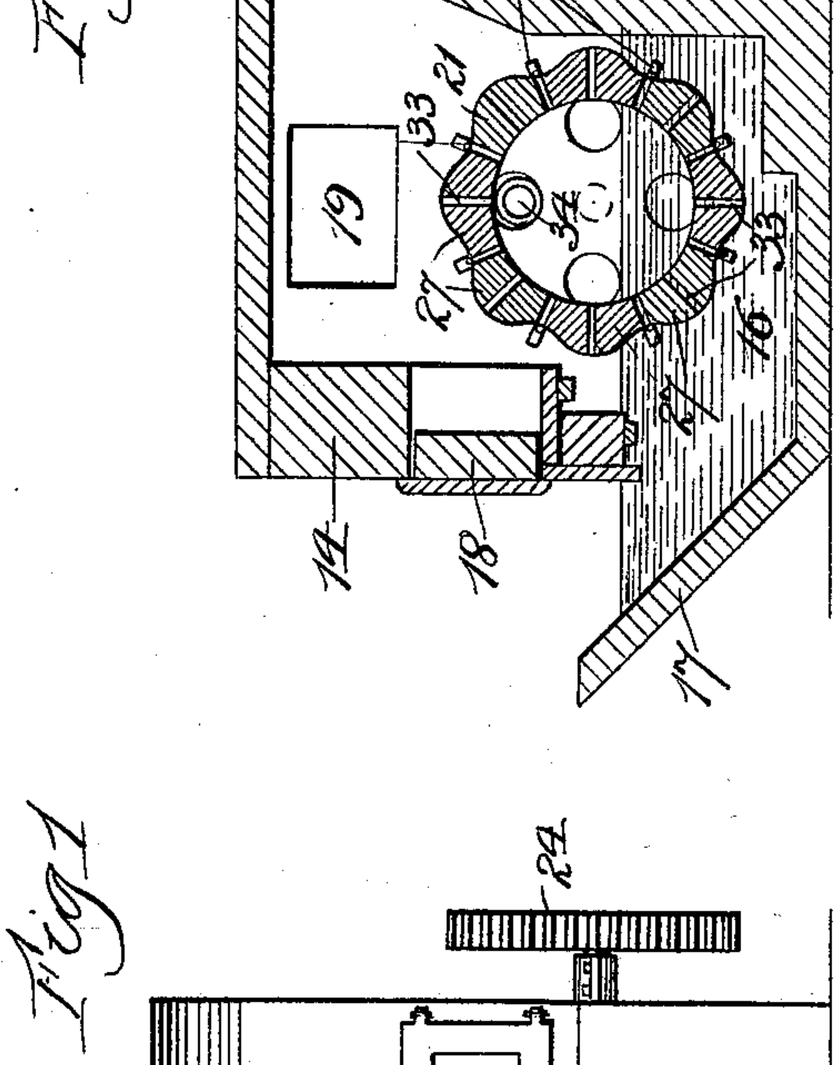
(No Model.) 3 Sheets—Sheet 1.

A. M. HEWLETT.

FURNACE.

No. 543,018. Patented July 23, 1895.

Fig. 1



Witnesses
Wm. M. Cheem.
Wm. L. Fleming

Fig. 2

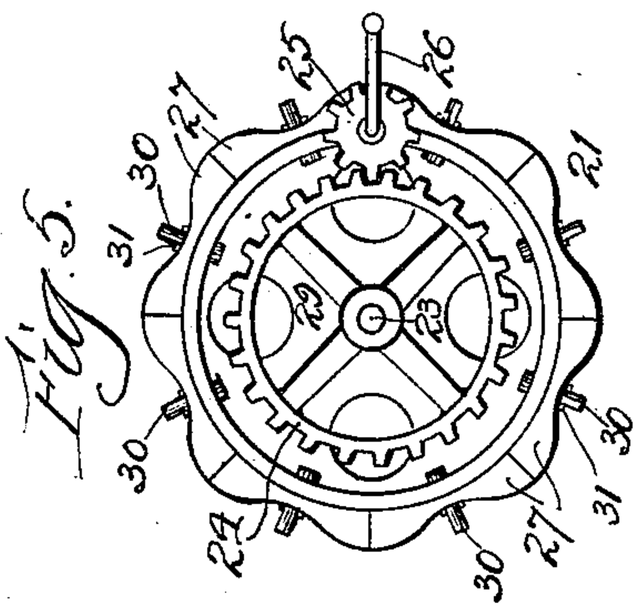


Fig. 3.

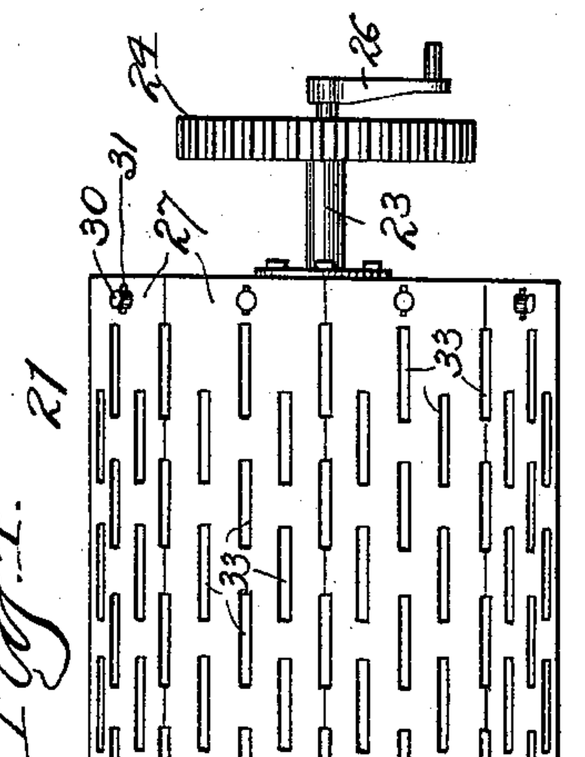


Fig. 4.

