T. H. Leavitt. 2 Sheets--Sheet 1.

Imp'ts in the manufacture of Peat Fuel.

No. 122,181. Patented Dec. 26, 1871.

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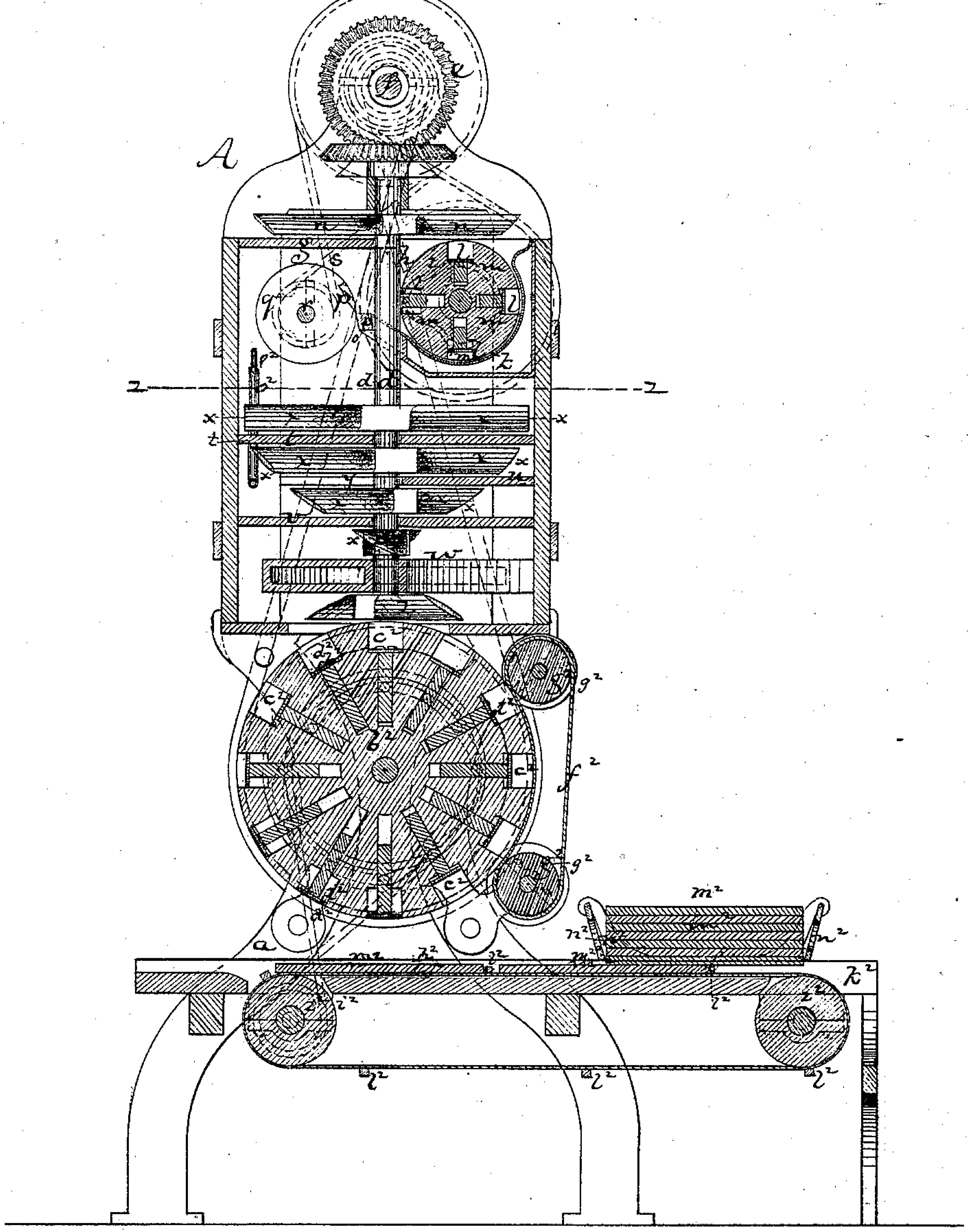

