Feb. 15, 1938. L. STEINMÜLLER 2,108,394

FURNACE GRATE

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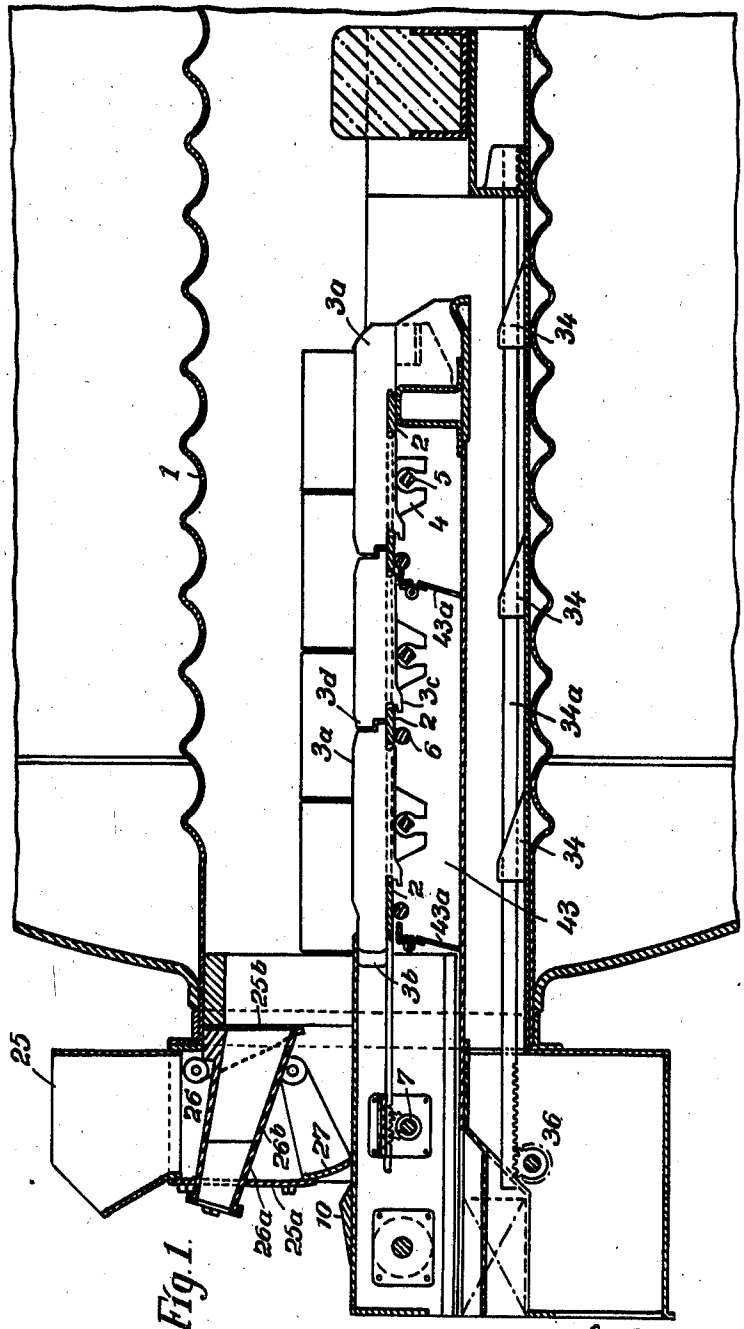


Fig. 1.