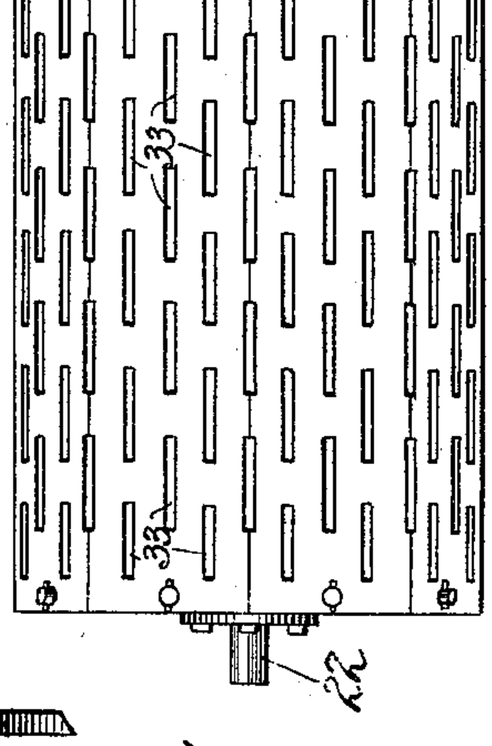


Fig. 5.

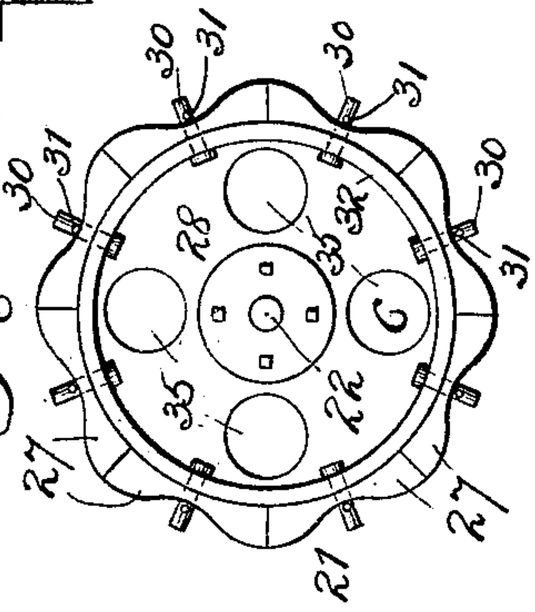
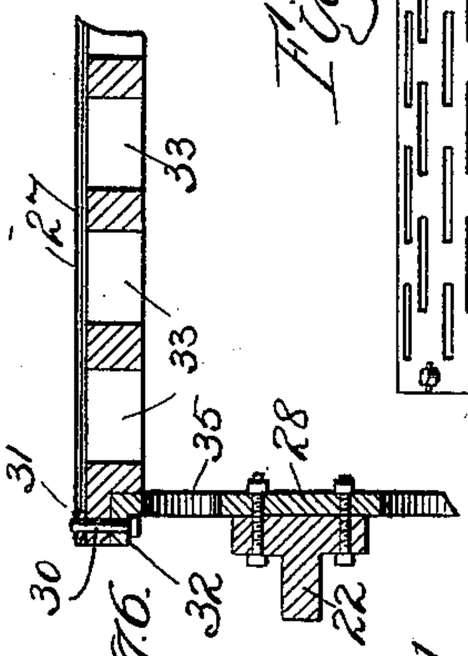


Fig. 6.



Inventor
Alfred M. Hewlett.
Bond Hoffman Pickard & Jackson
Attys.

(No Model.)

3 Sheets—Sheet 2.

A. M. HEWLETT.

FURNACE.

No. 543,018. Patented July 23, 1895.

Fig. 7.

