A. HOFMANN.

MECHANICALLY STOKED FURNACE.

APPLICATION FILED OCT. 31, 1918.

1,388,714.

Patented Aug. 23, 1921.

2 SHEETS—SHEET 1.

Fig. 1.

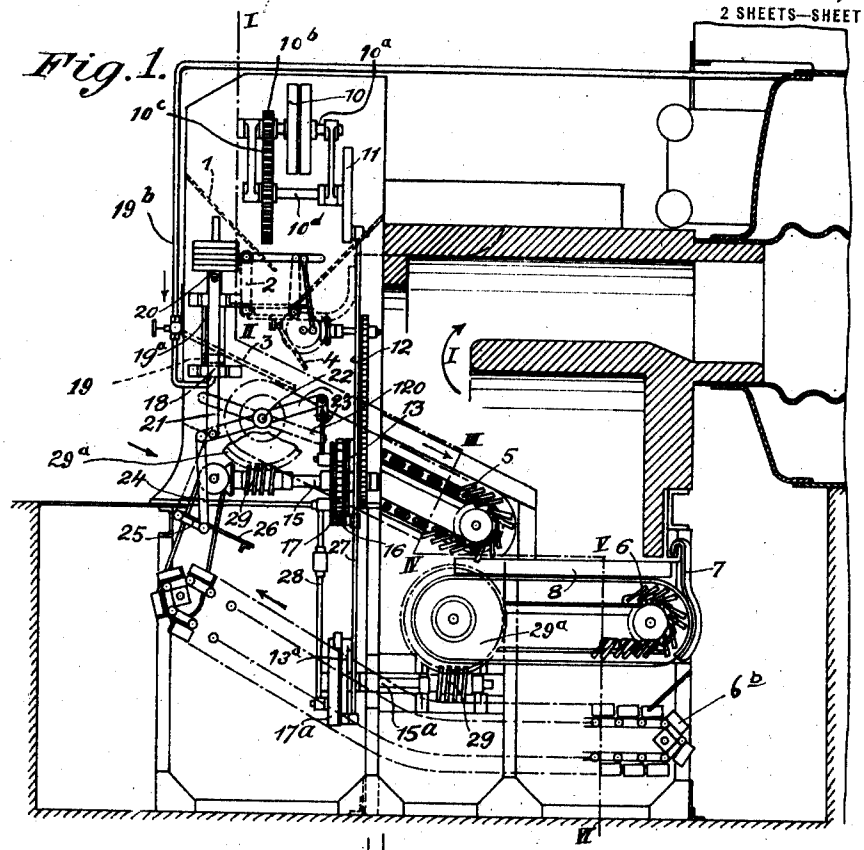


Fig. 4.

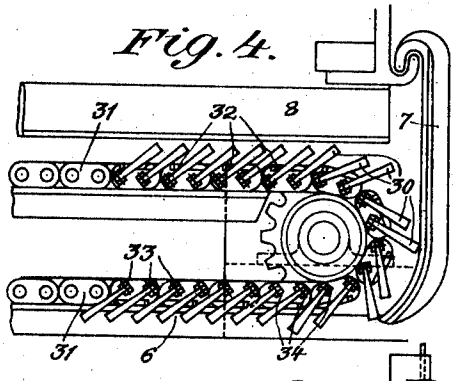


Fig. 10.



Fig. 5.

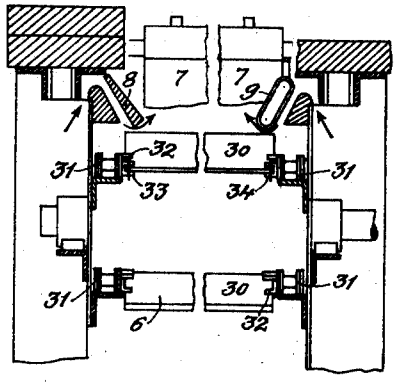
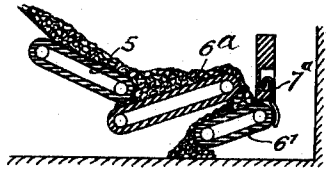


Fig. 5a.

Fig. 9.



Inventor.
A. Hofmann.
By L. R. Kerslake
Atty.

A. HOFMANN.

MECHANICALLY STOKED FURNACE.