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FURNACE GRATE

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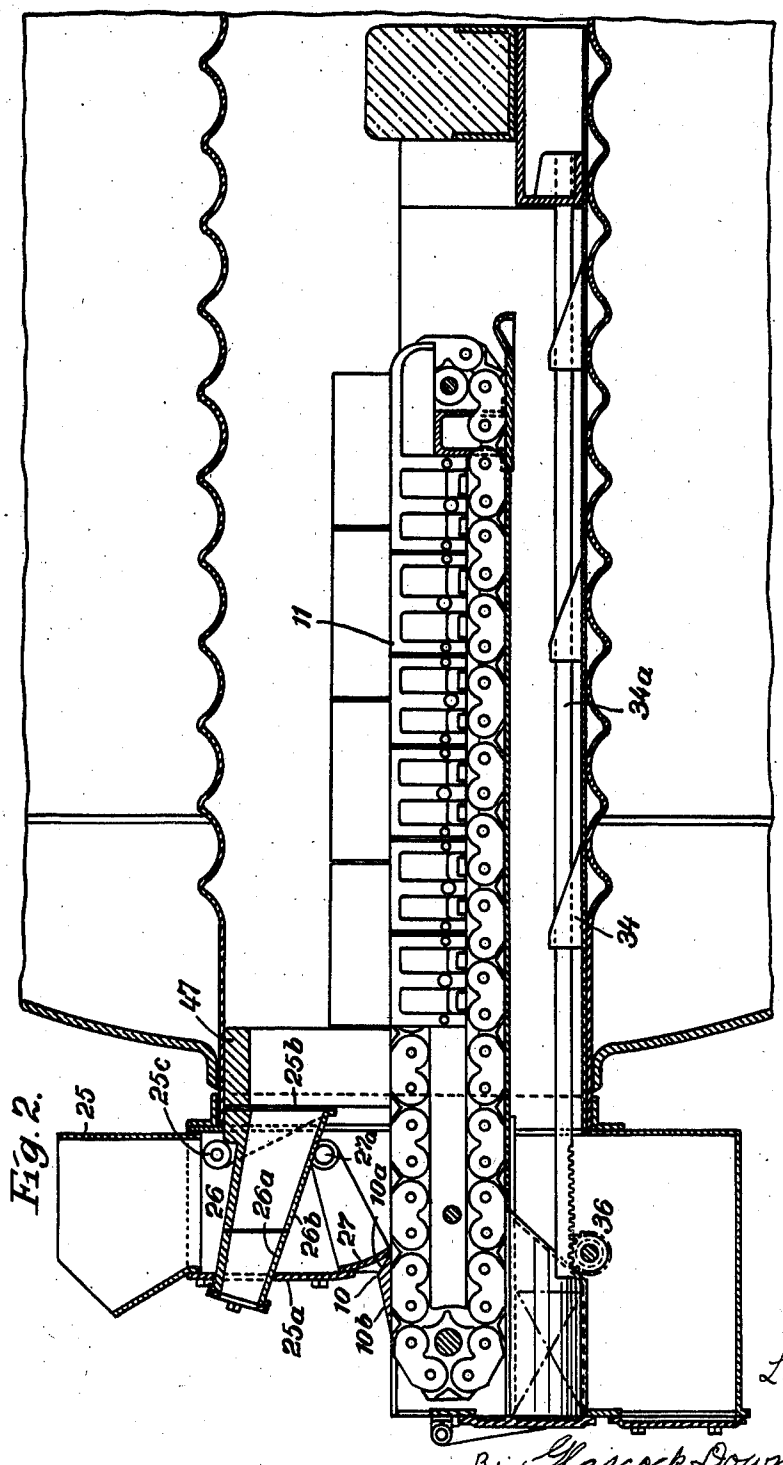


Fig. 2.

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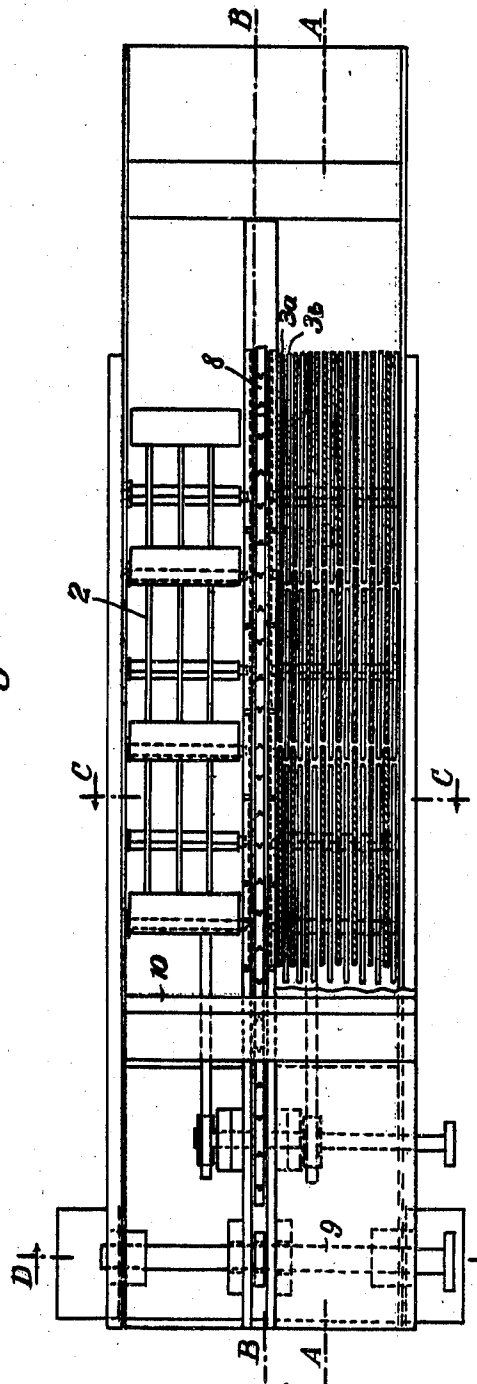
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Feb. 15, 1938. L. STEINMÜLLER 2,108,394

