

Specification of Alexander Speid Livingstone : manufacture of fuel.

Contributors

Livingstone, Alexander Speid.

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A.D. 1851 N^o 13,450.



S P E C I F I C A T I O N

OF

ALEXANDER SPEID LIVINGSTONE.

MANUFACTURE OF FUEL.

LONDON:

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A.D. 1851 N° 13,450.

Manufacture of Fuel.

LIVINGSTONE'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, ALEXANDER SPEID LIVINGSTONE, of Swansea, in the County of Glamorgan, Engineer, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her
5 Royal Letters Patent under the Great Seal of the United Kingdom of Great Britain and Ireland, bearing date at Westminster, the Eleventh day of January, One thousand eight hundred and fifty-one, the fifteenth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Alexander Speid Livingstone, my exors, admors, and assigns, Her special
10 licence, full power, sole privilege and authority, that I, the said Alexander Speid Livingstone, my exors, admors, and assigns, or such others as I, the said Alexander Speid Livingstone, my exors, admors, or assigns, should at any time agree with, and no others, from time to time and at all times during the terms of years therein expressed, should and lawfully might make, use,
15 exercise, and vend, within England, Wales, and the Town of Berwick-upon-Tweed, my Invention of "**IMPROVEMENTS IN THE MANUFACTURE OF FUEL;**" in which said Letters Patent is contained a proviso that I, the said Alexander Speid Livingstone, cause a particular description of the nature of my said Invention, and in what manner the same is to be performed, by an instrument
20 in writing under my hand and seal, to be enrolled in Her said Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

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NOW KNOW YE, that in compliance with the said proviso, I, the said Alexander Speid Livingstone, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, are particularly described and ascertained by this Specification thereof, reference being had to the Drawings hereunto annexed (that is to say):—

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My said Invention consists,—

Firstly, of machinery for compressing or forming artificial fuel into blocks or shapes.

Secondly, of a long oven or tube for drying blocks or pieces of fuel, the oven and its flues being constructed in such manner that different parts of its length may be heated to different degrees of temperature, for the purpose of enabling me to pass the blocks or shapes through the various degrees of temperature to which they may require to be exposed, in order to dry them in the manner required.

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Thirdly, the exposure of such blocks or pieces of fuel as aforesaid successively to the various degrees of temperature of such an oven as aforesaid, by means of carriages moving slowly along the oven, so that the blocks or pieces may be gradually heated to the required maximum degree for the purpose of drying them, and the heat applied to them for this purpose be again gradually diminished until they are withdrawn from the oven.

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My said improved machinery for compressing or forming fuel into blocks or shapes is shewn in Figures 1, 2, 3, and 4 of the said Drawings hereunto annexed.

Figure 1 is an elevation of the machine; Figure 2 is an end view of the same machine; Figure 3 is a plan of the machine; and Figure 4 is a section of the same, as taken through the line L, M, Figure 3, similar parts in each of these Figures being marked with similar letters. *a, a*, is the revolving table; *b, b*, are the rollers; *c, c, c, c*, are arms, each of which projects from the body of the roller, and is hung by the pin *d*; *e, e*, are the shafts which carry the rollers, and are supported and kept in their places by the standards *f, f*, which are fitted with brasses, and secured by straps and cottars. *g, g*, is a spur wheel acted upon by the screw pinion D, which receives its motion from the steam engine. *i, i*, is an oblong pipe which conveys the small coal from the pug mill to the table of the machine *a, a*. On this table, at an angle with the rollers, are teeth *2, 2*, which act into teeth on the roller, and thus turn the table on the upper side, while the teeth on the under side of the table, acting into the teeth of the under roller, is turned by it. *X, X*, is a lever and counterbalance weight to enter the hole in the table, and lift up the compressed block of fuel. The end of this lever acts into a series of inclined

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planes in the inside of the revolving table. It will be seen by an inspection of the Drawing that the dotted lines represent the position of the lever when the block of fuel is raised to the upper surface of the table, and is ready to be removed. The dotted lines Y, Y, represent the block of fuel between the
5 arms of the rollers.

