moist, spongy substance, the accumulation of ages, found in almost every country

in the temperate zone, filling cavities in the surface of the earth and constituting what is generally called "bog."

It is a curious substance, possessing peculiarities of very interesting character. It is composed of vegetable matters, generally mosses, grasses, rushes, and various aquatic plants in different stages of decomposition; is exceedingly elastic, possessing, in this respect, some of the characteristics of India rubber or gutta percha, and is remarkably tenacious of water, — a fact which will, to some extent, account for the impossibility of reducing it, by pressure alone, to a solid, dry substance.

It differs much in different localities in composition and in actual value for fuel purposes, — some deposits yielding a product comparable, perhaps, to pine wood, while others may grade to compare with birch, oak, and the best of hickory. It varies in color from light brown to black, and in con-

sistency from that of bran mash to that of clay in the bank.

A writer in "The New American Cyclopædia" says, "Dense, compact peat appears to represent the first step in the progressive changes from vegetable substances to mineral coal."

Sir James Hall says, "I have always looked upon the peat of the Old World as one of the principal sources of our coal."

Dana says, "Peat is sometimes entirely converted into coal."

WHERE PEAT IS FOUND

The deposits of peat in the Old World are widespread, numerous, and extensive; and in Scotland, Ireland, Italy, France, Germany, Denmark, Norway, Sweden, Austria, Russia, and elsewhere, peat fuel is being used and has, for many years, been used to an extent and for a variety of purposes of which few in our country have any adequate knowledge or conception; and the universal verdict concerning its usefulness and value is such as to stimulate and warrant the production and use of it with us.

Our own government, in a recent Consular Report, has given a good deal of information concerning the extent of deposits, methods of manufacture, and uses to which it is put in foreign lands; the editors

remarking that "the use of peat is not without its industrial significance. The suggestion of its more extended use is practically interesting and in direct line with the best modern practice in the economical utilization of natural resources."

In our own country the deposits of peat are numerous, extensive, and in quantity simply enormous. New England is full of it; the deposits in the middle, western, and northwestern states and in Canada are immense; Mexico has rich and extensive store of it. The extensive tula marshes of California appear, so far as we learn, to be identical with peat; they abound in some sections of the state. It is understood that our government has instituted explorations and inquiries concerning these marshes, the result of which will doubtless be made public in due time.

Professor Lyell says, "It has seldom, if ever, been discovered in the tropics." Dar-

win states that "in the southern hemisphere peat does not occur nearer to the equator than latitude 45 degrees."

The extent, depth, and quality of peat deposits vary considerably, and seem to depend upon circumstances and conditions quite distinct from each other. Some cover only a few acres, while others are many miles in extent. The depth varies quite as much, say from one to twenty feet, though not a few are reported to be thirty, fifty, and even eighty or more feet in depth; but an average depth of what may be considered our peat regions, would probably be somewhere from six to twelve feet.

The geological reports of the several states and Canada afford much valuable information concerning location, extent, and quality of peat deposits.

The composition, density, and quality of peat varies with the position in which it is found; the vegetation or organic substances

from which, in different localities, it had its origin; the character and temperature of the locality and atmosphere; the proportion of earthy and mineral matter which it contains; and occasional minor peculiarities incident to locality and surroundings.

The manufactured fuel produced from the various kinds of peat must, therefore, differ in quality and characteristics, and consequently in heating qualities and value, fully as much as wood and coal in all their varieties.

HOW TO MAKE PEAT FUEL

THAT peat has been used for fuel in some parts of the world for centuries is well known, and, incidentally, mention is made of it by some of the earliest writers whose works are extant.

By some it was used in its crude state, as cut from the bog and dried in the open air; by others it was treated by various rude methods, formed into blocks, and dried in the open air. In more recent years, while these same methods have been continued in communities and regions where the habits and customs of olden times prevail, the spirit of enterprise and improvement has found illustration in numerous attempts to manufacture and solidify peat in such a manner as to produce a merchantable article of fuel.

Its more extensive use has steadily increased during the last two centuries, especially during the last half of the last century.

The earliest efforts appear to have been directed to machinery and apparatus for excavating, dredging, raising, and transporting the material from the bog and spreading it upon the ground to dry, and in this a good degree of success was attained.

Numerous methods have been devised and much machinery, some of it very cumbersome and expensive, has been built, for the purpose of cutting and excavating and delivering the peat from the bog to the factory. Although I have seen not a few of these in operation and learned of others, my own experience, confirmed by the testimony of others and by the observation of those who have had opportunities to see and investigate where I have not, is that

for cutting peat in this country there is no better machine than the simple *slane*, in the hands of a stout, good-natured Irishman, well treated and fairly paid. Such a "machine" will easily cut fifty tons of crude peat per day of ten hours. This statement has been occasionally questioned, but the *fact* remains nevertheless.

It is evident, however, that in order to work a bog which is entirely submerged with water and cannot be drained, or which is saturated with water to such an extent that it will not retain its form when cut out in the ordinary manner, dredging must needs be resorted to.

As an essential quality of peat in relation to its value for fuel is its density, attention was directed to solidifying it, and numerous efforts were made and various processes attempted by which, first, to expel the large percentage of water contained in it, and then to give it a

degree of solidity equal or approximating to that of hard coal; sufficient, not only for ordinary domestic purposes, but sufficient to stand the blast required for a very high degree of heat in the more severe processes of metal manufacture and steam service.

The multitude of attempts to solidify peat for fuel may all be classed under two heads, — *pressing* and *condensing*.

The earliest mention we find of its use for fuel shows that it was excavated in blocks, exposed to dry in the open air, and used without further treatment; later, it was excavated, trodden by the feet or macerated by other means into a plastic mass, formed by hand into balls or blocks of any size, and exposed to dry as before. This treatment, in various ways but substantially the same, yielded a fuel much preferable to the other, as in its crude state it was exceedingly friable, and much

of it was light and porous of texture. Efforts in various directions continued to be made to produce a still more perfect and marketable fuel.

The tenacity of peat for the water contained in its composition is remarkable, as has been before stated, and is one of the chief difficulties encountered in reducing it to the desired shape and condition for fuel. To rid it of all or a portion of this water, all manner of mechanical devices have been built and tested, but without avail. Evaporation would accomplish it in time, but the idea prevailed that it could be successfully done by *pressure*, and although repeatedly demonstrated to be impracticable, it has been, and still is, the subject of study and frequent invention.

Without attempting to enumerate or describe the various methods devised, presses built, and tests and experiments made, in a long series of years, to accom-

plish this, the following, abridged from the report of the Ontario Bureau of Mines, Bulletin 5, for 1903, may suffice as illustrative of all: —

"Countless attempts have been made to expel mechanically the water from crude peat by pressure, filtration, or centrifugal force, all applied in a multitude of ways, — but so far these attempts have invariably ended in failure.

"At the Trent Valley (Canada) Peat Works, hydraulic presses built for the purpose at Syracuse, New York, capable, it is stated, of exerting a pressure of three hundred tons, or two tons per square inch, were employed, the peat being loaded on trucks in layers between perforated trays overlaid with filter cloths, and in this manner submitted to pressure. Nineteen pressings were made in ten hours; the output being 14.42 tons per press."

There were eleven sample lots, and the

result of each sample was given, but may be summarized by the following averages:—

Water contained on entering the press, 77.71 per cent; displaced by pressure, 14.23 per cent; remaining after pressure, 63.48 per cent.

This peat was then "put through a disintegrator and then through a drying machine built by F. D. Cummer & Son of Cleveland, Ohio, a well-known machine containing a long rotary cylinder, many of which are in use for drying materials other than peat. Its evaporative power proved to be six thousand pounds of water per hour, and the output of dried peat three tons per hour. Eleven samples, averaging 63.48 per cent of water before entering the dryer, contained, on leaving it, 23.41 per cent, showing a reduction of 40.07 per cent. The temperature was 965° to 980° F."

"The most momentous experiments on

this line were carried on for a number of years at Düsseldorf, Germany, with a patent hydraulic filter press. Unlimited capital was available, and the expenditures amounted to about $100,000. Every idea which appeared feasible received a thorough trial, so that, if at all possible, the aim of the process might be accomplished; but all in vain. The attempt has recently been abandoned as impracticable. It was contended that this press would bring the peat down to contain about fifty per cent of water, but it proved difficult to reduce the water even to sixty-six per cent."

The result of every one of the multitude of experiments and operations in the same line during the last fifty years in this country and in Europe has been of like character as in the two cases here narrated.

In like manner the impression has seemed to prevail during all these years

that peat could best be solidified and put in shape for marketable fuel by *pressure*, and the aim has been so to handle and treat it that it should come from the machine a finished dry article.

In order to do this the crude peat must be dried before being submitted to the press. This is ordinarily accomplished by harrowing and raking the surface of the bog (after first removing the undecomposed vegetation overlying the peat) and thus exposing a thin layer of peat to the action of the wind and sun, reducing, by this means, the amount of moisture to perhaps forty or fifty per cent, after which it is submitted to the dryer, where it is claimed that it can be still further reduced to about ten to fifteen per cent of moisture; and in this condition it is submitted to the press.

Peats differ in composition, quality, and fitness for manufactured fuel as much as do

woods. Pure moss peats are invariably good, but from light and inferior qualities a fairly good fuel may be produced.

Of presses, an infinite variety of all shapes and kinds have been built, both in Europe and in this country, from early days to the present time, notably during the last fifty years, for the purpose of solidifying peat and producing the long-sought fuel in its perfection; but without avail.

The earliest presses of which we have record were very simple in construction, and although powerful, failed of the successful results desired and anticipated. Obstacles and hindrances were encountered and as often sought to be met by changes and improvements in machinery, until at present peat presses of splendid workmanship, marvellous power, and perfection in every detail are built and operated in this country, and are producing in briquette form, in moderate quantity, what appears

to be a very handsome article of fuel, but lacking still the element desired and anticipated by their projectors, which would entitle it to be pronounced a perfect success; and this, simply because the character and peculiarities of the material do not seem to be understood, and the general principles of its treatment have not been adapted to produce the result desired, and therefore cannot by any possibility succeed. Not one of these machines or methods of pressure has proved other than partially practically and economically successful. The failures in Europe appear to be chargeable to the same causes as in this country, and in both, large, and in some cases very large, sums of money have been expended.