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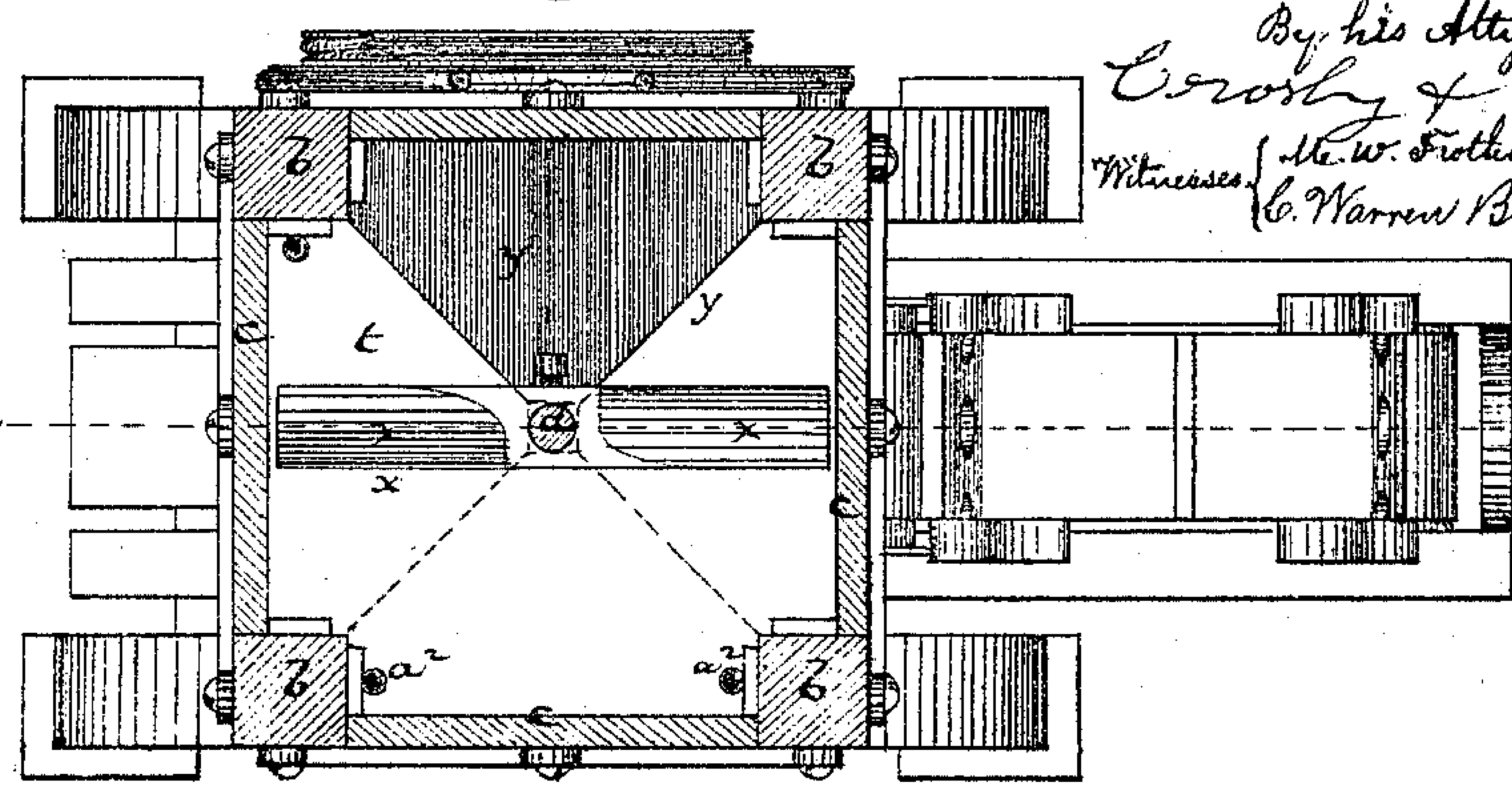