In Figure 2 are shewn the friction rollers *l*, which sustain the revolving table *a, a*, and keep it in its proper place. *m, m*, is a short platform on which the table slides, and serves as a bottom to the holes in the table, and is placed immediately under the oblong pipe from the pug mill.

10 In Figure 3 I have shewn the holes or openings in the table into which the materials for forming blocks of artificial fuel are to be forced, and those holes or openings must be made of the size and shape necessary for forming the blocks of the intended shapes and dimensions.

In Figure 4 will be seen more clearly the action of the arms. The arms
15 *c, c, c, c*, in the upper roller are suspended by the pins *d, d, d*, which allow them to enter the holes in the revolving table perpendicularly, and also to leave the table after the block is compressed in the same position, so that the block shall present an even surface. When the arm leaves it, the arms fall into their proper places by their gravity or weight. The under roller is some-
20 what different, as will be seen by an inspection of the Figure. An abutment *n, n, n, n*, to which the arms *c, c, c, c*, are kept by a spring *o, o, o, o*. This spring acts on the arm leaving the block, and by its compression causes the arm to release itself from the revolving table perpendicularly, and when clear of the table and out of the hole forces the arm against its abutment, and so
25 on, each arm having its own spring; it will be clearly seen that the holes in the table and the arms in the rollers must be accurately divided so that the arms fall into the holes with ease. The materials of which the blocks of artificial fuel are intended to be formed being first thoroughly incorporated either in a pug mill or by any other convenient means, I allow the mixture or
30 compound to fall through the shoot *i* to the revolving table *a, a*, which, having openings of the required size and shape, each of those openings will, as they successively pass under the shoot, be filled with the requisite quantity of material. As each of those openings by the revolution of the table is brought between the rollers, the end of one of the projecting arms of each of the
35 rollers will pass into the opening in the table, the end of the upper arm pressing downwards, and the end of the lower arm pressing upwards, and the material contained in the opening being thus compressed by the simultaneous action of the arms and the rollers to which they are respectively attached. Each of the blocks thus formed will, when the orifice containing it is brought

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round to the lifting apparatus X, X, be forced up by that apparatus to the upper side of the table, and is then to be removed from the machine. When blocks or pieces of artificial fuel are exposed to high degrees of heat in retorts, the outer surfaces of the pieces become partially charred, and by these means the power of the fuel to evolve heat, when burnt, is diminished, and 5 the charred parts are apt to crumble and fall off, thus causing considerable waste. These evils are prevented or greatly diminished by drying blocks or pieces of fuel upon waggons or trucks passing through long ovens, according to the second and third parts of my Invention.

The mode or modes of constructing long ovens or tubes according to the 10 second part of my Invention is shewn in Figures 5, 6, 7, 8, and 9 of the said Drawings. When a large oven or tube is required, I prefer to make it as shewn in Figures 5, 6, and 7.

Figure 5 shews a longitudinal section of such a large oven or tube, which may be constructed of cast or malleable iron or brickwork; but I prefer cast 15 or wrought iron, as I deem them to be more economical and stronger. *p, p, p,* is an oval iron tube, the shorter diameter of which is about four feet six inches, and the larger diameter about five feet six inches. The number of tons of fuel to be made in a day in this oven will decide the necessary length of it. Thus, if fifty tons a day are to be made, the oven will require to be made about 20 one hundred and fifty feet long; if one hundred tons a day, three hundred feet, and so on, according to the quantity of fuel to be dried. This tube is set in brickwork or masonry, and surrounded with the flues *r, r, r, r,* having fireplaces *s* at intervals about twenty feet apart from each other, and these flues run into a common flue, at the end of which there is a chimney. In 25 Figures 5 and 6 breaks are made to shew that the full length of the oven or tube is not represented by either of those Figures. *t, t, t, t,* are rails on which waggons or trucks may be moved. *u, u, u, u,* is an endless chain passing through the entire length of the oven, and wound round the barrel *v, v,* which barrel receives its motion from a shaft *w* of the steam engine; to 30 guide the chain pullies *3, 3, 3, 3,* are placed at each end, which lead the chain to the barrel, through the opening or culvert *L, L.* *N, N,* is a truck on which blocks of fuel are to be placed before it enters the oven. The truck first enters the chamber *O, O,* at the entrance end of the oven, and the length of this chamber should be a little more than the length of the description of 35 waggon or truck intended to be used, in order to allow sufficient space for attaching the truck to the chain *u, u.* *P, P,* is an inner door at the end of this chamber, and opening into the oven. This door is to be kept shut when the outer door of the chamber is opened to admit a truck, so as to prevent a