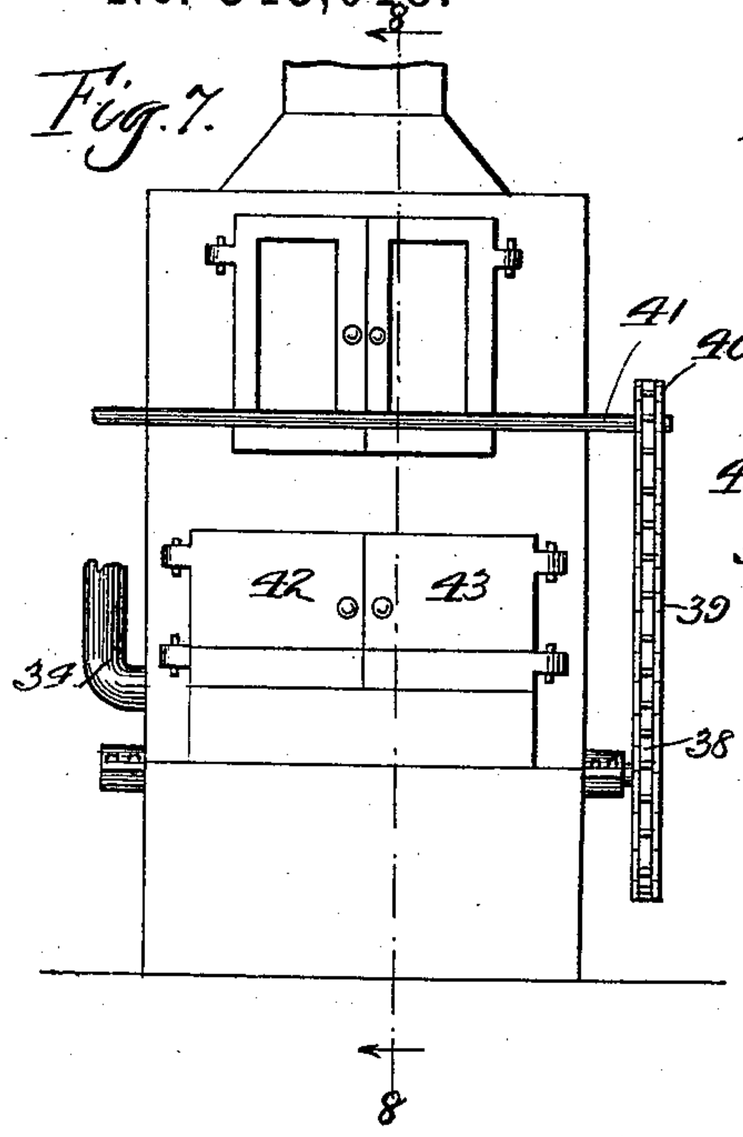


Fig. 8.

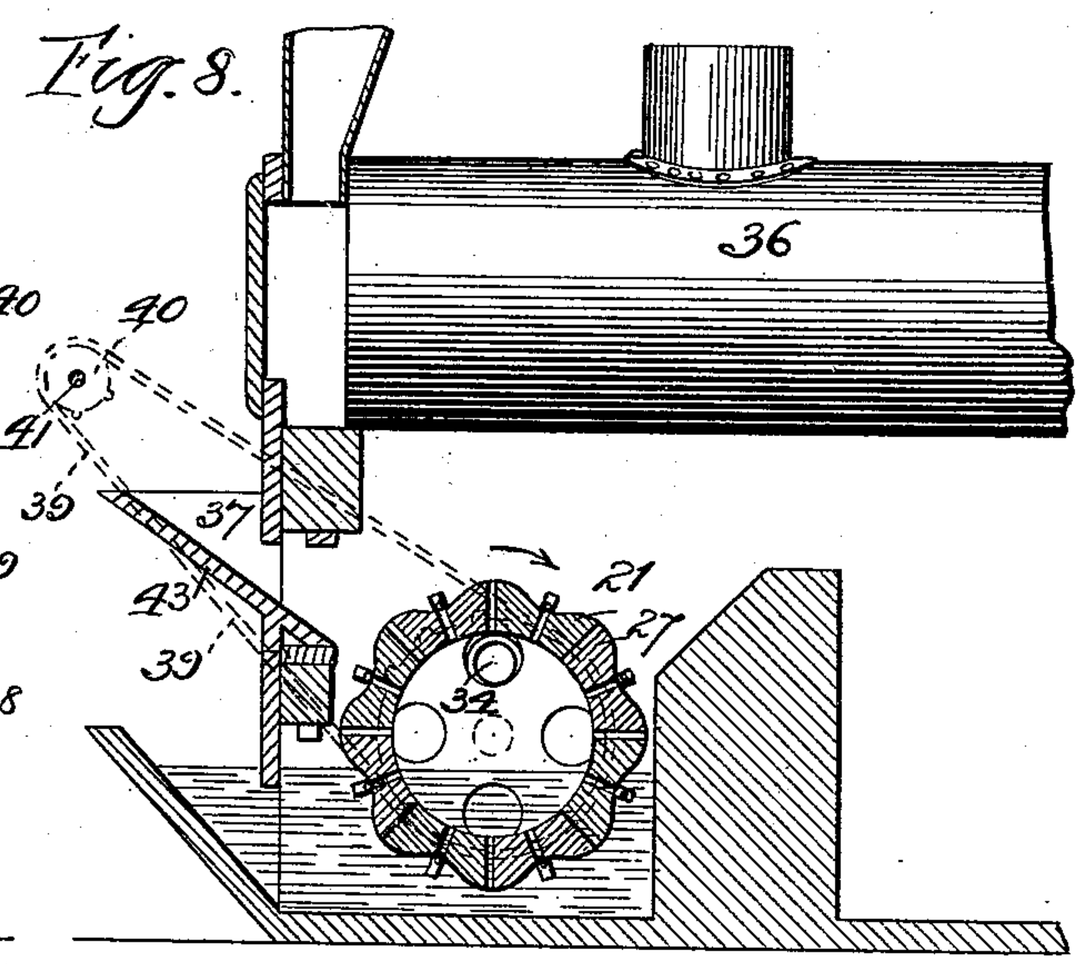


Fig. 9.