The most notable success in producing peat fuel by pressure in this country has doubtless been in Canada, where the "fuel question" may be said to be of even more importance as regards the uncertainty of

supply than with us of the States. The possibility and desirability of utilizing their deposits of peat, which are numerous and extensive, and are understood to be generally of good quality, has for many years engaged the attention of enterprising men of means and of mechanical ability, whose persistent and long-continued efforts have been the subject of government investigation and encouragement, as indicated by official reports during the last twelve years relating to peat fuel, its manufacture and use.

As early as 1891 the Canadian government reports contained a pretty full review of the doings and progress of the peat industry in both Europe and America, including Canada. The reports of subsequent years have furnished much additional information; a recent Bulletin of the Bureau of Mines, Ontario, presents "a summary of the existing conditions of the peat-fuel

manufacture in Ontario, and the prospect which it holds out of affording relief from a well-nigh intolerable situation." It treats of "the value and use of peat and the processes employed for the manufacturing it for that purpose; this being the aspect of the subject which confers upon it pressing, if not vital, importance."

The processes and machinery in use in Canada and the results there obtained may therefore be taken as illustrative of the progress attained in the enterprise in this country so far as pressing is concerned; for the Canadian methods and machinery have apparently found favor in the States with some who are ready and anxious to try to produce the fuel by this means.

It is not claimed that all the difficulties have been surmounted, but a good fuel has been produced in considerable quantities.

The machinery and processes in use in Europe differ somewhat from those in use

in this country, but involve the use of severe pressure for solidifying and briquetting the material. The London *Mechanic's Magazine*, in an article of some length on the use of peat fuel, says, "Mere *compression* of peat is not sufficient to insure its economical use; it requires *condensation*, which quality cannot be imparted to it by the most powerful pressure."

Notwithstanding the number and variety of presses built in this country and the amount of money expended, it may be remarked that really there has been no actual advance gained for many years. Machines for compressing peat, similar to those now in use in various places, were constructed and operated as much as thirty-five or forty years ago; but while numerous improvements in the mechanism and manner of operation have been made, the principle involved being erroneous, the result desired has not been and cannot be

attained. The plastic and adhesive properties of the material, necessary to produce a compact and enduring mass, are not only not developed, but are actually destroyed, and the particles composing the block of fuel are held together only by force of compact or pressure, the effect of which yields alike to fire and water. Fire disintegrates it, and water dissolves it. Handling and transportation tend to crumble it. The power required is enormous, the cost of plant is very large, and the product, though not without merit for some purposes, is seriously lacking in some qualities essential to a perfect fuel.

That the peat must be rid of its water, and dry at some time, is evident. It cannot be successfully and perfectly done before being blocked; it can be done after blocking. The difference in time required for this, take the season through, is in favor of drying after blocking.

The peat as prepared for the briquetting press, although called dry, is said to contain, ordinarily, from ten to fifteen per cent of moisture. The briquettes, as they come from the press, are in good form, solid and hard, burn freely, affording a pleasant fire and intense heat. In handling and transporting they are liable to crumble from the corners and edges, but the material is clean, emitting no noxious gas and possessing nothing of the character of crock or soot. They require only a light draft, and should not be poked or disturbed, as they are liable to disintegrate and fall to pieces.

As the material when placed under pressure contains some moisture, as above, it is readily seen that as that moisture evaporates, whether by the slow process of exposure to the atmosphere or the more sudden and rapid heat of combustion, which expands the moisture, it must result

in disintegration as above, there being no cohesion of the particles forming a block except by force of compact.

Professor Johnson remarks concerning the dry-pressing process: "Its disadvantages are that it requires a large outlay of capital and great expenditure of mechanical force. Its product is, moreover, not adapted for coking. When wet, the surface of the cake swells up and exfoliates as far as the water has penetrated. In the fire a similar breaking away of the surface takes place, and when coked the coal is but moderately coherent."

Mr. James Lang, a well-known mechanical engineer, who was sent by capitalists to Toronto to report upon the manufacture of peat fuel, says: "During the summer of this year (1902) I had occasion to visit the peat factories at Beaverton and Welland for the purpose of investigating the process and reporting on the

cost of manufacturing peat fuel. I entered upon the investigation with grave misgivings as to the practicability of manufacturing upon a paying basis, but the successful working of the Beaverton plant was a revelation to me. The new machinery designed and introduced by Mr. Dobson, of that town, has revolutionized the industry and made it possible to place peat fuel upon the Canadian market at a price which will compete successfully with coal. There is, undoubtedly, a great future for peat fuel in this country, and I have no doubt we are on the eve of an immense development of the industry."

Of one of the presses now in use in Ontario, the government report remarks: "One difficulty in operating this style of press satisfactorily has proven to be the excessive consumption of power, . . . eight tons per square inch. . . . The end of this

severe duty is usually a broken die or a ripped or cracked gear wheel."

Of another, apparently the one now most in favor and in use, the same report says: "One of these presses worked successfully during the summer of 1901, and, with some important improvements, during the summer of 1902, making about 600 tons of briquettes each season. Friction is almost entirely eliminated. . . . It is estimated that the total pressure exerted . . . amounts to $12\frac{1}{2}$ tons per square inch."

Our consul at Toronto, under date of Oct. 31, 1902, writes: "A word of caution to intending operators may be timely. I notice many references in the public press in regard to the formation of companies proposing to utilize peat beds. Fully $400,000 has, in the course of seven or eight years, been practically wasted in Canada in futile attempts in this line."

These statements, publicly made, are illustrative of numerous others of like character, and may be considered as sufficient to "afford food for thought." Opinions may differ, but facts do not admit of dispute.

It would seem that the enterprise, patience, perseverance, and pluck so plainly and persistently manifested for a series of years, in this matter, were entitled to a much greater measure of success in the production of this fuel than these statements and reports would seem to indicate, to say nothing of the pecuniary reward which such efforts might justly anticipate; but it proves to be a singular illustration of adherence to an erroneous idea and persistent efforts to do what can't be done, and to accomplish what has long ago and repeatedly been demonstrated to be impossible; and it is still more singular and astonishing that there are to-day those

who are embarking in fuel enterprises on the same line of operation, with the hope and expectation of accomplishing an impossibility.

Large sums of money have also been extravagantly expended or wasted in the States. A single instance, as illustrative, may suffice. The Hudson River Peat Co., many years ago, having evidently contracted "peat fever," capitalized at $800,000, and, proposing to do a big thing, secured an extensive bog nearly opposite Poughkeepsie, preparatory to making peat fuel by pressure. The working drawings for their machinery covered more than 500 sheets of large drawing-paper. The weight of metal was upwards of 200 tons. A single one of several large castings weighed nine tons, and was hauled by eight yoke of oxen. I visited the place while preparations were in progress. The peat was there, "a rich, abundant store,"

— and is presumed to remain there still, for I have never learned of any fuel being made there or of the result of the enterprise.

The manufacture of briquetted fuel, or "patent fuel," as it is called, has been carried on in different parts of Europe for some fifty years or more, and in some places has developed into an extensive and prosperous business. The material used is mostly coal dust, refuse coal and coke, lignites, etc., with the addition of a percentage of some adhesive matter, such as pitch, tar, asphalt, petroleum, naphtha refuse, and other resinous substances, as a binder, which are mixed with the material in a heated condition; the mass is submitted to powerful pressure, and turned out in blocks of any desired shape and size. I have seen "peat briquettes" from Germany of apparently firm and solid texture, superior to anything produced in this country, but am not informed of their com-

position, method of manufacture, or value for fuel.

Condensed peat fuel differs essentially from the *pressed* article already described and commented upon. The process of manufacture is exceedingly simple, rapid, and successful. The plant required for its production is comparatively inexpensive; the expense of manufacture is small, and the fuel produced is superior in many respects to that produced by any other process.

The crude material is excavated and brought from the bog in any convenient manner. The treatment is such that the original organization of the peat is destroyed; the air, of which a large amount is contained in its cells, is ejected; its plastic and adhesive properties are developed; advantage is taken of some of the peculiar natural qualities of the material, and it is then in condition to be blocked or moulded into any form desired, which may be ac-

complished in a variety of simple ways. It is then exposed in the open air for drying, or artificial means may be used to expedite this. I have made good steam fuel in four or five days' exposure in the open air; but, like wood, it improves with age. These blocks when broken may have the variety in size and shape that we are accustomed to find in coal. The fracture has much the appearance of a mineral fracture. It cannot be dissolved or reduced to its original consistency.

The product is a solid, hard fuel which burns freely with a light draft, consumes entirely from surface to centre, leaving a residuum of light ash, but no clinker or cinders, does not disintegrate, is as impervious to water as brick, emits very little smoke and no offensive gases, is readily carbonized, producing a strong coke of superior quality for domestic, steam, and metallurgical purposes.

PEAT COKE

Not only may we utilize peat in its natural condition and in its manufactured and solidified state, but we may carbonize it as we do wood and coal, and produce *peat coke;* and it is to this fuel and the proper production of it that I desire to call *special* attention because of its superior excellence for all ordinary purposes and for the more severe processes required in the arts.

Coked peat is said to have been used in the Freyburg smelting works about the year 1360, and mention is made of its use for like purposes in England in the early part of the seventeenth century.

Dr. King, an Irish writer, in 1685, says of peat: "It is accounted a tolerably sweet fire; we could hardly live without some

bogs. When it is *charred* [coked] it serves to work iron, and even to make it in a bloomery. Peat *charred* I reckon the sweetest and wholesomest fire that can be; fitter for a chamber or for consumptive people than either wood or stone coal or charcoal."

A variety of methods for coking or carbonizing peat have been adopted, differing somewhat in various localities and with differing results. A limited quantity of peat coke was at one time produced and used in Germany and Austria. I have seen descriptions of the manner in which it has been attempted in England, Ireland, France, Bohemia, Bavaria, Saxony, Russia, Friesland, and elsewhere, the general principles being the same, but differing in the manner of application. I do not learn, however, that the success in any of these countries has been such as to encourage its production in large quantities. The amount pro-

duced has been small, owing, perhaps, to lack of perfected methods. Notwithstanding the numerous, long-continued, and persistent efforts, they appear to have failed of the success required for a merchantable article, until finally there was remaining in all Europe only one establishment which could produce any.

Within the last three years, however, renewed attempts to coke peat fuel have been made in several places. We hear of them in Norway and Russia, and the statement is made that "the success realized is such as to warrant the erection of additional works." Of the process used I am not informed.

On the other hand, a recent report (March 13, 1903) from our Consul General at Christiania says that "for the purpose of studying the methods practised in other countries, the machinery employed, cost of production, etc., the government, in 1901, sent an agent

to Sweden, Denmark, Germany, the Netherlands, Austria, and Russia;" and "after extensive experiments, experts have come to the conclusion that plants for the carbonization of peat, where it is transformed into coke or coal, must be looked upon as failures."