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Witnesses { M. W. Frothingham. / C. Warren Brown

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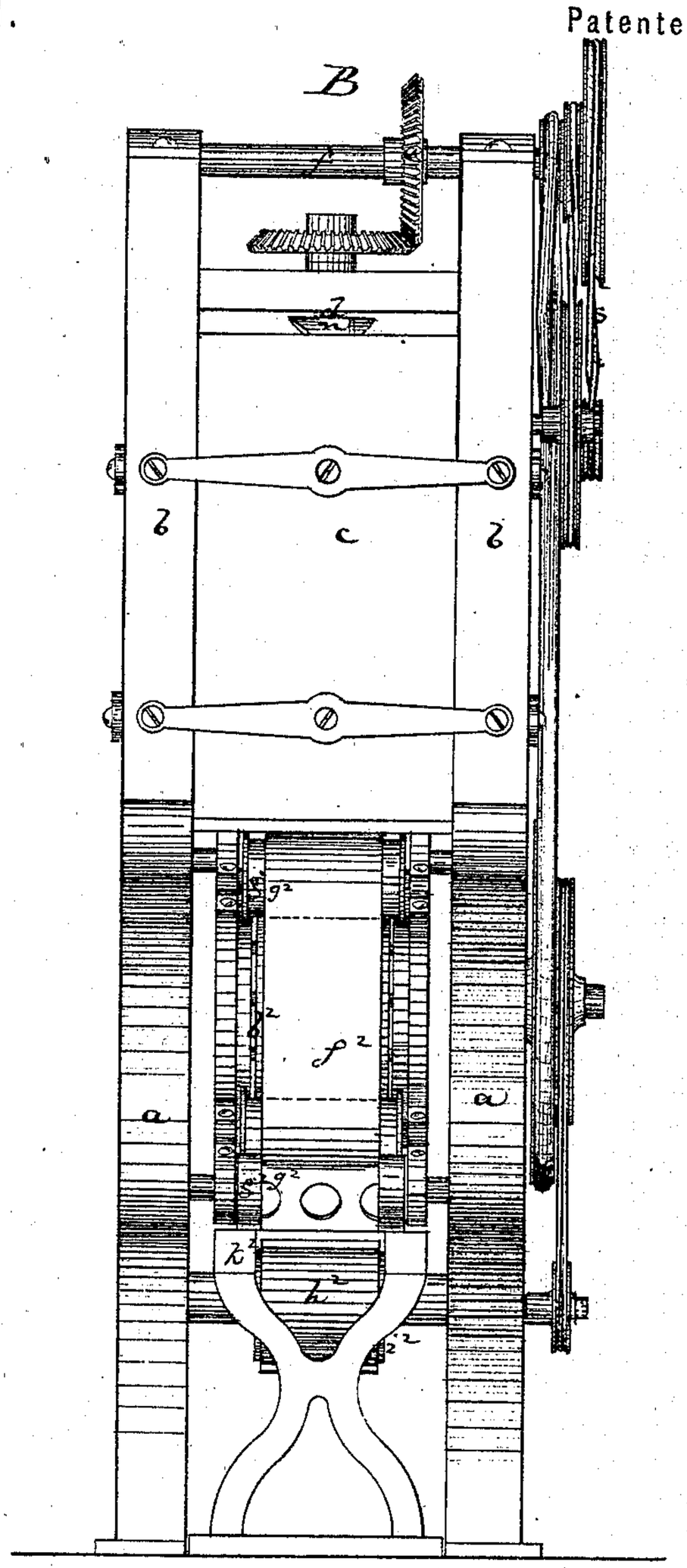

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UNITED STATES PATENT OFFICE.

THOMAS H. LEAVITT, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN MACHINES AND PROCESSES FOR MANUFACTURE OF PEAT FUEL.

Specification forming part of Letters Patent No. 122,181, dated December 26, 1871; antedated December 20, 1871.