FURNACE GRATE

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Fig. 3.



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Feb. 15, 1938. L. STEINMÜLLER 2,108,394

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Fig. 4

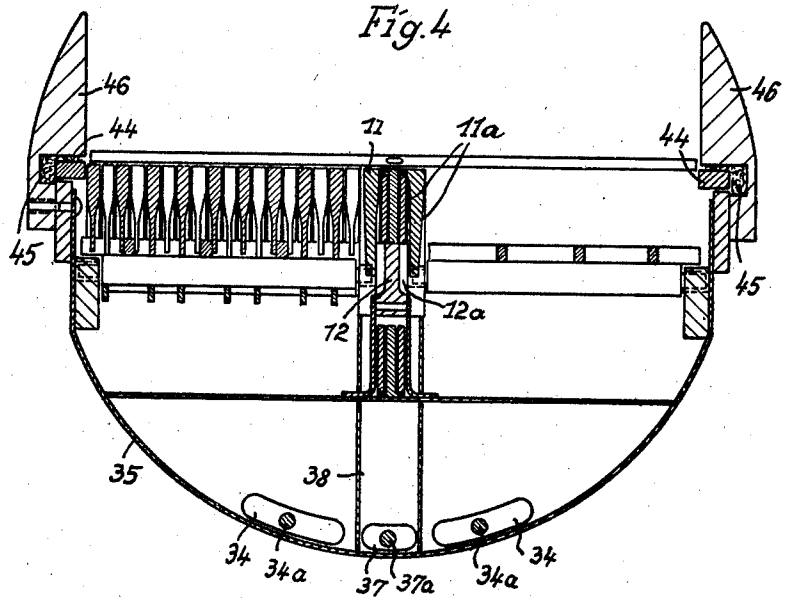
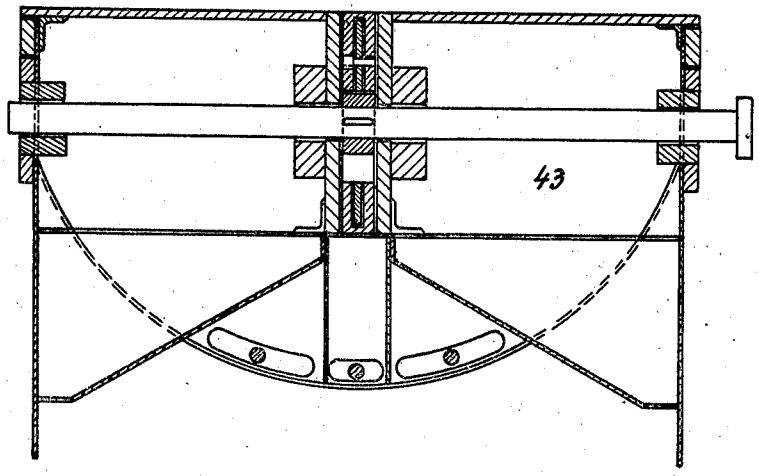