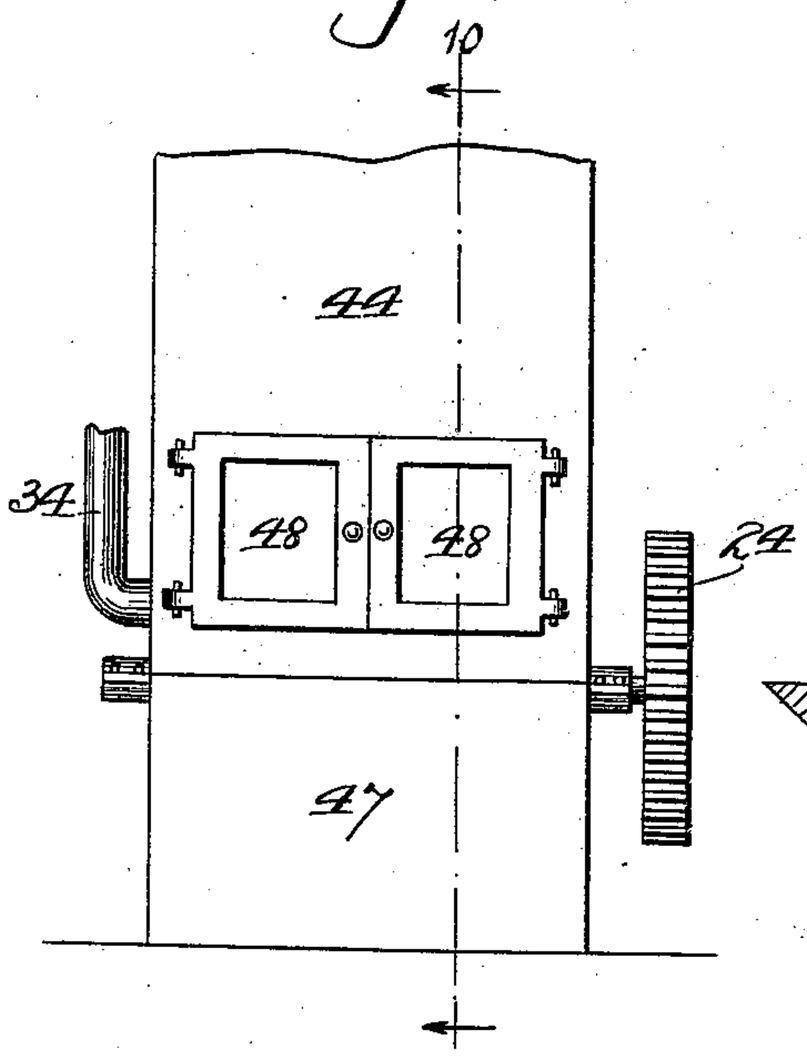
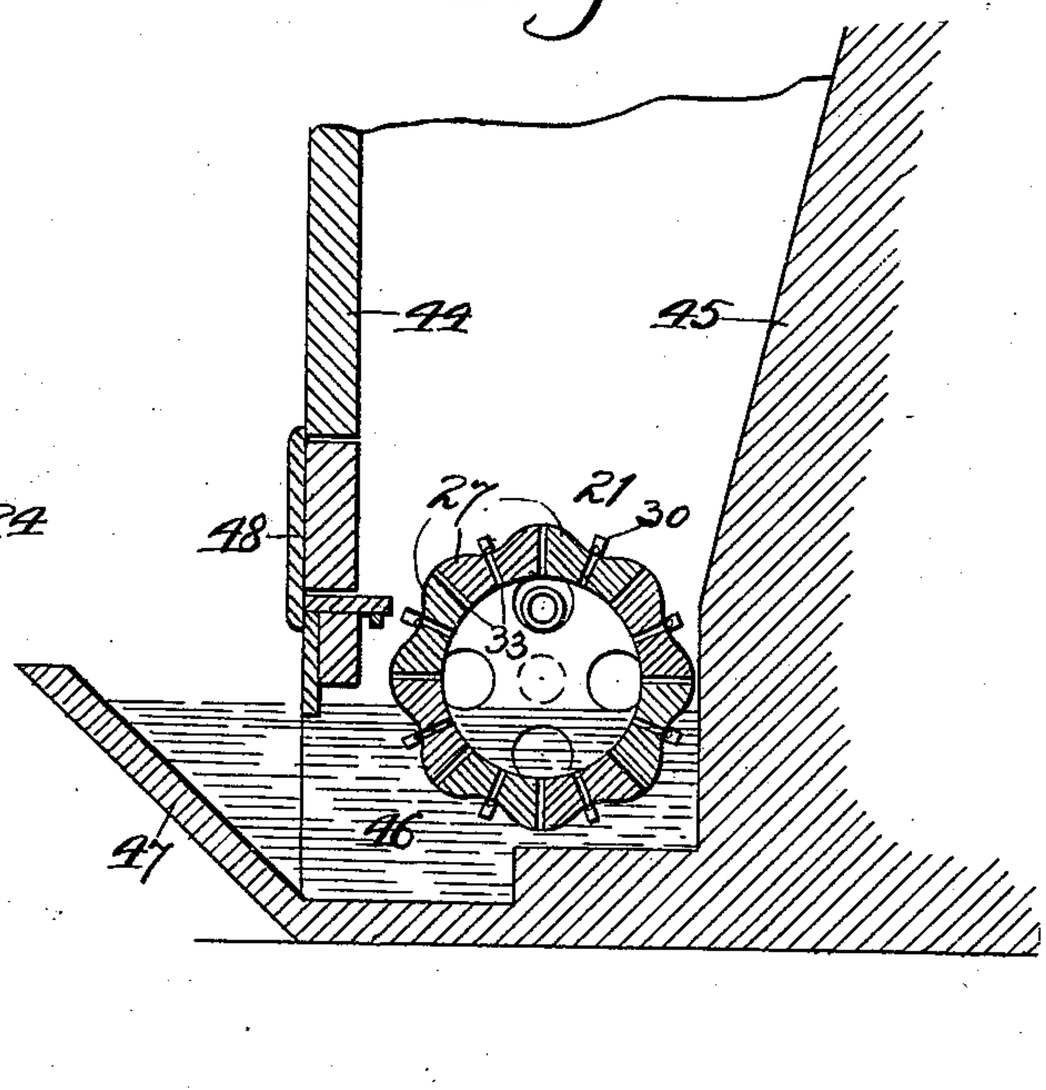


Fig. 10.