Until recently I have never known of any peat coke being produced in this country; but during the past three years, persistent and well-directed efforts have been conducted for the purpose of determining upon a practical method of producing the much-desired fuel at a cost and of a quality which should render it practicable to introduce it as a merchantable article, available for those purposes for which it is known to possess superior merit. The result has been a perfected process by which coke is produced from *condensed* peat which is far superior to the best wood charcoal, fully equal, and by some declared to be

superior, to the best coke made from coal of any kind.

The process is exceedingly simple and inexpensive and the product speaks for itself. Its calorific power is *intense.*

The crude peat as taken from the bog is *condensed* and solidified by what is known as the Leavitt process; the coking or carbonizing is accomplished by the more recently discovered Rockwell process: the former is not patented, but is free to all; the coking process is covered by patents. The gases generated from the peat in the process of coking are used for heating the ovens and are amply sufficient for that purpose.

The quantity of coke obtainable from a good quality of condensed peat may average about forty per cent of its weight.

The high heating power of peat and peat coke and its absolute freedom from sulphur

(or, at most, only a trace), and the properties deleterious to metals must commend it to all and must invest it with peculiar interest to the smelter and those who follow after him as manufacturers of metals which he produces.

In converting peat into coke, practically the same range of *by-products* may be obtained from the ovens as in the coking of coal; and, properly managed, the working expenses of producing coke from good peat may be covered by the value of these products.

From an article on "Coke as a Fuel," by G. L. Fowler, in *The Engineer* of April, 1903, we quote: "The temperature to be obtained by the combustion of coke is considerably in excess of that possible with any of the grades of coal. With a forced draft, such, for example, as that existing in a fire-box of a locomotive, a temperature of 4700° F. can be obtained. The corre-

sponding maximum temperatures for high-grade bituminous coal, such as Pocahontas and Anthracite, are about 4000° and 4500° respectively.

"Considered as a fuel for locomotive or stationary work, coke, within its limitations, may be regarded as almost ideal. It is clean, easily handled, burns freely and without smoke, is capable of furnishing an intense heat upon demand, has a low percentage of ash, and has no deleterious effect upon the boiler or furnace. Its use is merely a matter of price and supply, and where these two can compete with coal, there coke will find its field of usefulness and application."

Professor Johnson, in his valuable essay on "Peat and its Uses," says: "When peat is *charred*, it yields a coke which, being richer in carbon, is capable of giving a more intense heat than peat itself, in the same way that charcoal emits a more in-

tense heat in its combustion than the wood from which it is made.

"Peat coke has been and is employed, to some extent, in metallurgical processes, as a substitute for charcoal, and, when properly prepared from good peat, is in no way inferior to the latter; is, in fact, better.

"Peat condensed by *pressure* yields, by coking or charring, a friable coal, comparatively unsuited for heating purposes.

"A peat which is dense, as the result of proper mechanical treatment (*condensing*), yields a very homogeneous and compact coke, superior to any wood charcoal, the best qualities weighing nearly twice as much per bushel.

"I have carbonized, in an iron retort, specimens of peat prepared by Elsberg's, Leavitt's, and Ashcroft and Betteley's processes. Elsberg's gave 35, the others 37 per cent of coke. That from Elsberg's peat was greatly fissured and could be crushed

in the fingers to small fragments; that from the other peats was more firm and required considerable exertion to break it; all had a decidedly metallic brilliancy of surface."

INTENSITY OF HEAT GENERATED BY PEAT FUEL

It is a fact, acknowledged by all who have had practical experience in the matter, that peat produces an *intense* heat, a feature of so much importance as to entitle it to prominent mention and careful consideration. Its virtue in this respect is much increased when prepared, solidified, and dried, and it reaches its maximum of heating power when, in this condition, it is charred or *coked.*

In an interesting and elaborate article in the *American Railway Times* on "The Calorific Value of Fuel," the remark is made that "coal cannot produce a temperature equal to that obtained from coke. Twenty tons of coal will not give a temperature

so great as that afforded by one ton of coke."

The intense heat generated by *peat fuel*, and especially by *peat coke*, has been the subject of frequent remark, and is an important consideration in estimating its value.

PEAT FUEL FOR DOMESTIC PURPOSES

The ready and voluntary testimony of numerous parties who, during a series of years, have used peat fuel for heating, cooking, and the usual variety of household purposes, has been that it was the best fuel they had ever used; and those who more recently have used peat coke, of which I have before made special mention, are no less positive in the oft-repeated assertion that it is the "*very* best" fuel they have ever used.

It is easily kindled, burns freely, and gives a quick and intense heat. If covered with ashes, it will keep for a long time and can be rekindled at pleasure. For baking, boiling, and broiling, it is excellent; and for heating irons on ironing days there is no fuel equal to it. It is much cleaner than

coal, more pleasant to handle, and easily managed for all purposes.

It is an established fact that for the sick-chamber there is no fuel which yields such mild and grateful heat as peat. For consumptives and persons with delicate lungs, it is especially desirable, as it produces none of the painful effects of wood smoke or coal gas. If burned in a soapstone stove, it will afford the maximum of comfort to the most sensitive invalid. Within the circle of my own acquaintance are those who have borne repeated testimony, not only to the mild and soothing effect of this fuel, but to the absolute relief afforded in cases of lung difficulties.

It should be borne in mind distinctly, that with peat fuel, its value of service depends fully as much upon the manner in which it is used, and the methods and appliances for using it, as upon the peculiar qualities and characteristics of the fuel

itself. For open grates, ranges, and furnaces, the fire-pot or receptacle for the fuel should be smaller in area and of less depth than is ordinarily provided for coal. A smaller quantity is required for a charge, but renewed somewhat more frequently than coal, and should be burned with very much less draft; indeed, as soon as the fuel is once well ignited, it will frequently be found desirable to reduce, or almost close, the draft. It makes no soot and leaves no clinker, but only a soft, light ash.

PEAT AS A FUEL FOR GENERATING STEAM

PEAT as a fuel for generating steam has been repeatedly shown to be of great value. As yet, the production of it in this country (although numerous small plants have been operated for the production of it) has not been sufficient to insure a constant and steady supply, such as would warrant a manufacturing establishment, railroad, or steamship company in adopting it.

Its superior fitness and great value for all these purposes has been repeatedly and abundantly demonstrated, as is freely testified to by numerous practical men who would gladly avail themselves of it if a regular and sufficient supply was available. From the testimony of a few of these I quote: "The heating power of *condensed*

peat has been proved to be superior to that of coal; and it is well adapted to steam-engines, stationary, locomotive, or marine. It saves half the time of getting up steam, and will do double duty as compared with coal. The absence of smoke and clinkers, and the preservation of grate and fire-boxes from the effects of sulphur, are important additional advantages."—"The fuel, having no smoke and much gas, keeps up a constant flame; in fact, while using it, the generation of steam was so rapid that I stood with my hand on the valve lever all the time, fearing an explosion."

I have learned of trials of peat fuel on the Boston and Albany; New York, New Haven, and Hartford; Hudson River; Connecticut River; Central Vermont; Grand Trunk; New York Central; and other railroads—each of them with uniformly successful and pleasing results.

Some of its advantages for steam are

plainly discernible, and may be briefly stated as follows: It ignites readily and burns freely, generally with a large volume of flame. Combustion appears to be almost perfect, with very clear and intense heat, producing no cinders, no sparks, no soot, very little smoke, and no clinker; the consequence of which is that under a boiler steam is generated much more quickly than by coal, the flues and tubes of the boiler are kept free from soot, clean, and bright, and therefore in better condition to make the heat available, and the grate bars are not burned out and injured as with coal; while on the score of comfort to travellers it may be said that annoyance and actual suffering occasioned by cinders, sparks, and smoke, which, in spite of the numerous devices for consuming them, we are now constantly subjected to, are, by the use of this fuel, entirely obviated.

An oil refinery at East Boston, requiring

for its process superheated steam to a degree and extent which it was found extremely difficult to obtain with wood or coal of any kind (and under the most favorable circumstances necessitating two furnaces, one for generating and the other for superheating), made a faithful trial of *condensed* peat, in order to determine the intensity of heat generated by it. The fuel, which was from the Leavitt works at Lexington, Massachusetts, proved to be satisfactory. Steam was not only generated, but superheated to the full extent and temperature required; and it was satisfactorily demonstrated that with this fuel the whole service demanded might be had from one furnace instead of two — an item of no light importance.

A trial of the same *condensed* fuel was made at the Lowell Bleachery under their boilers (engine 500 horse-power), of which I have only verbal, but *reliable*, report. It

made more steam than coal and accomplished with ease the severest service required at the works. The superintendent said he considered it a perfect success, and that all now required was to adapt the fire-boxes for it and learn to use it.

My own personal experience during six years, while operating peat works at Lexington, Massachusetts, was confirmatory of all these statements. During four years I ran a 14 horse-power tubular boiler; (the fire-box, fitted for coal, was originally 32 × 42 inches, with grate bars $\frac{3}{4}$ of an inch apart and 15 inches below the boiler) I burned nothing but condensed peat of my own manufacture, and, finding that the heat generated was far in excess of what was required, the area of the grate was gradually reduced, by laying fire-bricks at the sides and rear end, to 16 × 36 inches — *less than one-half the original area.* The fuel was never more than six inches deep on the grate,

generally less; the amount of gas generated produced a constant flame which filled the entire space under the boiler, showing that if a larger quantity was used, it would probably generate an amount of gas in excess of what could be consumed, and must therefore be wasted. It burned with a very light draft, gave quick and intense heat, and at the close of the fourth year the grate bars were entirely uninjured and as good as when new.

At that time I had not learned to coke the fuel, but since doing so, have seen the *peat coke* used with results far in excess of what I have narrated above of my own experience.

The same general principles apply to locomotive service. The fuel area should be smaller and the exhaust considerably less powerful. It can be banked and quickly started again.

As long ago as 1866 Genery Twitchel,

then president of the Boston and Worcester Railroad (well known then, and doubtless remembered by some now, as one of the shrewdest of managers), after investigating my works at Lexington, was free to say that he believed the time was very near when the road would "dispense with coal because we have peat enough right on the side of the road to keep it running an almost inconceivable length of time."