Fig. 5



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FURNACE GRATE

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Fig.6

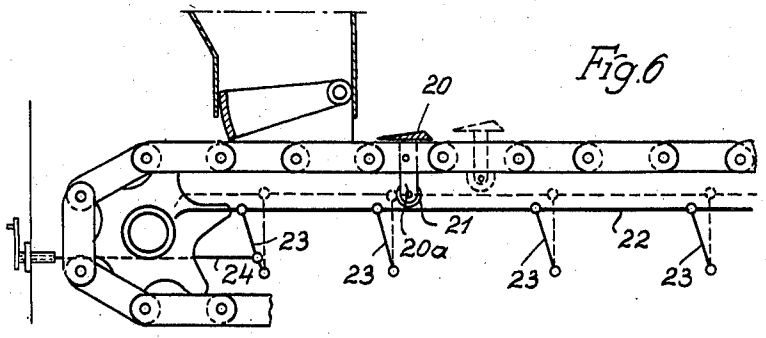
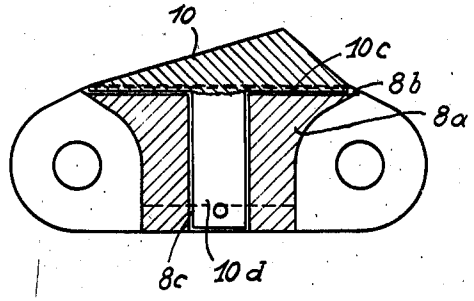


Fig.7



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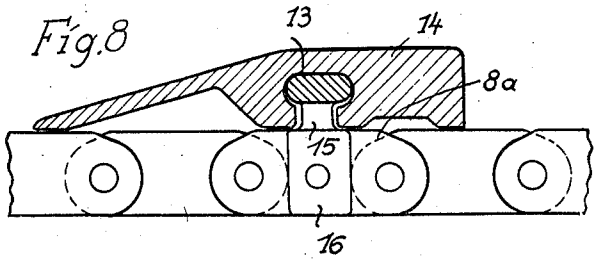
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Feb. 15, 1938. L. STEINMÜLLER 2,108,394

FURNACE GRATE

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Fig.8



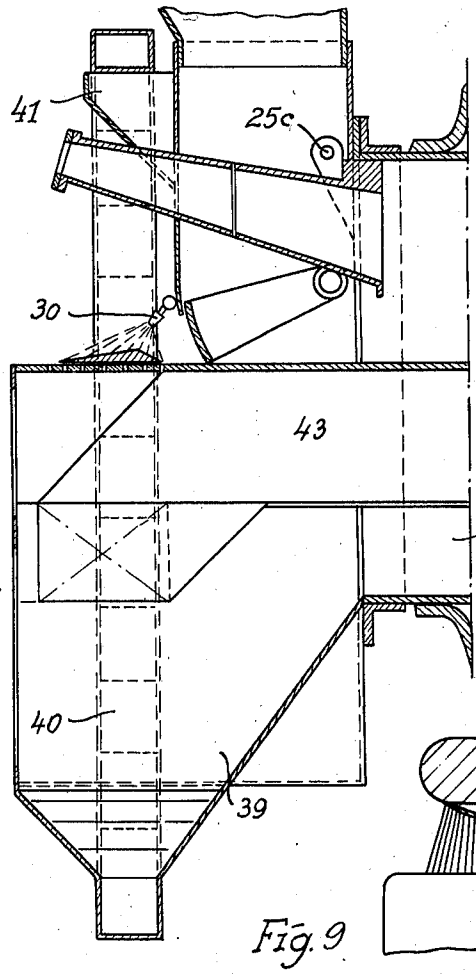


Fig.10

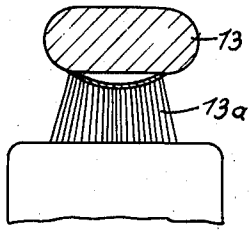


Fig.9

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Patented Feb. 15, 1938 2,108,394

UNITED STATES PATENT OFFICE

2,108,394

FURNACE GRATE

Lebrecht Steinmüller, Gummersbach, Germany

Application November 30, 1935, Serial No. 52,423
In Austria December 3, 1934

10 Claims. (Cl. 110—33)

This invention relates to a horizontal grate, that is to a grate, the bars of which lie in one plane only. Such grates have hitherto been useful only for relatively small outputs, so that their advantages could only be made full use of for small plants. As is to be expected such grate constructions are relatively primitively constructed. For instance, the loosening of the fuel has only been effected with the aid of stirring implements operated by hand and consequently it was only possible to attend to relatively small grates with such stirring implements.

According to the invention a horizontal grate is provided which can be constructed in any desired size and the charging and stirring of which and the removal of ash is effected entirely automatically.