Witnesses
Wm. M. Rheem.
Wm. L. Fleming

By

Inventor
Alfred M. Hewlett,
Bonde Adams Pickard & Janson.
Attys.

(No Model.) 3 Sheets—Sheet 3.

A. M. HEWLETT.

FURNACE.

No. 543,018. Patented July 23, 1895.

Fig. 11.

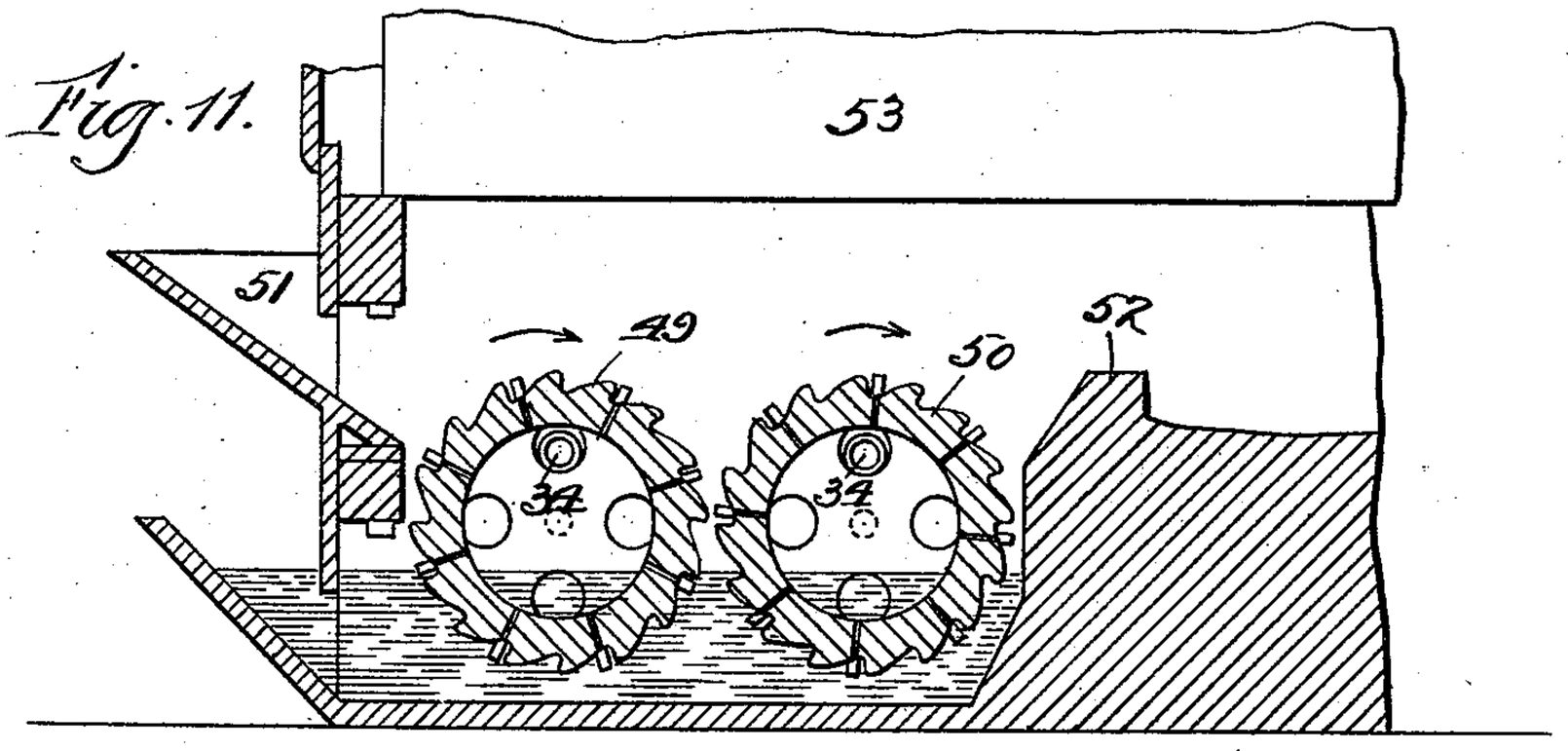


Fig. 12.