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current of cold air entering the oven. When the truck has been attached to the chain, and the outer door shut, the inner door is to be opened, and whilst another truck is being loaded with blocks of fuel, the preceding truck will have passed from the chamber into the oven, when the inner door is to be
5 again closed. The second truck is then to be run into the chamber attached to the chain, and drawn into the oven in the same manner as before, and so on, until the whole length of the oven is filled by a train of trucks; and in order that as little power may be expended in drawing the train, the oven may be lower at the drawing end than at the entrance end of the oven. The
10 fires being lighted, they are to be regulated in such manner that the temperature at the entrance shall be from ninety degrees to one hundred degrees of Fahrenheit's thermometer, gradually increasing until at the middle or nearer to the drawing end of the oven it shall attain a temperature of about three hundred and ninety degrees of the same thermometer, from which place to
15 the drawing end the heat should be allowed gradually to fall to about ninety or one hundred degrees. The temperatures of the different parts of the oven may be ascertained by thermometers placed at intervals along the whole length of the oven, each of them being placed so as to have its bulb heated to the same degree as the interior of the oven at the part where it is placed.
20 Figure 6 is an elevation of the same oven, shewing one of the furnace doors and the door to enter the oven for the purpose of attaching the truck to the chain, and the opening D¹, D¹, to allow the escape of any volatile or gaseous matters. These may be collected by any of the usual methods for that purpose and condensed, or may be allowed to enter the chimney, and thus escape
25 into the atmosphere. Figure 7 is an end view of the same oven, shewing one half of the door R removed. These doors lean against the end of the tube, and run on a rail by means of the pullies S, S, and their weight is balanced by the counterweight A, A. When pieces of fuel are placed upon trucks or waggons, for the purpose of being dried in this oven, the waggons are attached
30 to an endless chain which passes through the oven, and is put in motion by a steam engine or other suitable power. The waggons during their progress through the oven pass through the various temperatures ranging from ninety degrees or one hundred degrees at the commencement, and gradually increasing until it reaches three hundred and eighty to three hundred and ninety-five
35 degrees Fahrenheit; and then again gradually decreasing to the former temperature, and as the waggons arrive at the drawing end of the oven, the fuel is to be removed and allowed to cool, after which it is fit for use. The time occupied in drying pieces of fuel will vary according to the sizes and forms of the pieces and the materials of which it is formed; and I find that in drying

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a piece of about fourteen pounds weight, and of the ordinary shape, about twelve hours will be required for drying. It is evident that the speed of the trucks passing along an oven must be regulated, so that the drying shall be completed shortly after the truck shall have arrived at the hottest part of the oven. By thus gradually applying heat for drying blocks of fuel, a sufficient 5 degree of hardness is given to the fuel throughout the entire thickness of the blocks, and without deteriorating the quality of the fuel.

In Figures 8 and 9 I have shewn a mode of constructing an oven which may be adopted for drying small pieces of fuel, such as I make of anthracite coal dust, bituminous coal, and tar. 10

Figure 8 shews an end view of a series of tubes set in an oven similar to those used in the manufacture of gas. I use two chains made with long links of the length of the block of fuel. Between the links I fix a plate of malleable iron on which the block is placed, and motion is given to the chains, as before described. A fire is placed every twenty feet of the length of the 15 tubes, and the temperature is regulated in manner herein-before described.

My Invention does not apply to the materials of which artificial fuels are to be made; but I may observe, that in making artificial fuel to be compressed and dried according to my Invention, I usually adopt a mixture of coal and bituminous matter in the proportion of from eight to ten per cent. of tar and 20 ninety to ninety-two per cent. of small coals or coal dust, and from five to seven per cent. water, and intimately blend them together by putting the same into an ordinary pug or mortar mill, the arms of which by their revolutions stir up and mix the compound. And if I wish to use anthracite or stone coal dust, I mix with it, in the proportion of from thirty to fifty parts 25 bituminous coal, from seventy or fifty parts anthracite, from eight to ten parts of tar, and from five to seven parts of water.