An essential feature of the invention consists in this that the grate which is composed of a number of bundles of fire bars disposed longitudinally one behind the other is provided with one or more slicing and conveying rammers which, mechanically driven, are arranged so as to be capable of being reciprocated on or above the grate surface longitudinally of the same.

The particular features of the drive, the shape and the disposition of these rammers will be described in detail hereinafter.

A further feature of the invention is the peculiar arrangement of the fire bars, which is such that alternate fire bars are stationary and capable of being reciprocated. The invention further relates to the manner in which the fuel is fed, the possibility of observing the fire during operation, the removal of the clinker, ash and the fuel which has not yet been burnt, and the supply of air under pressure to the grate and the accessibility of the grate. A further advantage of the grate construction according to the invention resides in this that the grate surface may without difficulty be made of any desired length and also of any width through the provision of any number of separate grates next to one another. When several grates are disposed next to one another the rammers are preferably operated alternately or in opposite directions to one another, as in this way the fluctuations in the air supply caused by the stirring are equalized and as uniform a combustion of the fire gases as possible is obtained.

The invention is described in detail in the following description of a number of constructional examples which are illustrated in the accompanying drawings in which—

Figure 1 is a vertical longitudinal section through the grate on line A—A of Figure 3,

Figure 2 is a vertical longitudinal section through the grate on line B—B of Figure 3,

Figure 3 is a plan view of the grate surface, only one half of the grate being fitted with fire bars,

Figure 4 is a vertical cross-section through the grate on line C—C of Figure 3 to an enlarged scale,

Figure 5 is a vertical cross-section on line D—D of Figure 3 to an enlarged scale,

Figure 6 is a vertical longitudinal section at the chain with a rammer which is vertically adjustable,

Figure 7 shows another way of fixing the rammer to a special chain link,

Figure 8 shows a different way of fixing the rammer to a special chain link,

Figure 9 shows a cleaning device on the arrangement shown in Figure 8,

Figure 10 is a vertical longitudinal section through the front part of the grate with a cleaning device for the rammer and means for returning dropped fuel to the hopper.

In the constructional example shown in Figure 1 the grate is mounted in a furnace flue 1. The grate is composed of frames 2 on which rest the fire bars 3. Movable fire bars 3*a* and stationary fire bars 3*b* are provided. Both the stationary and the movable fire bars are supported by the frames 2. The stationary fire bars are provided with downwardly directed lugs 4 which embrace rotatably journalled bars 5. The bars 5 which are preferably of square cross-section stand on edge when in the operative position (Figure 1), so that in conjunction with the peculiar shape of the downwardly directed lugs they prevent the fire bars from being lifted off. For preventing the movable fire bars 3*a* from being lifted off the frames 2, the movable fire bars are provided at their forward end with a bottom projection 3*c* which engages under the frame 2 and are provided at the top with a projection 3*d* which engages over the correspondingly recessed rear end of the adjacent fire bar. At the front end of the grate all the fire bars are provided at their forward end with a flat depression, so that they engage under the front grate plate. The frame itself rests on rollers 6 and has a reciprocating motion imparted to it by a toothed drive 7. The reciprocating motion prevents the gaps between the fire bars from becoming clogged up, causing them to be continuously cleaned. This arrangement also pre-

vents cohesive cakes of clinker forming on the grate surface. In the middle of the grate a chain **8** is provided. This chain is acted on by driving means **9** which impart to it intermittently also a reciprocating motion. The chain carries a rammer **10** which, as shown in Figure 1, extends transversely right across the grate. The rammer **10** rests directly on the surface of the grate and is wedge-shaped. The rear surface **10***a* of the rammer, which faces in the direction of feed, is steeper than the front surface **10***b* which faces towards the front of the grate. At either side of the chain are cheeks **11** for guiding the chain. They prevent the chain coming in contact during its to and fro motion with the fire bars which are also in motion. These cheeks **11** are provided at either side with recesses **11***a* (see Figure 4), for giving the combustion air access both to the chain side and to the fire bar side. The chain itself runs on a longitudinal beam **12** which is also provided with recesses **12***a* for giving the air access.