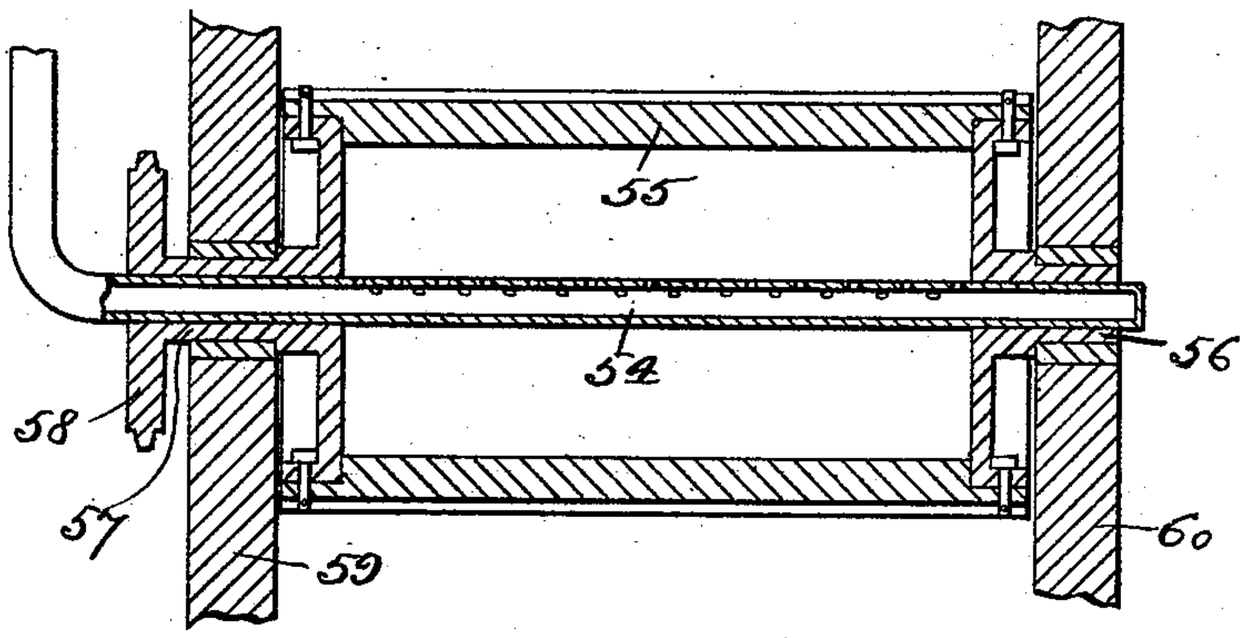
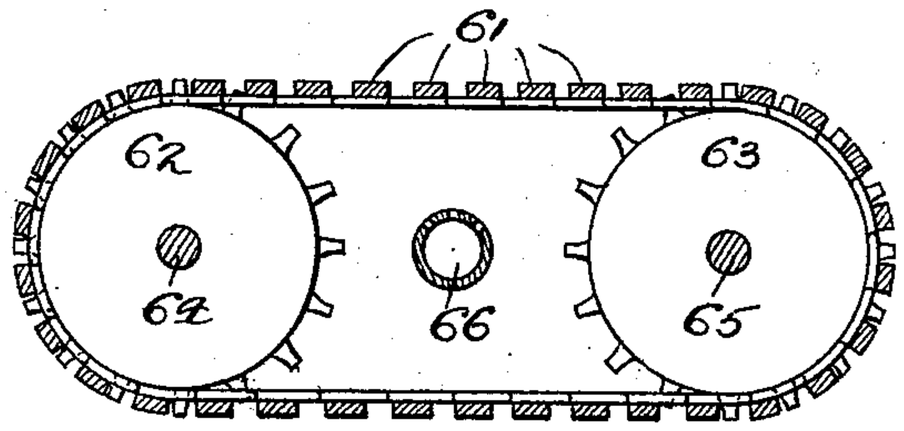


Fig. 13.



Witnesses.
Wm. M. Rheem.
Wm. L. Fleming

Inventor.
Alfred M. Hewlett,
By Bond, Adams, Burton & Jackson.
Atty's

UNITED STATES PATENT OFFICE.

ALFRED M. HEWLETT, OF KEWANEE, ILLINOIS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 543,018, dated July 23, 1895.

Application filed April 8, 1895. Serial No. 544,935. (No model.)

To all whom it may concern:

Be it known that I, ALFRED M. HEWLETT, a citizen of the United States, residing at Kewanee, in the county of Henry and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation of a furnace such as is used for puddling, busheling, or other purposes. Fig. 2 is a longitudinal vertical section of the same. Fig. 3 is an end view of the rotary grate. Fig. 4 is a side elevation thereof. Fig. 5 is an end view of the part shown in Fig. 4, looking to the left. Fig. Fig. 6 is a vertical section on line 6 6 of Fig. 3. Fig. 7 is a front elevation of a steam-boiler furnace having in combination a mechanical stoker. Fig. 8 is a partial vertical section on line 8 8 of Fig. 7. Fig. 9 is a front elevation of a gas-producer. Fig. 10 is a vertical section on line 10 10 of Fig. 9. Fig. 11 is a partial longitudinal vertical section, showing a modified arrangement of the grate. Fig. 12 is a vertical cross-section showing a modified arrangement of the air or steam-blast pipe, and Fig. 13 is a longitudinal vertical section showing another modification of the grate.

Heretofore many attempts have been made to produce a furnace adapted for puddling, busheling, or melting metal, or for producing gas, which would satisfactorily burn ordinary bituminous coal under a blast; but so far as I am aware none of such attempts have proved successful. Such failure has been due principally to the fact that in the furnaces heretofore constructed for the use of soft or bituminous coal, it has been impossible to properly consume the fuel, as with soft coal the blast caused a running together or packing of the fuel into a solid mass of clinkers, thereby seriously interfering with the draft, the result being that the necessary temperature could not be maintained. Another reason for such failure is that such furnaces have not been provided with adequate means for loosening and removing the clinkers, as is frequently necessary, thereby occasioning considerable delay and reducing the tonnage.

By reason of the objections above pointed out the use of soft-coal furnaces for puddling, busheling, &c., has been practically abandoned, crude petroleum being used instead with satisfactory results. Recently, however, owing to the diminished supply of petroleum and its consequent increased cost, as well as to the much greater cheapness of soft coal in certain localities, it has become extremely desirable, if not absolutely necessary, to substitute soft coal for oil as fuel, and to provide a furnace which will produce satisfactory results by the use of such coal is the object of my present invention.