Having thus described the nature of my Invention, and the manner in which it is to be performed, I declare that I claim,—

Firstly, the machinery for forming or compressing blocks or pieces of arti- 30 ficial fuel, in manner herein-before described.

Secondly, the construction of a long oven or tube for drying blocks or pieces of artificial fuel, in manner herein-before described; and,

Thirdly, the drying blocks or pieces of artificial fuel by exposing them to a temperature gradually rising to a maximum heat of about four hundred 35 degrees of Fahrenheit's thermometer, in manner herein-before described.

In witness whereof, I, the said Alexander Speid Livingstone, have hereunto set my hand and seal, the Eleventh day of July, in the year of Lord One thousand eight hundred and fifty-one.

ALEXANDER (L.S.) SPEID LIVINGSTONE.

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AND BE IT REMEMBERED, that on the Eleventh day of July, in the year of our Lord 1851, the aforesaid Alexander Speid Livingstone came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and
5 specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

JEFFERSON.

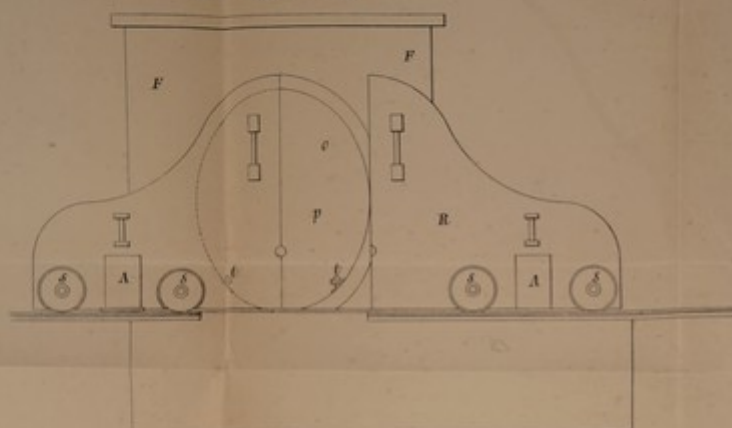
Enrolled the Eleventh day of July, in the year of our Lord One thousand eight hundred and fifty-one.

LONDON :

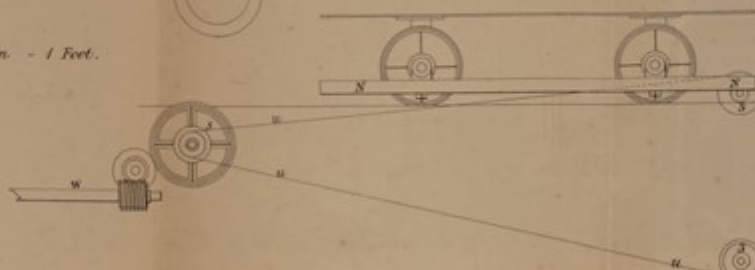
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FIG^{re} 7.