PEAT IN THE MANUFACTURE OF IRON AND STEEL

Concerning the use of peat fuel for the smelting of ores and the manufacture of iron and other metals, I have had no personal experience and very little opportunity for personal observation, and must therefore confine myself to the selection of a few out of the multitude of well-authenticated facts and opinions furnished by practical men, that have come to my notice; all of which, without exception, agree in commending peat as an excellent, and in most cases as a superior, fuel, not only for the purposes above mentioned, but for welding, annealing, softening steel plates, etc., contending that "good peat is

preferable to any other fuel." — "Peat and peat charcoal are better than wood charcoal." — "Peat coke is of still greater value than the best charcoal, and in the manufacture of iron it stands unrivalled." — "The working of iron by peat is known to improve its quality, and the welds, especially, are superior to those made with coal." — "After peat has been well carbonized [coked] it may be employed in puddling and reverberating furnaces and forges." — "Peat has been found preferable to all other fuel for case-hardening iron and tempering steel, forging horseshoes, and welding gun-barrels." — "Iron made with peat charcoal will not splinter." — "For giving toughness to the metal and uniformity of chill, qualities so essential to car-wheels, peat fuel is unsurpassed." — "In the manufacture of iron, peat fuel will, in all probability, come first into exclusive use, owing to its great superiority over coal in

every stage of iron and steel manufacture."

Peat-made iron is recommended for gun-barrels, horseshoes, and horseshoe nails.

A writer on fuels says: "Peat coke possesses a high heating power, suited to puddling-furnaces where the very finest grade of iron is made, as well as in all works of steel. Iron made by peat fuel is tougher than any other; it would be of the highest value as a war material. Peat-iron guns, if burst, would not fly about in fragments, nor would iron armor break and splinter by concussion."

Another writer says: "The use of peat gas for fuel is of long standing in the iron and steel industry of Sweden. It is used in the plate furnaces with excellent results. It has contributed largely to improving the quality of Swedish steel, the excellence of which is well known."

These quotations are probably sufficient

to illustrate the qualities and value of peat fuel in the estimation of practical men familiar with the requirements and use of fuel in the important steel and iron industries.

OTHER USES OF PEAT FUEL

It has been successfully used for all domestic and steam purposes, for smelting, reheating, and welding iron, steel, copper, and other metals; for burning brick and lime, for making glass, under salt pans, in breweries and distilleries, and for a multitude of other purposes; and the suggestion is made that it would be admirably adapted for steam fire-engines and for all purposes which require a *quick* fire and *intense* heat. Peat coke is reported to have been used for clarifying sugar.

PEAT FOR GUNPOWDER AND FIREWORKS

For the production of gunpowder some varieties of peat are superior to the charcoal of dogwood and alder. I have seen the black peat of Massachusetts so perfectly prepared and granulated, without any explosive admixture, that it was impossible to distinguish it from the best rifle powder, even by a well-practised eye.

In the manufacture of fireworks, also, it is reported to have been extensively used in Europe, and that with marked success, from the fact that combustion is even more instantaneous and perfect than from the materials ordinarily in use, and the fires produced exceed anything hereto-

fore attained. It has long been used by pyrotechnists in Europe, particularly for colored fires, giving them greater brilliancy than could be effected by any other carbon.

GAS FROM PEAT

The properties of peat for generating gas for illuminating and other purposes have many times been tested both in this country and in Europe, and, so far as reported, with uniformly satisfactory results, but varying considerably, according to the character of the crude material. Its yield is large, and, in most cases, the light produced has been pronounced superior in brilliancy.

The concurrent testimony appears to be that the production of gas from peat is more simple than from coal; that the quantity produced per ton is much larger; that it is purified without difficulty, is quite harmless and inoffensive, and that the illuminating power is far greater than that of gas from coal.

Dr. A. A. Hayes, at one time State Ge-

ologist of Massachusetts, wrote: "There are only two or three cannel coals known which afford so much illuminating material, placing peat in the first class of gas materials. It exceeds all common cannels, and, of course, is far above any bituminous coal, and can be worked with *poor* coal to make *good* gas."

Reports have been made from time to time of numerous experiments in this country and in Europe relating to this matter, and the opinion is freely expressed by those who appear to have given most attention to it, that peat is destined, at no distant day, to be used very extensively for this purpose, both on account of the quality and quantity of the gas produced, and the low cost of the material, when compared with the coals at present most in use.

COST AND MARKET VALUE OF PEAT FUEL

The expense of producing peat fuel is small compared with its value. The cost, as given by those who have manufactured it at different places, by different processes, and under different circumstances, is variously stated to be all the way from one to two dollars per ton. From my own experience during six years I have always considered it *safe* to say that it can ordinarily be produced, in good shape and marketable condition, for *less than two dollars per ton.* It has been sold at various prices, — all the way from three to eight dollars per ton.

I am told by the parties now manufacturing the peat coke, to which I have invited special attention, that the present

cost of that is "less than three dollars per ton"; and that "with improved machinery and equipment, and producing fuel in large quantities, the cost of a ton of peat coke will not exceed two dollars." Their price per ton in large quantities is five dollars, while in small quantities for domestic use it is being retailed at the rate of nine dollars per ton.

It should be understood that intelligent experience, prudence, and good management are essential to success in this as in any other manufacturing business.

THE MARKET FOR PEAT FUEL

In all manufacturing or producing business, the question of *demand* is fully as important as the matter of supply, and among those to whom the subject of *good, cheap fuel* comes for the first time as a matter to be considered, the inquiry is not infrequently made, "Can it be sold?" and a moment's reflection brings prompt reply.

Now every family, every place of business, — be it office, store, or workshop, — every manufacturing establishment, and every railroad in the land, are consumers of fuel; in fact, every man we meet is a purchaser of fuel in some shape, — some on a small scale, but very many on not only a large scale, but in quantities that are simply enormous. Moreover, in some of our heaviest establishments it is the prime

article of necessity, the main stay of the business, the basis of power; without it manufacturing enterprise would be impotent of action, and transportation, another great necessity of all mercantile and commercial transactions, would fail both by land and by sea.

Without attempting further to discuss the matter here, it is sufficient to say that the brief statements here given from reliable authorities, show that peat fuel, properly prepared, is a *good fuel*, superior even in many respects, for many purposes, to either wood or coal. It is also shown with equal clearness that it exists in immense quantities, and can be manufactured and produced at very small cost as compared with either wood or coal. In other words, it is good, cheap fuel.

This being the case, the natural result hardly need be stated, for a *good* article, of common necessity, when offered *low*,

commands a sale; and it is not too much to say that in any region where it is produced the *demand* will, for many years, be likely to *exceed* the supply, which will certainly be considered a healthy condition of things for the producers of the fuel.

Among my correspondents have been quite a number whose demand for this fuel in large quantities is distinctly stated; the fact of its value for the purposes required being now past question, while within the circle of my own personal acquaintance the cases are numerous of heavy concerns who would be purchasers of hundreds or thousands of tons of peat fuel at handsomely paying rates, and still consider it cheap, the moment they could be assured of a steady and constant supply.

CHEMICAL PRODUCTS OF PEAT

The by-products of peat are said to be valuable, varying somewhat in kind and volume, according to the composition of the peat. The manufacturer of peat fuel and peat coke will recover from the coking ovens a considerable quantity of liquor which may be turned over to the chemist for distillation, etc.

I have seen analyses by Professors Silliman, Dana, Johnson, Kane, Sullivan, Sir Humphry Davy, and others, who report tar, oils, paraffine, naphtha, acetic acid, wood alcohol, aniline colors, etc., as the result.

ASHES OF PEAT

The *ashes* of peat are of considerable value and used to good advantage on some soils, and are highly recommended.

Professor Dana says: "Peat ashes abound in carbonate, sulphate, and especially phosphate of lime. They make a very serviceable cement, and are used to some extent for that purpose. They certainly possess a value, and should not be allowed to go to waste."

CONCLUSIONS

An editorial in the *New York Tribune*, some years ago, on the "Importance of the Peat Enterprise," sums up the whole matter as below, and is as true to-day as then: —

"The results of numerous experiments, both practical and scientific, have already proved that American peat, however rudely prepared, will answer all the requirements of a perfect fuel, more economical than wood or coal.

"When solidified, it is equal in value to any other fuel for almost any purpose. Its composition is closely allied to wood and coal, containing carbon, hydrogen, oxygen, and nitrogen, with less waste in burning than the best of coal.

"The political power of any country depends upon the development of home manufactures.

"Everything, therefore, which tends to increase the knowledge of the existence and use of peat, as well as the treatment for improving its quality and heat-producing efficiency, should be ranked as great national blessings.

"The purposes to which peat fuel can be applied are as wide as those of wood and coal. For domestic purposes it is superior to either, except that the peat requires replenishing oftener than a coal fire, and less so than that of wood. It burns in open grates like cannel coal. Its great advantage as a locomotive fuel is that it burns with great freedom, gives *intense* heat, and throws off no cinders.

"The truly philanthropic minds of the present generation should be at once awakened to the introduction of peat fuel as

likely to produce one of the greatest blessings they could bestow upon the poor.

"The subject is even worthy the attention of every legislature, to encourage the development of peat, its manufacture and use."

ANTISEPTIC PROPERTIES OF PEAT

The antiseptic properties of peat are remarkable. The numerous cases, well authenticated, where the bodies of human beings, animals, and other perishable substances have been unearthed from peat bogs after having lain there for many years, afford unquestionable proof of this.

Properly prepared, it is suggested that it would serve an excellent purpose as a packing for meats and other perishable articles in storage or transportation.

PEAT AS A DISINFECTANT AND DEODORIZING AGENT

Dry, pulverized peat is not uncommonly used for these purposes. Every farmer knows its efficiency in these respects, when placed about vaults, drains, and other receptacles of filth.

A somewhat famous "Chemical Deodorizing Powder" which for many years has been extensively sold throughout the country, is simply *peat*, charred, pulverized, and put up in neat packages convenient for sale and use. Although "nothing but peat," I am satisfied from my own experience, and testimony abundant, that it possesses in large measure the properties and virtues claimed for it.

OTHER USES FOR PEAT

Peat has been utilized for various other purposes than fuel, but whether advantageously or not in all cases, I am unable to say. Paper of fair quality for some purposes has been produced from the fibrous portions of peat in France, and is now being produced in Ireland, and I have recently learned of a large plant in Austria, which produces from peat not only a variety of grades of paper, but textures having the appearance of cloths and carpets, and at a very small cost. Experiments on a limited scale in this country have demonstrated the practicability of producing good paper from some kinds of peat fibre.