APPLICATION FILED OCT. 31, 1918.

1,388,714.

Patented Aug. 23, 1921.

2 SHEETS—SHEET 2.

Fig. 2.

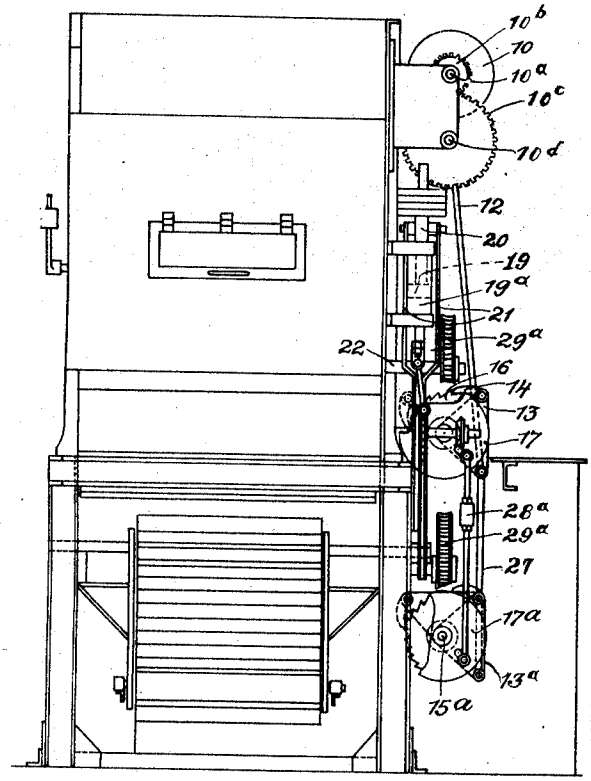


Fig. 3.

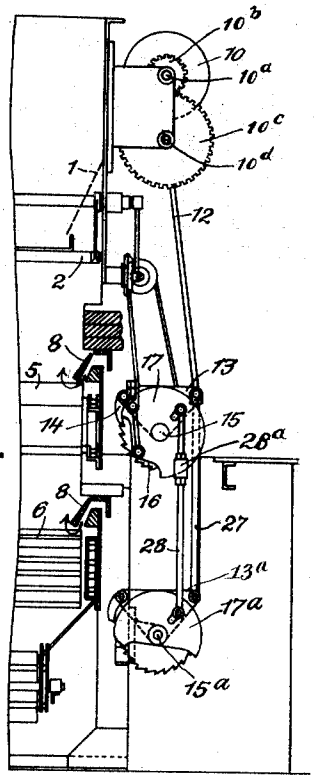


Fig. 6.

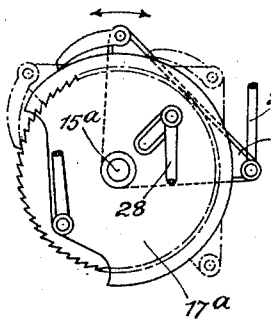


Fig. 7.

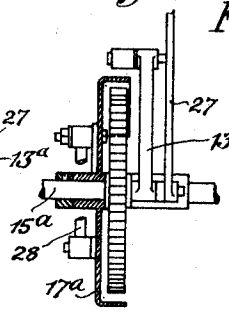


Fig. 8a.

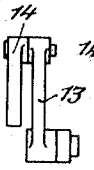
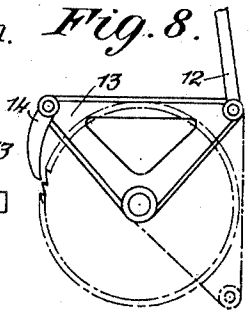


Fig. 8.



Inventor.
A. Hofmann
By C. R. Kerslake
Atty

UNITED STATES PATENT OFFICE.

ALFRED HOFMANN, OF ZURICH, SWITZERLAND.

MECHANICALLY-STOKED FURNACE.

1,388,714. Specification of Letters Patent. Patented Aug. 23, 1921.

Application filed October 31, 1918. Serial No. 260,560.