To all whom it may concern:

Be it known that I, THOMAS H. LEAVITT, of Boston, in the county of Suffolk and State of Massachusetts, have invented Improvements in the Manufacture of Peat Fuel; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention sufficient to enable those skilled in the art to practice it.

My invention relates to a new process of manufacture for the conversion of crude bog-peat into a hard, dense, and dry fuel; to an organization of mechanism by which this process, to a greater or less extent, is practiced; to the details of mechanical appliances used in such machine and process; and to the composition of such fuel.

In my improved process for converting wet spongy bog-peat into hard, dry, and solid fuel I first take the crude peat and, by suitable mechanism, express therefrom a part of the water contained in it. I then subdivide and knead the compressed peat, and after a continuous kneading operation I again compress the peat in suitable molds, by which last operation the peat is formed into blocks of suitable shape for fuel and ready for a final drying operation in the sun and air or in suitable buildings or dry-houses. It is in this process that my invention primarily consists. The invention further consists in combining with said process of treatment the injection of steam into the mass of peat being kneaded, and the treatment of such mass by the projection upon or thereinto of atomized liquid or liquid spray or powder. The invention further consists in combining with the kneaded mass, either in the process of working it or subsequently thereto, extraneous fibrous material—like shavings, dried grass, straw, or other similar fibrous material—as also in combining with peat extraneous inflammable substances, like oil or resin. The invention also consists in combining with the triturating and kneading mechanism a heater, cylinder, or case, over and around which the peat is worked. Also, in the details of combination of the various mechanical devices to be hereinafter explained.

It is well known that peat is decomposed or partially-decomposed vegetable matter, generally occurring in moist localities, where the growth consists mainly of mosses, rushes, flags, coarse grasses, &c., in many cases of very rank growth. As excavated from the bog it has the appearance of a tubular cellular mass of mud, generally dark brown or black in color, the cells being principally formed by the straw-like remains of the stems and stocks of the rushes, grasses, &c., of which it has been formed from year to year, these cells (or tubes, as they are in many cases) comprising a very considerable portion of the bulk of the mass, and being filled either with water or air. If allowed to dry in precisely the condition in which it is cut from the bog, *i. e.*, with its structure undisturbed, the mass will generally retain its form, in some cases with a good degree of strength and solidity, while in other cases it will be found to be exceedingly friable, and so loose in texture as hardly to bear handling.

Peats, although possessing the same general features, differ in structure and characteristics as much as the different varieties of wood and coal. If, without other treatment, pressure be applied to almost any of the varieties of peat, as has often been attempted for the purpose of extracting water and solidifying it, the peat, when dried, will be found much more friable than if dried in its natural state, as cut from the bog, without pressure. Peat has been used for fuel for centuries, generally in the condition first above mentioned—*i. e.*, simply cut from the bog in blocks or masses of convenient size and dried. But during the last fifty years numerous attempts have been made to prepare it in some better manner, the aim generally being to solidify it, and that for two principal reasons, viz.: First, in order to produce a more dense and harder fuel, which should be more enduring in service and capable of being employed in manufactures and the arts and elsewhere where a soft or light fuel would be entirely unfit for the service required. Second, so that it might be so reduced in bulk as to admit of transportation as an article of traffic. To this end various means have been devised and various machines more or less elaborate have been constructed, but operations thus far are all resolved into one of three methods, viz.: First, to place the material just as it comes from the bog under powerful pressure, for the double purpose of extracting the water and compressing the mass. Second, to dry and disintegrate the material, and in that condition to compress it into blocks of convenient size for use. Third, to work or temper the mass, in the moist condition in which it is taken from the bog, until it is reduced to a somewhat uniform degree of consistency, in many