The chain is driven by a driving mechanism disposed externally of the grate, which may be so constructed through employing control levers and couplings that the rammer can travel at different speeds along paths of different lengths on the grate. The driving mechanism may also be so constructed that the chain continuously performs to and fro motions even when the rammer is at rest. The object of this is to keep the air gaps between the chain and the side cheeks clean, just as in the case of the grate, and to prevent lumps of clinker forming which adhere to the chain and the side cheeks and thereby bring the chain to rest.

In the constructional form shown in Figure 7 the rammer is provided with a projection **10***a* which engages in a correspondingly formed groove **8***b* of the supporting chain member **8***a*, thus increasing the security against lateral twisting. For the rest the rammer **10** is provided with a lug **10***d* which engages in a corresponding hole **8***c* in the chain member and is also pinned to the chain member.

For enabling the rammer to be easily adapted to the fuel or the load, that is, to make it possible to use another shape of rammer, the rammer is divided as shown in Figure 8. A support **13** extending the full width of the grate is used, over which plates **14** are pushed, which form the rammer. These plates can as required be slid off sideways and be replaced by plates of another shape, when the rammer has been brought in front of the fuel hopper. The support **13** is connected by a neck part **15** to a lug **16** which is inserted in the supporting chain member **8***a*. As in this case the cleaning action of the plates **14** is not as great as when a continuous rammer is used, it is advisable to provide below the support **13** a separate cleaning device **13***a* in the form of wire brushes, scrapers and the like (Figure 9).

The object, namely to have a somewhat raised rammer available for a deeper layer of fuel, may be fulfilled, as shown in Figure 6, by providing a single rammer **20** which is vertically adjustable. This rammer has its lower end **20***a* extending right through the chain. This lower end carries a roller **21** which travels on a guiding rail **22**. The guiding rail **22** is vertically adjustable. It may for instance be mounted on rockable levers **23** which are controlled by rodwork **24** which is carried through to the outside.

For the supply of fuel a hopper **25** is provided. For enabling the fire to be kept under observation while in operation, an observation tube **26** is mounted in the hopper so as to extend through its lower end. For enabling the grate to be exposed from the front end, the lower part of the hopper is made so as to be capable of being hinged upwards. For this purpose the observation tube is also divided in such a manner that the forward half **26***a* of the tube is mounted in the front wall **25***a* of the hopper, while the rear half **26***b* of the observation tube is fixed to the rear wall **25***b* of the hopper. The front wall **25***a* of the hopper is arranged to hinge to the side like a door, while the rear wall **25***b* of the hopper can be hinged upwards about a pivot **25***c*.

The lower end of the front wall **25***a* of the hopper is formed by a pivoted door **27** which can be swung upwards about the pivot **27***a*. This takes place when the rammer **10** slides past below the lower edge of the pivoted door. In the example shown in Figures 1 and 2 the pivot **27***a* is disposed inside the hopper.

In many cases it may be of advantage to provide means for cooling the rammer. This is effected as shown in Figure 10 by means of a water rose **30** disposed in the vicinity of the front wall of the hopper.

The grate operates in the following manner: During its operative motion towards the end of the grate the rammer always pushes a portion of the fuel lying directly on the grate surface towards the rear, at the same time sliding along under the fuel. At each place it thus only feeds the fuel lying there for a short distance towards the rear, at the same time pushing it up on to its back. Thus at the front end of the grate the fresh fuel is conveyed further towards the back, while towards the back end of the grate the rammer conveys the fuel that is burning there onwards and at the far end of the grate pushes a portion of the clinker which is present there over the end of the grate into the ash pit. During its return motion however the rammer, owing to the very slight inclination of the surface **10***b*, slides along below the fuel without producing any substantial displacement of the fuel towards the front.

For conveying away the clinker the bars **34***a* are provided which are fitted with conveying rails **34** and are mechanically driven. In the constructional example which is intended for a furnace flue the entire grate with the frame and the ash pit is enclosed in a trough **35**, so that the bottom of the trough at the same time forms the ash chute. For driving the reciprocating bar **34***a* a rack and pinion drive **36** or any other suitable driving device may be employed.

The driving means just referred to also actuate conveying members **37** on bars **37***a*, which are disposed below the chain drive for the rammer or rammers (see Figure 4). These conveying members **37** with the conveying bar **37***a* are disposed in a separate channel **38** which serves as a collecting space for the unburnt coal which is conveyed towards the back by the chain members. This channel **38** preferably opens (see Figure 10) at the front end of the grate into a separate collecting chamber **39** in which is mounted an upwardly leading conveyor device **40**. The conveyor device **40** conveys the fuel into a subsidiary hopper **41** disposed on the front wall of the hopper **25**, from where the fuel passes through the hopper back into the fire space. The separate collecting chamber **39** may be provided with a water supply, so that the coal which is intermingled with glow-

ing embers can be quenched before being returned to the hopper.