To all whom it may concern:

Be it known that I, ALFRED HOFMANN, a citizen of the Republic of Switzerland, residing at 7 Asylstrasse, Zurich, in the Canton of Zurich, Republic of Switzerland, have invented certain new and useful Improvements in Mechanically-Stoked Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention has for its object to provide an improved mechanically-stoked furnace. According to this invention the improved furnace includes two or more traveling grates arranged one above the other in such a manner that each lower traveling grate receives the fuel dropping from an upper traveling grate and is adapted to convey away the slag and ashes.

Figure 1 is a side view of a furnace provided with my improvements. In this view certain parts are shown in section, certain parts are shown diagrammatically and other parts are shown partly broken away for the sake of clearness.

In the accompanying drawings:—

Fig. 2 is an end view of the furnace.

Fig. 3 is a front elevation with parts in section taken on the line I—II—III—IV—V—VI of Fig. 1.

Fig. 4 is a diagrammatic detail sectional view of one of the traveling grates.

Fig. 5 is a transverse vertical sectional detail view of the mechanism shown in Fig. 4 and illustrating means for air cooling one of the plates which is arranged on the side of the fire-box to prevent the slag from adhering to the sides of the brickwork casing of the furnace.

Fig. 5ª is a view similar to Fig. 5 but showing a modification in which the plate is water-cooled.

Figs. 6 and 7 show a side view and sectional view respectively of the pawl and ratchet mechanism used in driving one of the grates.

Fig. 8 is a side view of the pawl and ratchet mechanism used in driving the other grate.

Fig. 8ª is a detail end view of the pawl mechanism for driving the last mentioned grate.

Fig. 9 is a diagrammatic sectional view of a modified form of the invention.

Fig. 10 is a top plan view of a couple of the flap plates used for preventing the entrance of an excessive amount of air at the exit end of one of the grates.

Referring first to Figs. 1 to 8ª and 10, the fuel is charged into a hopper 1 from which it is delivered by a power-driven feeder 2 of known type and an inclined plate 3 on to the upper traveling grate 5. In order to prevent pieces of coal from rolling down and the advancing coal from becoming too highly heated a damper 4 is provided which is adapted to be operated from the outside and serves also to prevent entrance of the hot gases into the fuel-feed passage. This damper is raised when fuel is being fed on to the grate 5. The fuel is carried along by the grate 5 and then drops on to the lower traveling grate 6. During this advance the fuel is pre-heated, gasified and ignited by the forwardly deflected fire gases (indicated by the arrow I), the resulting smoldering or partial combustion causing at first an increase in its volume and afterward a decrease in its volume when the fuel has become completely degasified.

In passing from the upper grate on to the lower grate the layer of caked fuel is broken up and turned by the outwardly opening grate bars in somewhat the same manner as is done in hand-stoking with a poker for the purpose of loosening the layer of fuel.

The removal of the slag takes place at the exit end of the lower grate where the slag is removed continuously as the grate travels.

The larger pieces of coal pass on to the lower grate 6 while still only in the first stage of combustion, whereas the smaller pieces, the dust and the small coal have had sufficient time to be completely burned. The result of this is a diminution in the volume of the burning fuel so that, as is generally the case with traveling grates, vacant spaces or "holes" occur in the layer of burning fuel through which an injurious excess of air passes up through the fuel. For the purpose of diminishing these "holes" and the losses occasioned thereby, and so as to keep the lower grate always completely covered,

the speed of the lower grate is reduced as hereinafter described relatively to the speed of the upper grate in proportion to the diminution in volume of the fuel layer in such a manner that the large pieces shall also be completely burned, and that only slag, that is only incombustible matter, shall drop off at the rear.

In order to prevent the entry of an injurious excess of air at the point where the slag is removed, freely movable depending flaps 7 are provided at the exit of the lower grate. These flaps are caused by their own weight to bear against the grate bars and thus act as a closure against the entry of air in all positions of the grate. When a third grate 6′ is employed, as shown in Fig. 9, for carrying away the slag and travels therefore only at a very low speed, the flaps 7^a are provided at the third grate and the layer of slag is kept sufficiently high to prevent any entry of air between the two grates.

In order to prevent the slag from adhering to the sides of the brickwork casing of the furnace, both the longitudinal sides of the grate are provided with metal plates 8 or 9 which are prevented from burning by being cooled by means of air as at 8, or water as at 9. The residues, such as slag and ashes, are removed from underneath the grate by a conveyer 6^b and raised to a point whence they can be taken away by hand.