cases introducing into the mass an additional quantity of water until it is of the consistency of mortar or thinner, and in this condition spreading it in the open air or otherwise to dry, various means being adopted for cutting or molding it into blocks of convenient sizes for use. For machinery of this latter class Letters Patent No. 53,011 were issued to me March 6, 1866. The first of these methods fails, from the fact that the air contained in the tubes and cells before alluded to, instead of being driven out, is immediately, on the application of pressure, sealed even more closely in those cells, and the pressure applied takes effect only on this air, which is the only elastic or compressible portion of the mass, the solid matter and the water being alike incapable of compression; and the consequence is, that if pressed in a tight box or mold, on removing the pressure the air-cells again expand and the mass resumes nearly its original dimensions, and, when dried, is found to be still porous, and even more friable than when dried without having been submitted to pressure. The reason for this I do not pretend to give; but I speak of the fact as demonstrated in my own experience. Again, if pressed in other than tight molds or boxes, any openings intended to allow the water or air to escape have been found to furnish as free passage for the peat also, so that the water and air must necessarily be retained under pressure; or, if allowed to pass out, it was with a certainty that the peat would follow and, therefore, no satisfactory results could be obtained. The second method involves the necessity of expensive and very powerful machinery. The product in some cases has been very hard and generally attractive in appearance, but the material of which it is composed being dry, and neither plastic nor adhesive, the particles are compacted only by force of mechanical pressure, and the blocks, when placed either in water or on the fire, become quickly and finely disintegrated, so that the fuel is likely to be spoiled and rendered entirely unfit for use by exposure to rain, and is practically useless for many of the purposes for which fuel is required from lack of cohesion, or the fact of its rapid disintegration while burning. The process has, in all cases, proved to be too expensive to warrant its use, and is now, I believe, entirely discarded both in this country and in Europe. The third method, under various modifications, is the one now generally in use, and produces by far the best fuel of either of the three methods. It is applicable to nearly all the varieties of peat, and produces a fuel having strength and solidity to a degree which is not obtained by either of the other methods. There are, however, difficulties attendant upon it which all acknowledge, and which it is desirable to overcome, the principal of which is that in this method of treatment, as generally pursued, there is an amount of water varying from seventy to ninety per cent. of the whole weight, which must be handled and moved through all the course of treatment, involving, of course, corresponding expense for labor, and which heretofore it has been found impracticable to eject or remove from the mass as treated, except by the slow process of evaporation in the open air or by the more expensive and less satisfactory process in dry-houses.

It is a peculiarity of the material that after receiving the treatment (tempering) necessary to give it strength and cohesion, its affinity for water is such that it has baffled all attempts to separate them by any mechanical means heretofore known, and it has been my purpose to devise a process and the necessary mechanical appliances to put it in operation, by which the advantages of this third method should be retained and its difficulties overcome, so as to produce a fuel possessing strength and cohesion capable of being charred without disintegration, and which, for domestic purposes and in manufactures and the arts, should possess the properties requisite for its successful use in all these cases. And it has been my aim, too, to produce machinery for manufacturing it which should be of a character to be easily managed and capable of turning out large quantities in good merchantable shape and at moderate cost.

In my process the crude peat, just as it is cut from the bog—its structure being very nearly in an undisturbed condition—is submitted to pressure in such manner (hereafter described) as to extract a considerable portion of the water contained in its cells. It is then brought under the action of knives so as to cut up finely any sticks, roots, or fibers which might otherwise accumulate in the mill and tend to clog its operation. After this the mass is very thoroughly worked, by a rubbing or other process, for the purpose of still further breaking up the original structure of the mass and ejecting from the tubes and cells so broken up the air which is contained in them, leaving nothing but the solid matter in moist condition. The same treatment is continued for the purpose of drawing out, laminating, and packing the particles and minute fibers of the mass and developing certain plastic and adhesive properties, which, until such treatment, appear to be, to a certain extent, latent.