Peat has been manufactured in such manner as to serve for building, ornamental, and

other purposes, as a *substitute for terra cotta and papier-mâché.*

It is said that the solid bitumen from the distillation of some peats may be advantageously employed like asphalt in the preparation of material for *paving.*

It has also been stated, on what appears to be good authority, that the amount of resinous and vegetable matter in some peats is such as to render them apparently available for tanning purposes.

PEAT AS A FERTILIZER

"PEAT is highly concentrated vegetable food." As a fertilizer it possesses a value far beyond what is generally accorded it. Much of it is composted and used in its gross form, but it is quite possible to mix with it ammoniacal and other ingredients, grind and prepare it in the form of a poudrette, and place it on the market as a commercial article for fertilizing purposes.

In past years I have manufactured it in considerable quantities, using the refuse of a neighboring glue factory and grinding it with the condensed peat fuel. The product was a fine granulated article having much the color and appearance of ground coffee. It was clean and entirely odorless, but holding all the ammoniacal properties in the best shape for affording nourishment and stimu-

lus to vegetation. It was sold under the name of the "New England Fertilizer," and the united testimony of those who used it was that it was "a superior fertilizer." The cost of production was very small compared with the real value and the price it should command if placed on the market in competition with the more expensive brands on sale.

PEAT-MOSS LITTER

The undecomposed mosses which accumulate and are found on the surface of some peat meadows may be profitably gathered, dried, and utilized for stable bedding, mattresses, etc. Large quantities of it are gathered, dried, and used for these purposes in the old countries, and in recent years considerable quantities have been imported from Germany and sold here to our best stable keepers, horse men, and dairy men. It makes a soft, substantial bedding, and its high disinfecting and deodorizing properties readily absorb all noxious gases and tend to keep the stables free from objectionable odors. It comes in bales of about 250 pounds, and is sold in Boston at two dollars and a half per bale.

MIXED FUELS

A NUMBER of mixed fuels have been produced from time to time in the old country; utilizing, for this purpose, refuse coal, coal dust, and lignite, with pitch, tar, rosin, oil, bitumen, or other adhesive and inflammable material, as a binder; and in some instances peat has been used. The materials are mixed, formed into blocks, generally oval in form, submitted to heavy pressure, and turned out in good shape for handling and use. This is called patent fuel or briquettes. Large quantities have in recent years been used in European countries with much favor, and the demand for them is steadily increasing.

I have manufactured a considerable quantity of the mixture of condensed peat

and coal dust, producing an excellent fuel at moderate cost. Two tests only were made of it for steam service — both on the Boston and Albany Railroad on regular trips from Chester to Washington, 12 miles (up the Hoosac Mountain), well known to be the most difficult portion of the whole line, having several short and some double curves, with a grade of 83 feet to the mile for a part of the distance, a total rise of 950 feet, and requiring the most severe steam service from locomotives. On one of these trips I accompanied the engineer, and was furnished with his detailed statement of the run, indorsed by the fireman. They were astonished and delighted; said it had accomplished what never was done with coal; and that it was the greatest fuel for making steam that they had ever used.

It is, however, doubtful if it would pay to manufacture this fuel for any other

purpose than to realize something from the coal dust. It does not improve the peat, but it affords a means of utilizing the dust.

I have once prepared a fuel of peat saturated with crude oil, which was of course highly inflammable and burned furiously. The peat furnished a wick for the oil while that lasted, and was then consumed on its own merits.

There are parties in this country who propose (and have patented some three years ago) a mixed fuel of peat with percentages of crude oil, bitumen, lime, and perhaps other ingredients; but I do not understand that they have yet any works in operation.

The Tide Water Coal Co., of Portsmouth, Rhode Island, and the International Coal Co., of Rutland, Vermont, produce coal-dust briquettes; the former with coal tar as a binder, and the latter using hydraulic cement; and doubtless there are others.

CAUTION AND ENCOURAGEMENT

The manufacture of peat fuel as now successfully accomplished *inaugurates an entirely new industry* which will command capital and require labor.

The raw material is lavishly abundant, widespread, and easily available, and the demand for the product is universal and unlimited.

The cost of production is small compared with its real value; and the price which it commands in the market yields a percentage of profit such as is realized in few other enterprises; affording, nevertheless, a superior quality at a low price, making it indeed a *good, cheap fuel.*

Pioneers in the peat-fuel business in any section of the country, though they may

reasonably expect to share to some extent the difficulties of inaugurating a new enterprise, will, with ordinary good management, prudence, and perseverance, be sure to find, without effort, ready and constantly increasing demand for their product, and realize large and legitimate reward.

Most of the new enterprises of the age are understood to demand, and require for their development and success, very large preliminary outlays of money. Not so with peat; the outlay required is comparatively small, while the returns are quick and sure, for "everybody" is a ready customer for *good* "cheap fuel."

The men who have been, and still are, ready to *sink* large sums in oil wells and gold mines at a distance are apparently slow to observe the wealth that lies plainly before them at home, in the *peat mines* which multitudes pass every day. The next generation will probably wonder that

this generation of enterprising men is so blind.

Intending operators in this field would do well to secure all the information possible from those who have been practically familiar with the manufacture and use of this fuel, whether they have been successful or not. Valuable information has many times been obtained by failure as well as by success, and it is not infrequently the case that a little diligent inquiry from those who have ploughed and searched the same field before, and learned to their cost just "how not to do it," would have, at least, saved some useless expenditure of time and money, and might possibly have hastened the day of success.

On one point I cannot better give expression to my own ideas than to quote from a correspondent, who writes: "If the peat manufacture succeeds in this country, of which there is scarcely a doubt, it will not

be through the agency of monster monopolies, which buy up all the swamps obtainable, with all the paraphernalia of joint stock companies, but by individual effort, or the union of a few individuals who will conduct the manufacture of it in the same manner as any other legitimate business. In that way the business will succeed, and will develop an almost inconceivable amount of riches which are now buried and unavailable."

WHAT SHALL WE DO ABOUT IT?

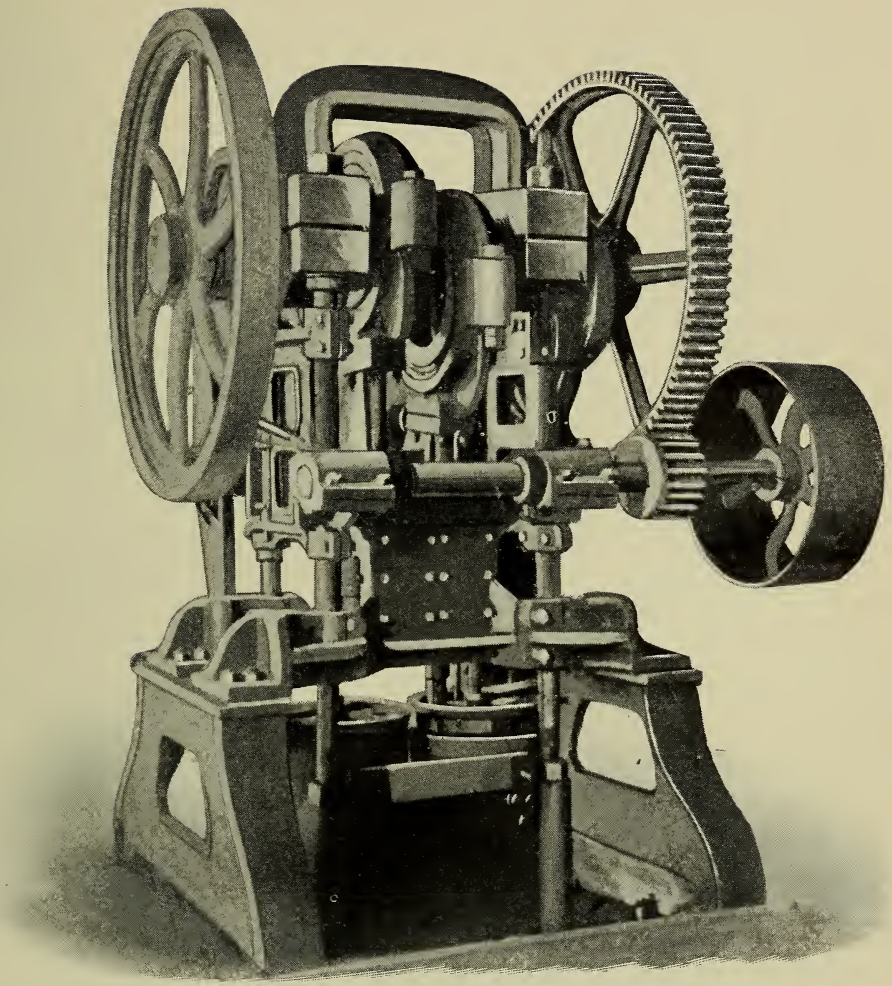
If, then, we have at our own doors, and in great abundance, an article of fuel available at small cost, which is equal in value and superior in quality to that which we bring from a distance, and upon which we are now, and for many years have been, mainly dependent, is it not plainly apparent that it affords opportunity for the creation of *an entirely new, productive, and profitable industry*, employing capital and labor on a very large scale and utilizing resources now lying dormant, the importance of which is beyond estimate?

A PEAT BOG.

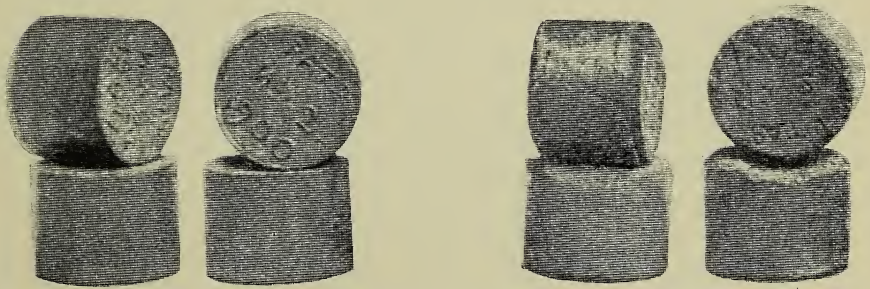
A SLANE OF THE OLDEN TIME, ABOUT 1760.

A MODERN SLANE.

(MADE BY O. AMES & SONS, NO. EASTON, MASS.)