I have discovered that by providing suitable means for facilitating the removal of what clinkers are formed without permitting the furnace to cool, and at the same time securing a much higher temperature than heretofore by generating combustible gases for combustion in the furnace, and thereby preventing to a great extent the formation of clinkers and the packing of the coal upon the grate, all such objections may be avoided and an intensely hot fire which will give very satisfactory results be produced by the use of bituminous coal.

In the drawings I have illustrated several forms of furnaces involving my invention, as will hereinafter be described in detail.

Referring to the drawings, 14 indicates the front wall of a puddling or busheling furnace.

15 indicates the bridge-wall.

16 indicates the ash-pit.

17 indicates the front wall of the ash-pit, which, as shown in Fig. 2, is inclined and projects forward of the front wall of the furnace, so that access may be had to the ash-pit.

18 indicates a door in the front wall of the furnace.

19 indicates a door through which fuel is introduced into the fire-box of the furnace.

20 indicates a door through which the furnace is charged with the metal.

21 indicates a revolving grate, which is mounted on trunnions 22 23, journaled in opposite sides of the furnace. The trunnion 23 carries a gear 24.

25 indicates a pinion, which is suitably supported and meshes with the gear 24, as shown in Fig. 5.

26 indicates a crank for rotating the pinion 25. By this construction the grate 21 may be rotated by hand. If desired, instead of using the crank 25, the grate may be rotated by power, as will be hereinafter described.

As best shown in Figs. 3, 4, and 5, the grate 21 is made up of a number of sections 27, secured to end disks 28 29, such sections being preferably secured in place by bolts 30, through which pass keys 31, as best shown in Fig. 6, the bolts passing through flanges 32 in the end plates 28 29. Each of the sections 27 is provided with a number of perforations or air-passages 33, as best shown in Figs. 2 and 4. The exterior surfaces of the sections 27 are such that the grate will present a roughened or corrugated appearance, sufficiently so to adapt the grate to retain and carry around with it as it is rotated the clinkers as they are formed. Such corrugations or depressions may be of various forms, and I therefore do not desire to restrict myself to the specific form shown.

As best shown in Fig. 2, the grate 21 is mounted between the bridge-wall and the front wall of the furnace, and its diameter is such as to almost fill the space between such two walls, the object of which is to prevent the coal being carried down with the clinkers. As also shown in Fig. 2, the ash-pit is partially filled with water, the depth of the water being sufficient to partially submerge the grate and to extend slightly above the lower edge of the front wall 14. The clinkers and ashes, being delivered from the grate by its rotation, fall into the ash-pit. They may then be raked forward and removed by the operator standing in front of the furnace, owing to the projecting front wall 17 of the ash-pit, as best shown in Fig. 2.

The air or steam blast is admitted to the furnace below the bed of fuel on the grate through a pipe 34, which opens into the upper part of the ash-pit opposite the disk 28, which is in close proximity to the wall of the furnace. In order to permit the air or steam to pass into the grate 21 openings 35 are provided in the disk 28 at suitable intervals, so that as the grate rotates the air or steam will be permitted to pass into it, and thence it passes upward through the openings 33 to the fire. The escape of air in any other direction from the ash-pit will, however, be prevented by the water therein.

Should it be desired to remove any or all of the sections of the grate, this may be accomplished by opening the door 18, when ready access will be given to said sections. The doors 18 are lined with fire-brick to protect them from the intense heat of the furnace.

When the furnace is in operation, at suitable intervals, preferably just after each charge of metal is withdrawn, the grate is partially rotated, thereby causing what clinkers have been formed upon it to be discharged into the ash-pit. This is facilitated by the water therein, which softens the clinkers, so that they drop off more readily. By thus rotating the grate a substantially clean active grate-area is presented, thereby permitting the air or steam blast to pass freely through it. After thus removing the clinkers a fresh supply of fuel is thrown upon the grate and the furnace is again charged with metal.

As will appear from an inspection of the drawings, the air or steam blast enters below the upper or active surface of the grate, which in furnaces of this description, carries a bed of fuel of from twelve inches to sixteen inches in depth, and it has free communication with the water in the ash-pit—that is to say, the blast and the water are not cut off from each other. The result is that the grate being highly heated generates steam under the bed of fire from the water in the ash-pit, and such steam is forced by the suction of the blast up through the grate into the furnace being decomposed in its passage into its elements and forming with the carbon of the fuel certain combustible gases, the combustion of which produces a most intense heat, the fire being one which is especially adapted for treating iron. Furthermore, the steam rising from the water in the ash-pit being carried up by the blast dampens the clinkers upon the grate and softens them, so that when the grate is rotated they become detached more readily.

With my improved furnace I have thus been able to utilize the dirtiest slack-coal without any difficulty whatever and without stopping the furnace, the clinkers being continuously disposed of without the necessity of cooling the furnace, the result being that the tonnage produced has been greatly increased.

If desired, the waste heat may be conducted from the furnace illustrated in Fig. 2 to a boiler, so that it may be utilized in making steam.