Although a prime object is to extract a considerable portion of the water, it must be understood that a considerable amount of moisture is necessary during treatment in order to insure cohesion of the peat when formed into blocks, and a large amount of water having been extracted by the operation first alluded to, its place may be supplied during the rubbing process by one or more jets of steam, admitted or forced into the mass under pressure while the mass is being kneaded; and it is found that a very small quantity of water, in the form of steam, so injected, serves the purpose equally well as the larger amount which has previously been extracted, and has the further advantage of imparting heat to the mass, which, at a subsequent stage—that is, after the peat so prepared has been molded and exposed to dry—has the effect to promote, to a very perceptible degree, the process of evaporation, inasmuch as evaporation will commence more quickly and proceed more rapidly from a heated mass than from the same mass in a cold state. And it is also demonstrated that the scald-

ing or cooking of the peat consequent upon the admission of hot steam tends to the more perfect development of its plastic and adhesive properties, and yields as a result a stronger and less friable fuel. If practicable, the mass at this stage should be still further heated, cooked, or scalded, or brought to a high temperature, but without increasing the amount of moisture above what is absolutely necessary to insure its cohesion when formed into blocks. In this condition it may be molded or formed into blocks of any size or form in any convenient manner, and either with or without being again exposed to pressure, in manner similar to that first mentioned, for the purpose of extracting a further amount of moisture and of giving the blocks more compact and perfect forms. The blocks so produced may then be laid away to dry either in the open air or in suitable dry-houses, the heat imparted to them in the process of manipulation operating as an active agent in promoting rapidly the process of evaporation. At this stage the material bears somewhat the same relation to the dry fuel that green wood does to dry wood, and the process of drying or curing in both appears to be similar; but the result obtained by this process is peculiar in that as the peat so prepared dries it assumes a mineral-like hardness and appearance, and breaks with a fracture not unlike coal or stone, and can never again be dissolved in water or reduced to a plastic mass; its characteristics having been entirely changed, partly by the treatment I have described and partly by chemical action (apparently in the nature of carbonizing) consequent upon that treatment.

One essential advantage in the economy of labor gained by this process is apparent, for whereas the average percentage of water contained in peats as ordinarily excavated and brought to the mill for treatment is seventy-five per cent.—none of which, by any former process, is actually extracted during the treatment—many persons choosing rather to add more water to it—and the same has, therefore, to be handled and carried away again after treatment in the mill—by this process a very considerable percentage of the water is extracted and passes off, and the labor required to remove and handle the manufactured product is, therefore, reduced by the weight of water taken out.

The drawing represents a machine embodying my improvements in peat-treating mechanism.

A shows the machine in sectional elevation taken on the line *x x*. B is an end elevation. C is a sectional plan taken on the line *z z*.

a a denote two stands or uprights, connected by suitable cross-beams, and having mounted upon them a strong frame-work, *b*, which, with side plates *c* extending from post to post *b*, forms the casing of a mill, in which the peat undergoes that treatment which prepares it for the final compressing and molding operation in the block-forming molds. Extending centrally through the mill is a vertical shaft, *d*, rotating in suitable bearings, and having at its top a bevel-gear driven by a gear, *e*, on a horizontal shaft, *f*, rotating in suitable bearings at the top of the machine. At the top of the mill is a horizontal plate or table, *g*, upon which the crude peat is received, this plate extending half way across the mill, as seen at A, and having an edge-flange, *h*, which extends to the circumference of a rotary cylinder, *i*, the axis of which turns in suitable journal-boxes on the frame *b*, the hopper-space over the mill opening to the top of this cylinder, as seen at A. Around the rear and under the cylinder is a perforated plate, *k*. In the cylinder *i* are mold-spaces *l* extending from end to end of the cylinder and radially into it from the cylinder-face, and working in each mold-space is a plunger, *m*. By a suitable cam mechanism each plunger is carried to the bottom of its mold when the mold is approaching the upper part of the mill, and the mold is then open and in condition to receive the peat, which is swept into it from the plate *g* by suitable inclined blades, sweeps, or arms *n* projecting from the shaft *d;* these arms not only sweeping the crude peat from the plate *g* into the space over the cylinder, but pressing it down into each mold as the mold comes into position. As the filled mold moves on it comes to the perforated plate *k*, and the cam mechanism then moves the plunger outward, compressing the peat against the plate *k* and expressing water therefrom, the water escaping through the perforations of the plate. The plungers may also be perforated to allow the expressed water to escape through the plungers as well as through the plate *k*. The expressed water may be led off through any suitable ducts or conductors. After each mold has passed its lowest position, and by the contiguous plate *k*, the cam mechanism throws the plunger still further out and causes it to eject the peat. The compressed blocks of peat ejected from the cylinder *i* are pushed along until each reaches and passes over a bar, *o*, against or in juxtaposition with the outer edge of which rotates a knife or cutter, *p*, extending between two heads *q*, which are mounted on a rotary horizontal shaft *r*, driven by a band, *s*, extending around a pulley upon said shaft and another pulley on the shaft *f*, the rapid rotation of the knife cutting up the peat, which falls from the cutter down upon a plate or shelf, *t*, which plate or shelf is the upper one of a tier or series of horizontal shelves *t u v w*, over and rotating closely against the top surface of each of which are arms or spatula blades or sweeps *x* extending radially from the vertical shaft *d*. In each of these shelves a opening, *y*, is left on one side, and through the opening the peat falls to the shelf below. The peat upon the upper plate *t* is worked by the rotating blades above the plate, and is finally carried around to the opening *y*, through which it drops onto the next plate *u* below. Here it is again similarly worked over by the arms over said shelf until it escapes through the shelf and drops to the next plate *v*, where it is further worked until it drops through the opening onto the heated plate *w*, where it is again similarly worked over by the arms until it drops through the opening at one side of the heater upon the bottom plate of the mill. From this plate it is wiped or swept off and forced into the molds c^2 of the ma