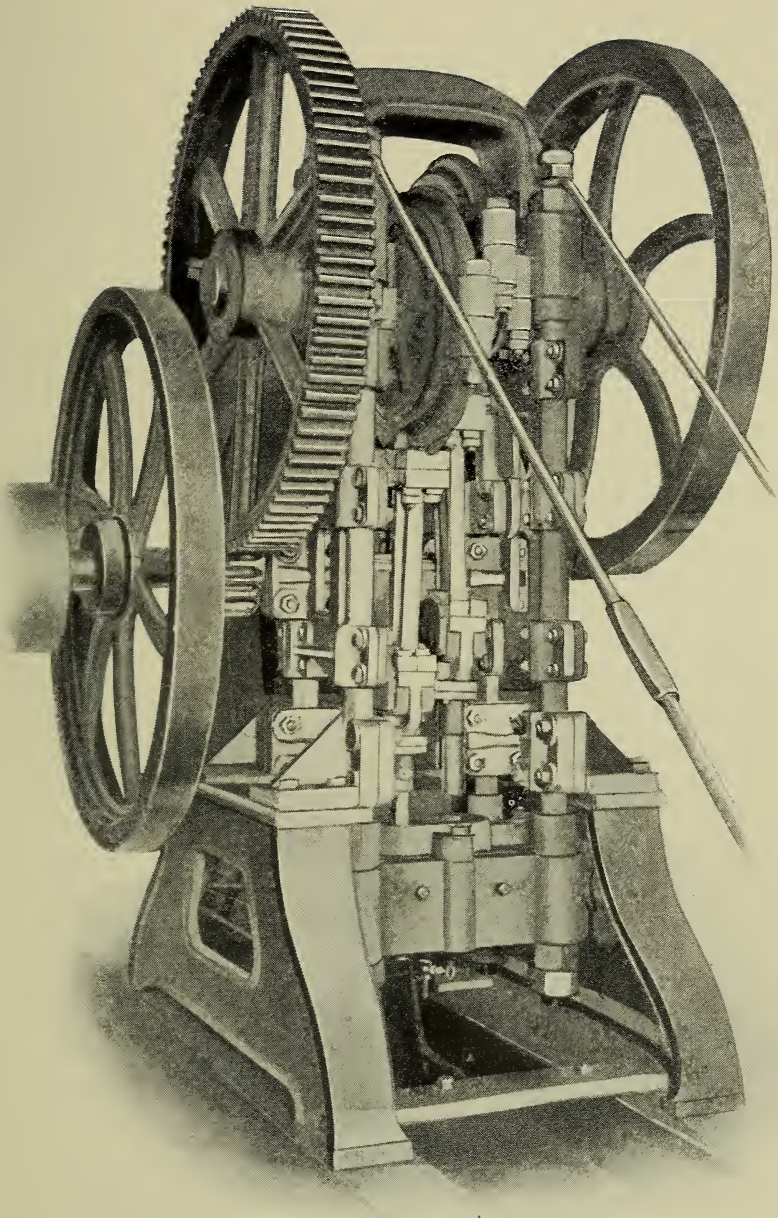


DOBSON'S PEAT PRESS.



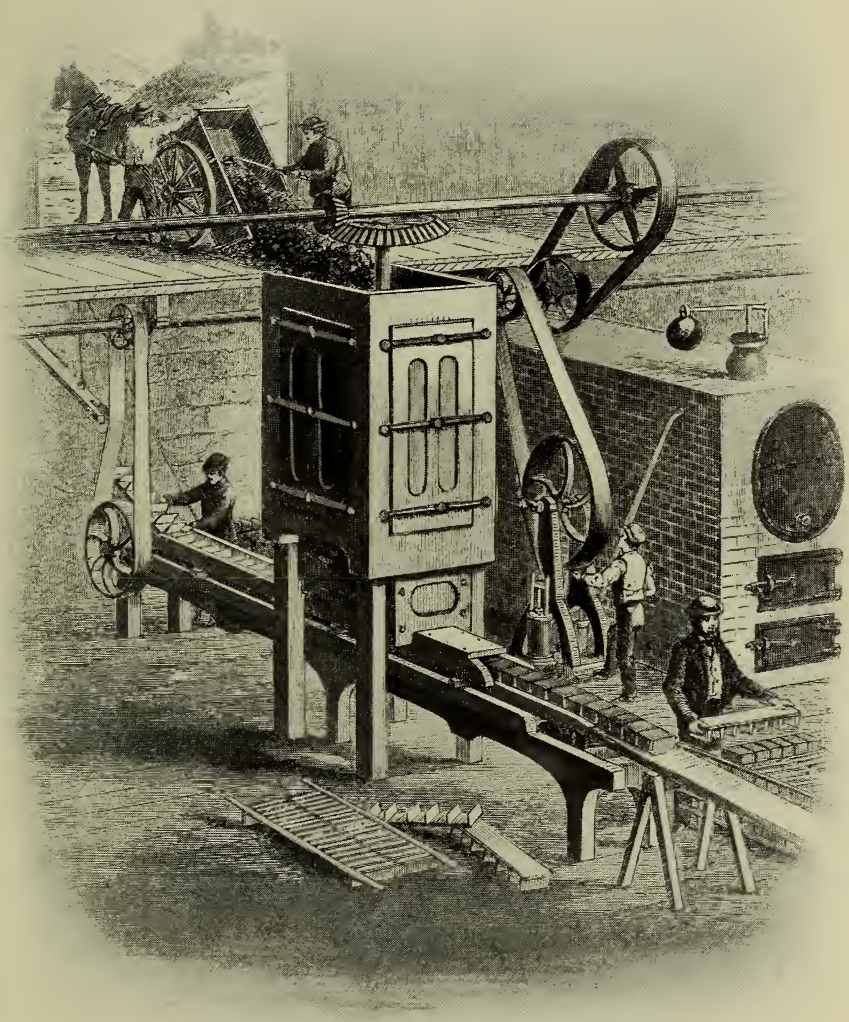
DOBSON PEAT BRIQUETTES.

FRESH FROM THE PRESS. AFTER TRANSPORTATION BY RAIL.



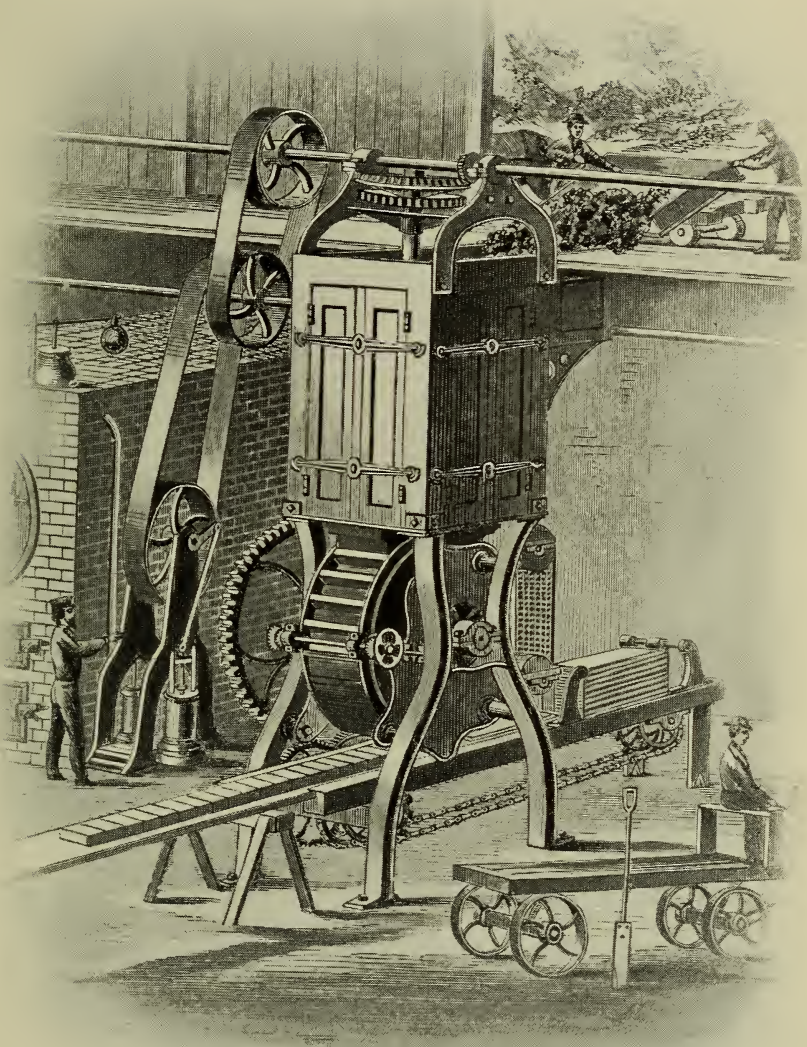
DICKSON'S PEAT PRESS.

LEAVITT'S PEAT WORKS, LEXINGTON, MASS.

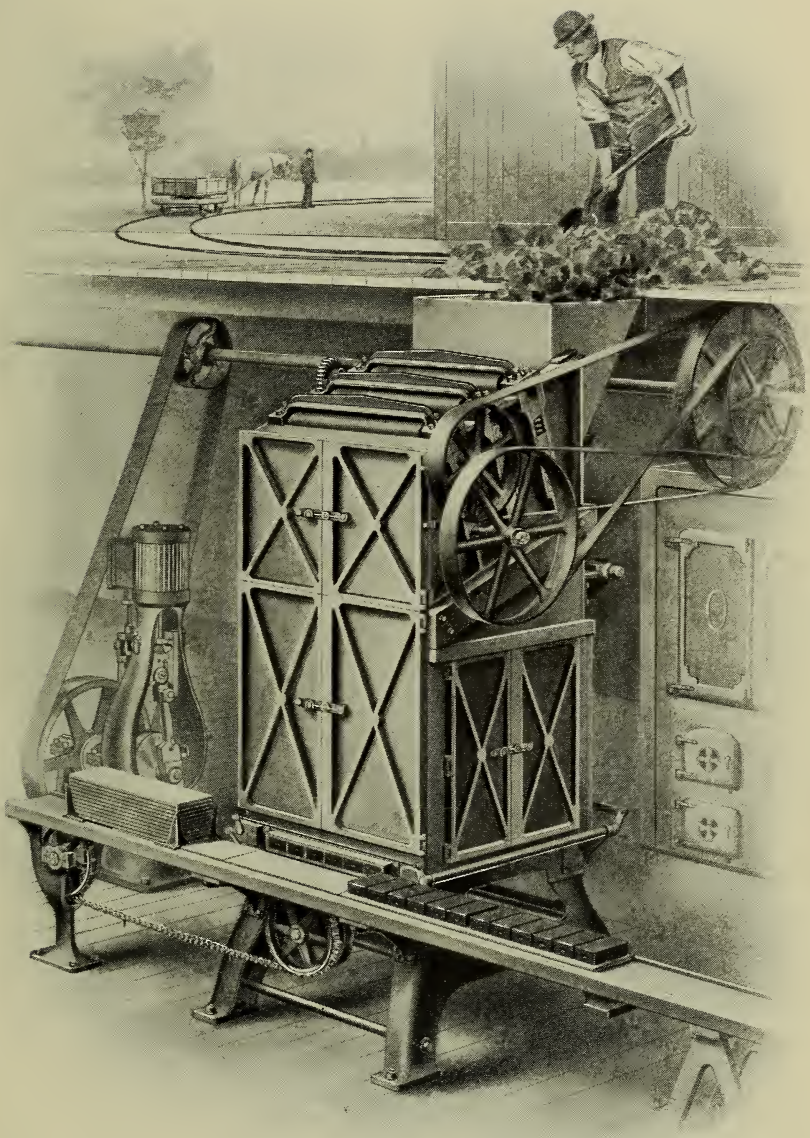


LEAVITT'S PEAT CONDENSING AND MOULDING MILL.