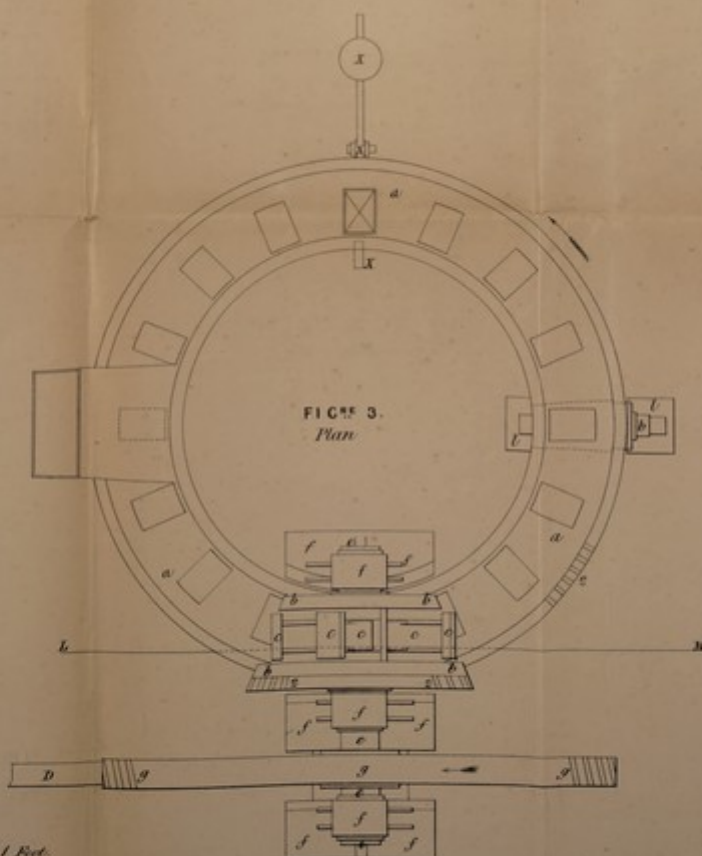
End View of Oven



Scale 1 in. = 1 Foot.



FIG^{re} 3.
Plan

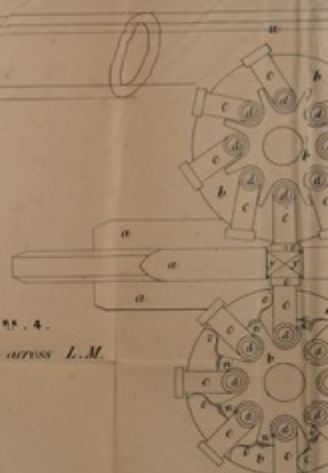


Scale 3/4 of an inch = 1 Foot.

The enrolled drawing is not altered.

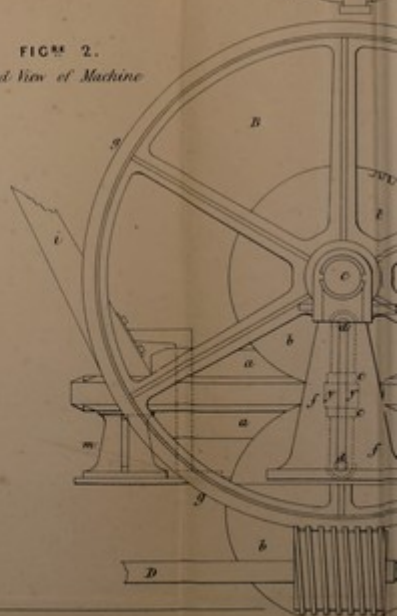
FIG^{re} 4.

Section across L.M.