mold-cylinder by another set of arms or sweeps ². All of these rotating arms are beveled or inclined, and tend collectively and in succession to knead the material, like spatulas, or as dough is kneaded, working it over and over and converting it into a doughy and cohesive mass of pulp. The bottom of the mill becomes filled or charged with this pulp, and the heater *w* is so constructed and arranged within the mill that it is entirely surrounded by peat, which thereby becomes considerably heated and is in more workable or plastic condition to be pressed into the molds.

To lubricate and warm the material while under the action of the spatula-blades or sweeps, and passing under the mill, steam-pipes a^2 may run through the mill, these pipes having suitable connections with a source of hot-steam supply, and being preferably provided with holes through which the steam under pressure is forced in jets and ejected into the mass of peat, the steam so applied keeping the mass sufficiently moist or "in temper" to enable it to be readily worked by the rotary sweeps and formed into a strong plastic pulp or paste, which is heated by contact with and proximity to the heater *w* before it passes into the molds, this heater being a hollow chest with steam-passages into and from it.

The mold or block-forming cylinder b^2 is a large wheel having a series of peripheral molds, c^2, each provided with a suitable compressing and ejecting-plunger, d^2. At one side of the mold-wheel or cylinder b^2 is an endless apron or band, ², running over two drums, g^2, and in contact with the peripheries of the mold-cylinder, the and being driven by the mold-cylinder. As, the rotation of the mold-cylinder, an open or npty mold comes to the top, or directly under ıe center of the pulping-mill, the blades or sweeps press the peat into it, and, as the filled mold asses on, it soon comes against the apron f^2. his apron is porous, and may be made of canas or other porous material, and the plungers may also be made porous; and as each mold tates in contact with the band its plunger is rced out radially by a suitable cam mechanism, ereby compressing the peat in the mold against e band and expressing the water, which runs f through the belt or apron and also through e plunger. By this operation the peat is formed to solid and partially-dried blocks ready for the al drying operation. After each mold has passed e apron f^2 its plunger is forced still further outrd and ejects the block of peat, which falls upan endless apron, h^2, running around drum the shafts of which turn in bearings on the der side of a long frame, k^2. This apron is proled with a series of lugs or cross-strips, l^2, and one end of the frame k^2 is placed a pile of ards or block-receivers, m^2, piled between guide ces n^2 and resting upon the apron, the receivs being taken successively, one by one, by the gs or strips l^2, and as each moves under the old-cylinder it receives the blocks ejected or opping therefrom, there being at all times a eiver under the cylinder ready to take the cks. The apron may be made of any desira- length to conduct the blocks to any desired location for removal to a dry-house or to be piled in the open air.