1870.

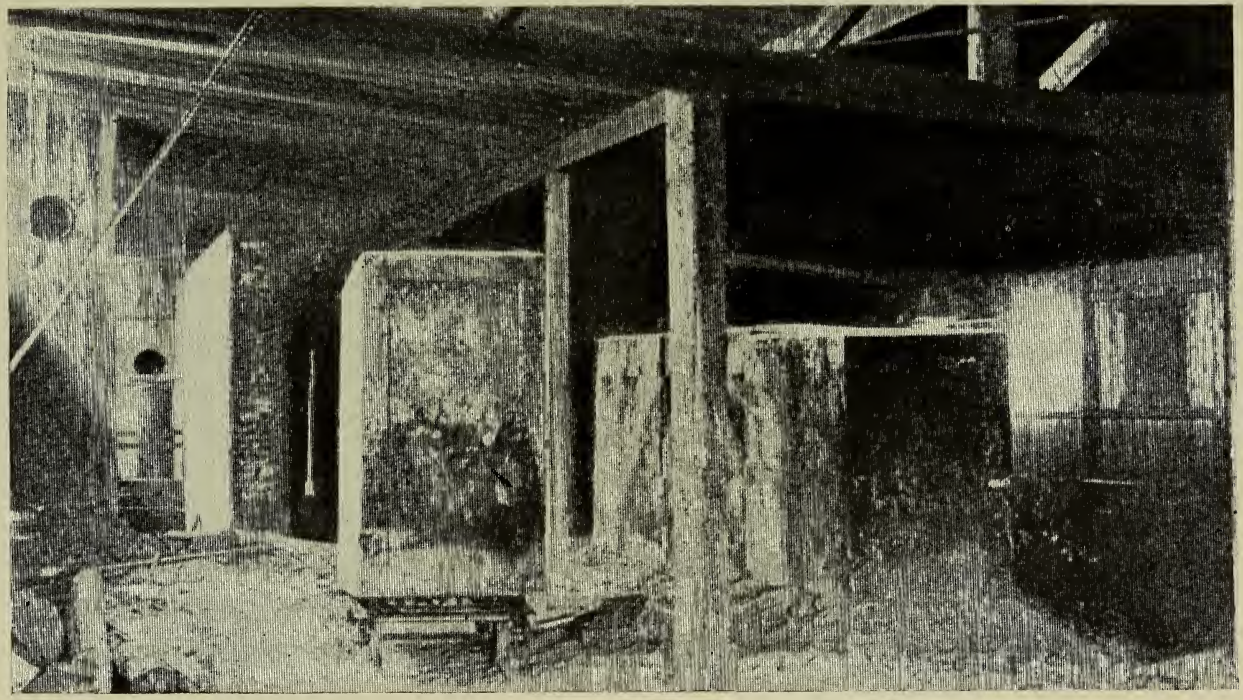


LEAVITT'S PEAT CONDENSING AND MOULDING MILL.
IMPROVED



LEAVITT'S PEAT CONDENSING AND MOULDING MILL.
PERFECTED.

PEAT COKING WORKS.



PEAT COKING OVENS.

PEAT FUEL, BROKEN.

PEAT COKE, BROKEN.

APPENDIX

We have felt a degree of satisfaction, perhaps justifiable pride, because of the exceedingly favorable mention which was made, by the Press and others, of the volume referred to in the Preface; but have experienced a much greater degree of satisfaction in observing the remarks, oftentimes at considerable length, which have been added upon the subject-matter of which it treats, showing a quick appreciation of its importance, and a readiness voluntarily to aid in disseminating information concerning it, which is rarely accorded to any new enterprise.

Some of the following extracts from opinions expressed are of general, others of local interest; but all are worthy of careful perusal, as expressive of disinterested opin-

ions "on the merits of the case." Certain it is, that all, with one accord, bear earnest testimony to the value of peat as an article of fuel.

OPINIONS EXPRESSED

(Referred to in the Preface)

"*Facts about Peat.* It is a thorough production, the author proceeding exhaustively and arranging his abundant matter in a manner that renders the task of following him easy and profitable. He has mastered his subject, and evidently has neglected nothing that is calculated to illustrate it and to press useful facts on the mind of the inquirer. Various, minute, and copious in its facts, and showing how valuable is peat as an article of fuel, this work must have a great effect in directing attention to a neglected agent for the production of heat, one which Providence has placed most freely at the command of man, and which ought to be made to enter very largely into human consumption.

"Mr. Leavitt is literally correct when he says that the substance of which he treats so well 'is of sufficient importance to command earnest attention, not only from the business man, on the score of its application to domestic purposes, manufactures,

and the arts, but from the philanthropist, in view of the relief it may be made to afford as one of the necessaries of life.' Mr. Leavitt's work should be read by all, as it is full of information, and it needs only that the value of peat should be understood to bring it into general use to the great relief of all interests."

— *Boston Traveler.*

"Mr. Leavitt has published more information — historical, scientific, and practical — about peat, we venture to say, than any other man in the country is possessed of. Those who seek to be thoroughly informed should procure it."

— *Brooklyn Union.*

"We consider it a valuable, timely, and interesting work. The whole community are interested in the subject of which it treats."

— *Fall River (Mass.) News.*

"Mr. Leavitt's facts and remarks throw a great amount of light upon the subject, and they ought to have a wide circulation. We have an abundance of peat, and he tells us of its importance as an article of fuel and how to prepare and use it."

— *Pawtucket (R.I.) Gazette.*

"Mr. Leavitt has prepared an exhaustive statement of the history and properties of peat, the

localities of peat beds, the methods of preparation and manufacture, its applicability to the various arts, as well as to the production of heat, and other incidental matters of practical importance."

— *Worcester* (*Mass.*) *Spy.*

"Full of most interesting facts on the subject."

— *Hartford Press.*

"It will be found especially interesting to manufacturers and railroad managers."

— *Hartford Courant.*

"A well-timed and well-executed compilation of important facts. Of all men, farmers should turn their attention to peat, for the preservation of their best forests for more valuable uses than fuel."

— *Vermont Watchman.*

"Giving us all the information upon the subject of peat that the most laborious and extensive research can possibly furnish."

— *Lowell Courier.*

"It contains more historical facts on the formation of peat beds than anything we have heretofore seen."

— *New York Spirit of the Times.*

"Containing 'Facts' which are not only interesting, but of the highest value. Turning listlessly to its title page, we became so much absorbed in its pages that we read it as closely as an editor ever finds time to read anything. The glowing heat and cheerful light of a peat fire are the very ultimatum of a social evening."

— *Providence Daily Press.*

"Replete with interesting and instructive 'Facts,' demonstrating that abundant sources of supply are to be found in all the New England states, and its economy over wood and coal. Its perusal by every consumer in New England would be productive of great good, and excite a new enterprise throughout the New England states."

— *Portland (Me.) Advertiser.*

"A very interesting work, because peat forms one of the products of industry, which, when perfected from its raw state, forms, like mines of iron, lead, copper, and silver, *great* wealth to a nation."

— *Union and Journal,* Biddeford, Me.

"It embraces much curious and instructive matter of practical and scientific interest."

— *Lowell Citizen.*

"Peat exists in exhaustless deposits in every northern state — Minnesota is full of it. This volume furnishes a vast deal of information respecting the peat bogs of each state, and its methods of preparation and use are elaborately discussed."

— *St. Paul Press.*

"The practicability of condensing peat so as to produce an article of fuel of great value has been abundantly proved.

"The process appears to be completely successful, and at such a moderate expense as to admit of general application wherever there are peat bogs.

"This fuel when well prepared has qualities which make it equal to any other, and, for some uses, superior to any.

"It is both economical and agreeable. For steam it is quicker and more effective than anything else.

"In making and refining iron, it is, at least, equal to charcoal, and in the finer grades of iron work it is invaluable.

"It furnishes an illuminating gas having double the power of coal gas.

"The amount of solid wealth which this invention will add to the country quite leaves petroleum in the background."

— *New York Independent.*

"A simple and rational process by which crude peat, as it is taken from the bed, can be converted into solid, dry fuel, in good shape and at moderate cost.

"The machinery is simple, and not too expensive for use, and can be easily set up and run by the side of the peat bed.

"The personal character of the inventor is fitted to inspire confidence that he would not come before the public unless he had a good thing calculated to be of general benefit. This method may fairly claim to be not only the best, but the only one, so far as is known, in this country, that is at once effectual, cheap, and rapid. He is the pioneer in the movement in favor of the use of peat."

— *Brooklyn Union.*

"The favorable results of recent experiments with peat have called the attention of many business men to it.

"It will be likely to come into close competition with the fuel from the coal mines. The tendency will be, in any event, to protect the public from speculations and monopolies in coal."

— *New York Evening Post.*

"The testimony of scientific men is freely given as to its value."

— *Scientific American.*

"This subject is attracting much attention at various points, on account of the scarcity and high price of fuel."

— *The Prairie Farmer*, Chicago, Ill.

"It bids fair to become of great value to our state, as we have abundance of it here. It may eventually fill up the greatest deficiency of our state, by furnishing an article equal to coal for fuel and smelting purposes."

— *The Northern Farmer*, Fond du Lac, Wis.

"Madison, in this state, and Chicago, Illinois, have been boasting of having in their immediate vicinity large beds of peat, which are capable of being turned to good account for fuel for domestic purposes, but more especially for mechanical purposes. Well, Kanosha cannot afford to be behindhand in any of these great natural resources; so she also boasts of inexhaustible peat beds.

"One ton of peat will go as far and make as much heat as two tons of the best Lehigh coal for all mechanical purposes."