In Fig. 8 I have shown a modified arrangement of furnace, the furnace being there shown as arranged to generate steam in a boiler 36. The furnace is also provided with a mechanical stoking device, consisting of a chute 37, through which the coal is fed. The grate 21, instead of being driven by a gear 24, is provided with a sprocket-wheel 38, around which passes a link-belt 39, driven by a sprocket-wheel 40, mounted upon a shaft 41. The shaft 41 may be rotated by any convenient power. The grate 21 rotates in the direction indicated by the arrow in Fig. 8, carrying the fuel over toward the bridge-wall. By this arrangement the grate is continuously moved at a slow rate of speed, it being desirable to regulate the speed, so that by the time the coal is carried from the front of the furnace to the bridge-wall it will have been burned to a clinker or ash, and will be ready to be dropped into the water by the action of the grate. The chute 37 is formed by two doors 42 43, hinged to the front of the furnace and so arranged that when closed they will form a hopper or chute for the passage of the coal. By this arrangement of the fuel-supply and grate the smoke is almost entirely consumed. Instead of using an air-blast under the boiler in this construction I prefer to introduce steam into the furnace, the steam being introduced in substantially the same

way as the air-blast above described in connection with Fig. 2. I prefer to use steam in this connection, because it carries with it sufficient air to give all the draft necessary, and it is more economical than air for the purpose of making steam or heating the water in the boiler, as the air-blast would make the heat too intense and would burn out the boiler.

In Figs. 9 and 10 my modified grate is shown as being used in connection with a gas-producer, 44 being the front wall of the producer, 45 the rear wall, 46 the ash-pit, 47 the front wall of the ash-pit, and 48 the doors of the producer. The operation of the grate is substantially the same in this connection as in the arrangement above described.

In Fig. 11 I have shown a modified arrangement of my improved grate designed more particularly for use in boiler-furnaces, 49 50 indicating two rotary grates, the outer surfaces of which are formed in sections, as above described, said sections having toothed surfaces, the direction of the teeth being toward the rear. The grates 49 50 rotate in the direction indicated by the arrow in Fig. 11, the fuel being deposited upon the grate 49 from a chute 51, and being deposited by the grate 49 upon the grate 50, which carries it over to the bridge-wall 52. 53 indicates the boiler. The advantage of this construction is that the coal is caused to travel a greater distance, thereby insuring its consumption before it reaches the bridge-wall. Instead of arranging the air or steam-blast pipe, as shown in Fig. 2, it may be made to extend through the furnace, forming a shaft for the grate, as shown in Fig. 12, 54 indicating the air or steam pipe, 55 the grate mounted thereupon by means of sleeves 56 57, having a sprocket-wheel 58 or other suitable device, whereby it may be driven. The pipe 54 is perforated, preferably at its upper portion only, to permit air or steam to discharge into the grate. 59 60 indicate the side walls of the furnace.

Fig. 13 illustrates a still further modification of the furnace, consisting of an endless belt 61 of suitable material, said belt being in the nature of a conveyer-belt and being mounted upon wheels or pulleys 62 63 arranged at the opposite ends of the fire-box upon shafts 64 65 respectively. 66 indicates the air or steam blast pipe. The operation of the grate 61 is substantially the same as that of the grates shown in Figs. 2 and 11.

I am aware that to provide a furnace with an ash-pit adapted to contain water and having an opening to permit of the withdrawal of the ashes and clinkers from such ash-pit is not new, and also that a water-sealed ash-pit in itself is not new; but so far as I am aware no one has heretofore produced a furnace having a rotary grate, a water-sealed ash-pit thereunder arranged so that the steam rising from the water in the ash-pit under the influence of the blast may permeate and loosen the clinkers, so that they may readily drop off when the grate is rotated, as above described. Neither has any one heretofore produced a furnace having a grate, a water-sealed ash-pit arranged thereunder, and means for conducting a blast into the ash-pit under the active surface of said grate and in communication with the water in the ash-pit, so that the steam generated from such water will be forced through the bed of fuel and be decomposed, producing a most intense heat, as above described.

That which I claim as my invention, and desire to secure by Letters Patent, is—

1. In a furnace, the combination with a water-sealed ash-pit, of a rotary grate, and means for introducing a blast into the furnace below the active surface of the grate, said blast having communication with the water in the ash-pit, whereby the steam generated from such water will be carried through the bed of fuel with the blast, substantially as described.

2. In a furnace, the combination with a water-sealed ash-pit, of a cylindrical rotary grate partly submerged in the water in the ash-pit, said grate being provided with perforations, and means for introducing a blast of air into said grate and in communication with the water in the ash-pit, whereby the steam generated by the heated grate will be carried with the blast through said grate, substantially as described.

3. In a furnace, the combination with a rotary grate, of a water-sealed ash-pit arranged thereunder, said ash-pit having an external opening whereby the ashes may be removed without interrupting the operation of the furnace, and means for introducing a blast into the space between the upper surface of the grate and the water in the fire-box, such blast having access to such water, whereby the steam generated by the heated grate will be carried with the blast through said grate, substantially as described.

4. In a furnace, the combination with a bridge wall and a front wall forming a fire-box, of a rotary cylindrical grate in said fire-box, said grate having perforations in its surface, a water-sealed ash-pit under said grate, said ash-pit having an external opening, and means for introducing a blast into said grate, said blast having access to the water in the ash-pit, substantially as described.

5. In a furnace, the combination with a water-sealed ash-pit, of a grate, and means for introducing a blast into the furnace below said grate, said blast having communication with the water in the ash-pit, whereby the steam generated from such water will be carried through the bed of fuel with the blast, substantially as described.

ALFRED M. HEWLETT.

Witnesses:
CHAS. I. PIERCE,
H. L. DAY.