During the passage of the peat through the pulping or kneading mill I sometimes throw into or upon the mass oil or other inflammable liquid or powder; and to accomplish this in the best manner I prefer to use steam atomizing-tubes, as follows: o^2 is a steam-pipe having within it another pipe, p^2—the lower or open end of which is within the outer pipe o^2—through which is conveyed any liquid or powdered substance which it may be desirable to incorporate with the mass of peat in the process of manufacture. The materials so to be introduced, which may be oil, lime-water, melted or pulverized gums, or pulverized ores, &c., are held in any convenient receptacle, and from thence are allowed to run through or may be forced through the inner pipe p^2 in regulated quantity, steam at the same time being let on to pass through the outer pipe o^2. As the liquid or other matter passes from the end of the inner pipe it is at once caught by the steam within the outer pipe o^2, atomized and mingled with it, and forced, in the form of spray, into and through the mass of peat or other material with which the mill is filled, and which is kept in constant motion by the sweeps operating within the mill, so that by this means any quantity, small or large, can be very thoroughly and evenly disseminated through the mass, materially adding to the value of the peat as an article of fuel.

The mechanism of my apparatus may be driven by an arrangement of shafts, drums, gears, pulleys, and belts, as seen in the drawing, or in any other suitable manner.

After treatment in the pulping-mill it is sometimes found that the peat and the water still remaining in it are so intimately mingled, or that the peat has such an affinity for the water contained in it, as to render it extremely difficult to express from it any material portion of the water. In order to overcome this difficulty I mix with the peat straw, grass, rushes, husks, shavings of wood, or any similar substance—preferably in dry condition — the effect of which is to attract to these surfaces a portion of the moisture and under pressure to deliver it from the mass. The straw, grass, shavings, &c., serve also the purpose of strengthening the fuel or adding to it cohesiveness, and, being combustible, such material forms practically a component part of the fuel for heating purposes. The grass, straw, rushes, shavings, or other similar material used, may be previously saturated with oily or resinous material.

Instead of the perforated plate a pervious apron may be arranged to operate in connection with the cylinder; or the apron may be so arranged as to operate in connection with both cylinders.

I claim—

1. The process of treatment described, said process consisting in first compressing crude peat to extract a portion of the water contained in or held by it, next dividing up the compressed peat and working or kneading the mass, either with or without the application of heat, steam, or water, and then compressing the peat, so worked, in suita-

ble molds to extract more or less of its moisture and form it into suitable blocks for fuel.

2. Also, the process of treating peat in a pulping-mill by injection into or upon it of inflammable material.

3. Also, in combination with the pulping-mill, the cylinder *i* for receiving and compressing the peat and delivering it in uniform quantities and at uniform intervals into the mill.

4. Also, the rotary cutter *p*, in combination with the mold-cylinder *i*.

5. Also, the combination of a compressing and molding cylinder above a pulping-mill—a mill provided with rotary beaters or blades—and a block-forming mold-cylinder below the mill, all arranged to operate substantially as described.

6. Also, the steam-pipe o^2 and inclosed pipe p^2, arranged to eject an inflammable liquid or powder and steam upon the mass of peat in the mill.

7. Also, in combination with the block-forming and compressing-cylinder, the apron f^2 for closing the molds and acting as a bed against which to compress the peat, and through which to express water therefrom, the apron traveling with or being moved by the cylinder.

8. Also, in combination with the block-forming mold-cylinder, the endless carrier-apron h^2, provided with lugs l^2 which automatically take the block-receivers m^2 and carry them into position to receive the blocks from the mold-cylinder and then away with said blocks, substantially as described.

9. Also, a peat-fuel having artificially combined with it straw, dried grass, or similar material, to facilitate the expression of the water therefrom.

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Witnesses:
FRANCIS GOULD,
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