— *The Kanosha (Wis.) Telegraph.*

"Peat swamps are sources of great national wealth. So well convinced are we of this great truth that the writer of this, by direction of the

editor-in-chief of the *Tribune*, has made a special mission to Massachusetts for the sole purpose of learning 'facts about peat' from the head centre of information upon this subject.

"For this purpose we spent parts of three days in familiar conversation with T. H. Leavitt, author of the most valuable treatise upon peat as an article of fuel that has ever been published in America (besides, the inventor of the most successful machine for preparing the crude article for use), and who as a gentleman of sufficient scientific attainments and sound sense, coupled with untiring energy and Yankee perseverance, has devoted more attention to the acquirement of real knowledge than any other man we have met.

"We have also, in this month of June, visited and examined the operations of his works at Lexington, Massachusetts, where the practical effects of 'condensing peat' for fuel can be witnessed, and the capacity of machines and the utility of applying steam power to the work fully demonstrated."

—Solon Robinson, in *New York Tribune.*

"Of the value of peat, properly prepared, as an article of fuel, there is no question. Besides its worth for domestic purposes, it is unrivalled by any other substance for raising steam. Being free from sulphur, peat is also well adapted for the reduction

of ores; and in making the best iron, and in the finer processes of making iron and steel, it is equal to wood charcoal (and when charred it is pronounced better for welding purposes than charcoal itself), while some kinds of peat are equal to the best bituminous coal for making gas."

— *Springfield* (*Mass.*) *Republican.*

"The two main sources from which the present generation may expect to derive practical benefit, and to which we may look for aid in the economizing of our coal, are peat and petroleum.

"The thickness of peat varies in different localities from two to forty or fifty feet. Assuming the average thickness to be only twelve feet, an acre would yield thirty-five hundred tons of dried peat; consequently the aggregate estimated acreage in this country would produce twenty-one thousand million tons of dried peat, equal to a supply of twenty-one million tons per annum, for a thousand years.

"It cannot be supposed that these enormous masses of vegetable matter were created to be either useless or noxious.

"The value of peat is well known and admitted, both for domestic fuel and for generating steam, and charcoal made from peat is, in all respects, equal, if not superior, to wood charcoal.

"The general heating power of condensed peat has been proved to be very superior to that of coal; and, in fact, this article appears to be well adapted as a fuel for steam engines, whether marine, stationary, or locomotive. Its use has been found to effect a saving of fifty per cent in time in generating steam, and it will do double duty as compared with coal. The absence of smoke and clinkers, and the preservation of furnace bars and boilers from the destructive effects of sulphur from coal, are additional and important advantages.

"Such a substitute for coal or coke deserves attention. The comparative absence of smoke and the total absence of all sulphurous vapors ought to be a sufficient inducement, independently of the economy effected.

"The wonder is that it has not been generally brought into use. One reason why it has not, may lie in the limited quantity manufactured. Another cause for its non-adoption may be the hesitancy to depart from the old beaten track, which so often stops the way of improvement.

"The success of the practical trials it has undergone ought to be sufficient to commend its further use. No serious alterations to machinery are involved in its adoption."

— *American Railway Times.*

After the lapse of somewhat more than a year, during which time he had persistently continued his investigations near and far concerning this whole matter, Mr. Robinson, before quoted, wrote as follows: —

"Simple as is the process by which crude peat is converted into a good merchantable article of fuel, and easily as the machines are managed, it must be expected that some difficulties and perplexities will arise, and accidents and delays occur, and that some will fail to realize at first the full measure of success anticipated, though for all such misfortunes there is generally to be found some good cause, and such has been the case.

"From some we hear: 'It is a perfect success.' 'All works finely.' 'The machine does all and more than was claimed for it,' etc., etc. Others have met with accident or delay, from no good cause that we can learn, but, as nearly as we can judge, from carelessness or that lack of proper attention which all machinery requires for its successful use; while others still, from yielding to speculation, at an early stage of their operations, and absolute and acknowledged mismanagement of what might otherwise have been productive of excellent results, have failed to realize their anticipations, and we fail to hear much from them, while it is evident that the merits of the case are too well

demonstrated to admit of their saying anything against the enterprise.

"It is, perhaps, but reasonable for pioneers in the peat business in any section of the country to expect to share, to some moderate extent, the difficulties of inaugurating a new enterprise, but with ordinary good management, patience, and perseverance, these are the very men who may as reasonably expect to reap the largest reward as they grow up with and lead in the business.

"Of the peat enterprise generally as to what has been done, what is being done, and what remains to be done, what practical men can do, and what impractical and theoretical men think they can do or want to do, a great deal more might be said if more was necessary. But we only wish to make such statements as will call the public attention to the subject and induce further and more careful inquiries before expending money for peat lands, peat stock, or peat machines, so as to be thoroughly informed both in the manufacture and use of the material, with detailed results of cost, product, value, etc., which we are accustomed to look for in relation to the production and use of any other staple article.

"Information must be obtained by conversation, correspondence, and observation, but mainly, perhaps, by personal intercourse with men from all

sections of the country, whose tests, experiments, views, and interests concerning peat have varied in detail almost as much as the names they bear.

"We find some of these reports and operations crude and almost trifling, others evidently more earnestly and carefully pursued, and others still, prosecuted at considerable outlay of time and money, but all tending to give the public better information, as well by failures as by success.

"A gentleman who recently visited the works at ——, Michigan, writes: 'They use a Leavitt mill, and run about fifty tons crude peat per day, turning out a very fine article. They have no doubt of their abundant success, nor have we.'

"Another in Michigan writes: 'The general interest is deepening daily, and the conviction that there is something in peat worthy the attention of all, is becoming universal. We run a Leavitt machine, and work up about fifty tons of crude peat per day. The mill has worked satisfactorily in all respects, and fully up to everything claimed for it.'

"A gentleman during the past week has informed us that the —— Peat-Fuel Co. are operating a Leavitt mill to one hundred tons per day, and 'doing splendidly.'

"Mr. ——, of Illinois, writes that they used a Leavitt mill last year and this, and says, 'We can make twenty-five tons of dry peat per day, are all

right, and can beat the great —— Peat Co. or any other company I have heard of yet.'

"Mr. —— states that he has used the fuel for burning lime, and on a large scale, and with the most satisfactory results; and that it can be used in any kind of kiln.

"Inventive geniuses have also worked the peat placers to some advantage. All sorts of peat machines, practicable and impracticable, have been offered to the public with any amount of assurance that each was the only variety by which peat could ever possibly be prepared for commercial or practical purposes.

"We have no recommendations to make nor advice to give purchasers which of these machines is most suitable to their use. Several have utterly failed, or else have proved too expensive to afford any probability of ever making 'returns,' although some of them have made good fuel. Leavitt's machine certainly appears to have been the most successful; indeed, we hear of very little actually accomplished by any other.

"We indorse nothing; yet are free to say that if about to start peat works, we should buy a Leavitt machine in preference to any other with which we are acquainted.

"We have lately requested a practical engineer to give us his views upon the subject of peat

machinery. We give it for whatever it is worth, without indorsing it. He says: —

"'I have made up my mind that the only mill good for anything for peat fuel is the Leavitt. I have never seen a mill equal to this. There is common sense in it. It is the only one that will make peat for all purposes on scientific principles.'

"A valued correspondent at the West, a gentleman who, for the past two years, has given more persistent and untiring attention to the subject, both as relates to the value of the fuel and the best process and machinery for producing it, with special view to the requirements of that section of the country, writes: —

"'The Leavitt is the only machine I have met in all my investigations that fully and completely performs the desired work. They are ahead of the world in this department of manufacture.'

"He has a Leavitt machine, and writes that he proposes to put up two more of the same kind.

"In what we have said we have not intended to speak disparagingly of the inventions and operations of any one in this line, much less to indulge in any remarks which should savor of prejudice in favor of any one, only so far as our own convictions were concerned, and to stimulate all to make practical investigation for themselves.

"In Wisconsin, Iowa, and Minnesota a good

deal of money has been expended in experimental machines of various kinds. Published reports which we saw some months since seemed to indicate fair prospect of success, but a personal friend who has recently traversed that section and examined some of the works, and made careful inquiries concerning others, gives a less encouraging report than we could wish.

"It seems apparent that they have failed to comprehend the character and requirements of the material, and consequently that their several machines have not been adapted to accomplish the desired results.

"The West, of all sections of the country, needs a good peat machine, and every effort to meet the want should be liberally encouraged.

"Large sums were expended by the —— Peat Co., but without the desired result, except to a very limited extent, and at large cost, and from which only comparatively small 'returns' were realized. From their late superintendent, an eminently practical, matter-of-fact man, we have learned the following facts: —

"That while in all respects their company was well organized, with ample means and a good bog to work upon, with every evidence and conviction of the value of peat fuel, yet they failed to realize success in its manufacture from the simple fact

that their process was wrong; and after large expenditures in the vain endeavor to make successful a machine which was at the outset an impracticable thing, they have finally abandoned it as such, but with undiminished faith in peat as an article of fuel.

"Of the operations of the last year we can give no really definite information. We are not aware that any one concern produced last year any very large quantity, sufficient to supply a market, but many commenced in a small way and some not until quite late in the season; but wherever any was produced, it found favor at once with consumers so readily and to such extent that it was made evident that no one need question whether the fuel could be sold, but rather, can we produce a supply sufficient to satisfy the demand?

"The indications are that many large manufacturing and other establishments will, at no distant day, produce their own fuel from peat bogs in their immediate vicinity. The heaviest class of business interests are investigating the subject vigorously; there are numerous inquiries for large quantities of fuel, to be furnished at once.

"We believe that the most successful and profitable working of peat beds will be on individual account for home use. There are many farmers within our own knowledge, who, if they owned a

small-sized machine of moderate cost, could work peat enough for a year's supply of fuel at less expense than they could cut their own wood. Such kinds of operations will always produce good returns, whatever may be the result of organized companies.

"Railroad companies, manufacturing establishments, and other large consumers of fuel must be supplied, and their requirements are to be met only by the product of the fuel on a large scale.

"This is to be done not by speculative companies, but by individuals, associations, or companies, who enter upon and prosecute the manufacture of peat fuel as a legitimate business, in the same manner as any other manufacturing business is conducted, — prudently, systematically, and with the proper appliances.

"The statements of those who have prosecuted the business in this manner show conclusively that practical operations in the manufacture of peat fuel, intelligently and prudently conducted, may rank well among the larger and profitable enterprises of the age.

"We caution the public against all extravagant statements of monstrous profits, too large to be believed; yet we have excellent reports, of a character highly satisfactory, of successes already achieved."