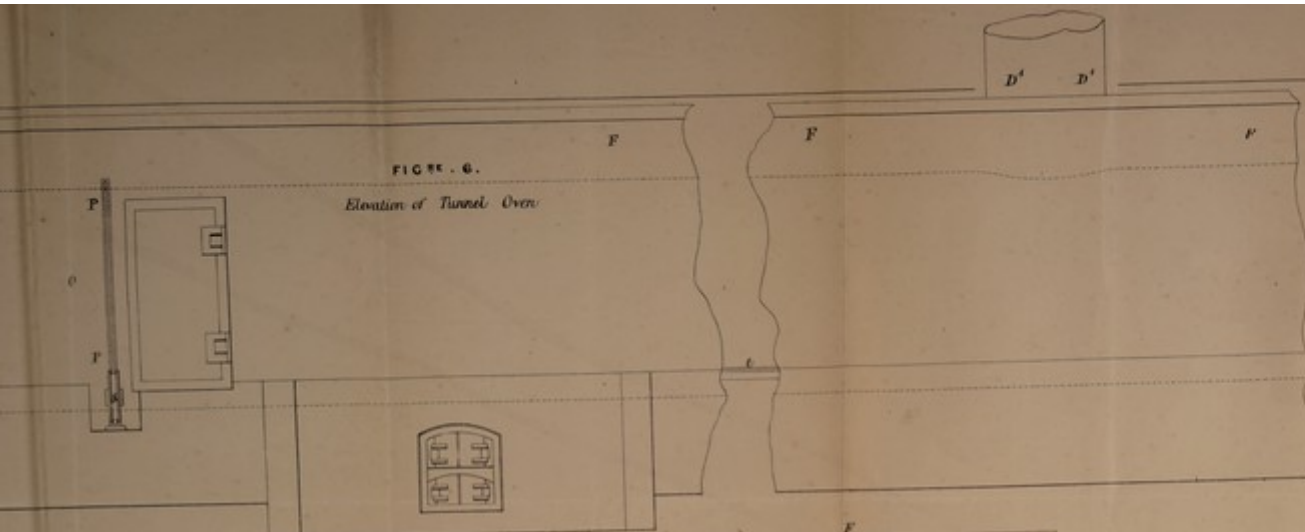
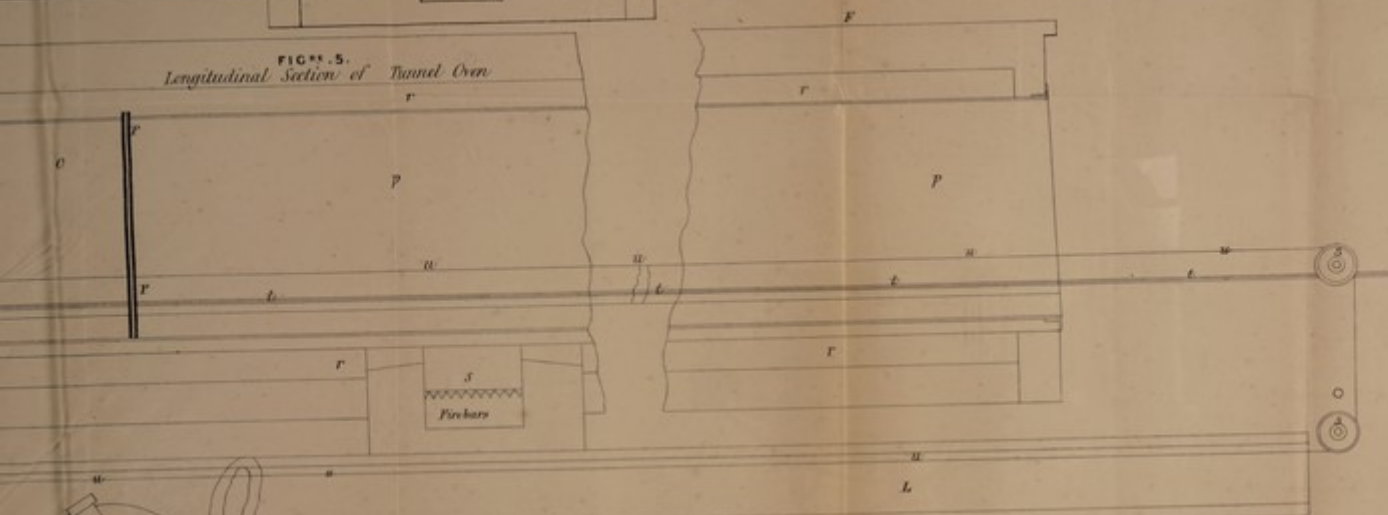
FIG^{re} 2.

End View of Machine

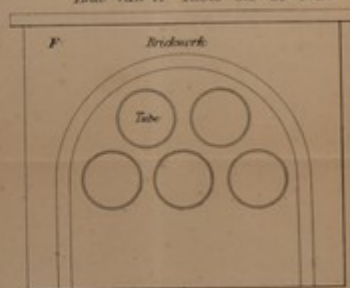


FIG^{RE} 6.

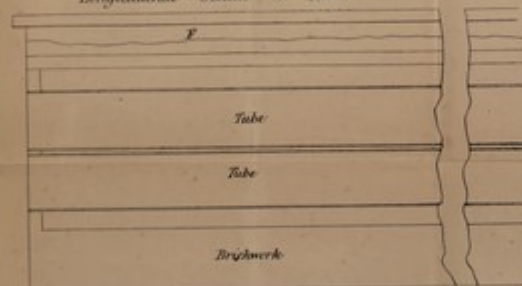
Elevation of Tunnel Oven

FIG^{RE} 5.
Longitudinal Section of Tunnel OvenFIG^{RE} 8.

End View of Tubes set in Oven

FIG^{RE} 9.

Longitudinal Section of Tubes

FIG^{RE} 1.

Elevation of Machine