The furnace mechanisms are driven from a pulley 10 fixed on a shaft 10^a. This shaft carries a fixed gear 10^b that drives a gear 10^c fixed on a shaft 10^d, which also carries a fixed constant-throwcrank 11. This crank imparts a constant throw through a connecting rod 12 and a lever 13 to a pawl 14. The lever 13 is loosely mounted on a shaft 15. Since the amount of coal to be burned must be varied to suit the steam consumption, it is necessary to vary accordingly the speed of the ratchet wheel 16, which is fixed on the shaft 15 and controls all the mechanisms. This variation is effected by arranging the pawl 14 to slip idly over more or less of the periphery of a shield 17 when a reduced steam production is desired. By this means the speed of the shaft 15 may be varied at will from *nil* to the maximum, and the feed and removal of the fuel may be regulated according to requirements. The alteration in the position of the shield 17 is effected by means of a piston 19 working in a cylinder 19^a and being under the influence of boiler pressure through the medium of the pipe 19^b. This piston moves up when the boiler pressure rises and descends when the boiler pressure falls. The movement of the piston is transmitted, by rods 21 connected to the piston rod 20, to a lever 23 fulcrumed on the shaft 22. One end of the lever is connected by a rod 120 to the shield 17 and the other end of the lever is connected by a link 24, to a lever 25 which controls the air inlet flap 26.

The motion for driving the lower grate is transmitted from the upper lever 13 through the rod 27, which connects the upper lever to the lower lever 13^a, and the shifting of the lower shield 17^a is effected from the upper shield 17 through the medium of the connecting rod 28 which may be lengthened or shortened by means of a threaded sleeve 28^a, whereby the shield 17^a can be given more or less lead over the upper shield 17, and thus the speed of the grate 6 can be reduced as desired relatively to the speed of the upper grate 5.

The grates are driven by means of worm gears 29 mounted on the shafts 15 and 15^a. These gears engage worm gears 29^a fixed to the drive shafts of the grates.

The shaft 15 also supplies the motion for driving the mechanism actuating the fuel feeding apparatus 2 and the slag-removing conveyer underneath the grates 5 and 6. By this means all the drives for adapting the combustion to the steam consumption are derived from a single shaft 15. As above stated the grates are constructed as traveling grates for the purpose of preventing the losses that occur with ordinary grates due to small coal dropping through. The transversely arranged grate bars 30 are held at both ends in chains 31 by means of noses 32, 33 projecting from the inner fishplates of the chains, and are kept from falling out when inverted by means of pins 34.

As the grate bars pass over the chain wheels the bars open outwardly and thus form wide spaces between the bars whereby the layer of caked fuel is broken up.

The improved furnace may be applied to various types of boilers but in the drawings I have shown it applied to a flue boiler.

In the modification illustrated in Fig. 9, the fuel drops from the second slightly upwardly inclined traveling grate 6^a on to a likewise inclined third traveling grate 6′ whose speed is somewhat less than the speed of the grate 6^a.

What I claim is:—

1. In a furnace, an inclined upper traveling grate, a lower traveling grate extending partially beneath the upper grate and receiving the fuel directly dropping from the upper grate and conveying away the slag, means for driving the traveling grates at adjustable different speeds, and boiler steam controlled means for regulating the air supply and the conveying away of the slag to suit the steam consumption.

2. In a furnace, an inclined upper traveling grate, a lower traveling grate extending partially beneath the upper grate and receiving the fuel directly dropping from the upper grate and conveying away the slag,

a rotatable shaft, a crank actuated by said shaft, a main shaft for driving the upper traveling grate, a ratchet mechanism placed on the main shaft and actuated by the crank to impart to the shaft a step by step movement, a shield loosely mounted on the main-shaft, automatic means actuating said shield to vary the extent of said step by step movement for causing the main shaft to be driven automatically at different speeds, a third shaft for driving the lower traveling grate, a ratchet mechanism placed on the said shaft and actuated by the said crank to impart to this shaft a step by step movement, a shield loosely mounted on the third shaft and connected to the first mentioned shield for automatically varying the extent of the last mentioned step by step movement for causing the third shaft to be driven automatically at different speeds.

In testimony whereof, I have signed my name to this specification.

ALFRED HOFMANN.