For making the grate suitable for a very high specific output means are provided for the supply of air under pressure. For this purpose an air-box **43** is provided below the grate, to which air is supplied under pressure by a blower. The air-box may be divided up by flaps **43***a*, through the opening and closing of which the grate, more particularly the grate end, can be cut off more or less from the supply of air under pressure. The supply of the air under pressure is effected at the front of the grate from the side.

In order to prevent that too much air will pass through at the side of the grate, more particularly in the case of under-grate blast, air obstructing rails **44** are disposed on either side of the grate (see Figure 4), which are pressed by an elastic medium, for instance asbestos wool **45**, against the fire bars. This also provides means for allowing for the expansion of the fire bars when they become heated.

The grate bed is bounded on either side by fire resisting bodies **46** which on the outside are adapted to the shape of the furnace flue. These bodies are not required in furnaces which are built into special fire chambers, as in that case they are replaced by the side walls. It is also advisable to provide a fire resisting lining **47** at the front end of the grate.

I claim:

1. In a furnace, a horizontal grate, a wedge shaped rammer extending over the entire width of said grate, means comprising a continuous flexible band entirely below the plane of the grate surface for reciprocating said rammer longitudinally over the surface of the grate, the surface of the rammer directed toward the rear end of the grate being steeper than the surface directed toward the front of the grate.

2. The apparatus as claimed in claim 1 in which the rammer consists of a plurality of parts, a transverse beam on which said parts are detachably held and means for connecting said beam to the reciprocating means so that it will move therewith.

3. The device as claimed in claim 1 in which the means for reciprocating the rammer comprises a chain and a rail longitudinal of the furnace on which said chain travels, said rail being provided with lateral recesses for the supply of air.

4. In a furnace, a horizontal grate, a wedge-shaped rammer extending over the entire width of said grate, means for reciprocating said rammer longitudinally over the surface of the grate, the surface of the rammer directed toward the rear end of the grate being steeper than the surface directed toward the front of the grate, the means for reciprocating the rammer comprising a chain and a rail longitudinal of the furnace on which said chain travels, said rail being provided with lateral recesses for the supply of air, and stationary side cheeks are provided laterally of the chain said side cheeks having recesses for supplying air to cool the chain and for auxiliary combustion air.

5. The device as claimed in claim 1 in which a water pipe is provided along the front of the furnace and means for spraying water from said pipe on the rammer.

6. In a furnace, a horizontal grate, a wedge-shaped rammer extending over the entire width of said grate, means for reciprocating said rammer longitudinally over the surface of the grate, the surface of the rammer directed toward the rear end of the grate being steeper than the surface directed toward the front of the grate, and means for adjusting the height of said rammer so that it can travel either on the surface of said grate or at a distance above said surface.

7. An apparatus according to claim 6 in which the means for adjusting the height of the rammer comprises a lug on the rammer extending through the reciprocating means and a roller on the end of said lug, a guiding track on which said lug rests and means for vertically adjusting said track.

8. In a furnace, a horizontal grate, a wedge-shaped rammer extending over the entire width of said grate, means for reciprocating said rammer longitudinally over the surface of the grate, the surface of the rammer directed toward the rear end of the grate being steeper than the surface directed toward the front of the grate, means for adjusting the height of said rammer so that it can travel either on the surface of said grate or at a distance above said surface, the means for adjusting the height of the rammer comprising a lug on the rammer extending through the reciprocating means and a roller on the end of said lug, a guiding track on which said lug rests and means for vertically adjusting said track, said last named means comprising a rod extending to the exterior of the furnace, and levers connected to said track and operable by said rod.

9. The apparatus as claimed in claim 1 in which the rammer consists of a plurality of parts, a transverse beam on which said parts are detachably held and means for connecting said beam to the reciprocating means so that it will move therewith, and in which scrapers are attached to said transverse beam for cleaning the grate surface.

10. The device as claimed in claim 1 in which the means for reciprocating the rammer comprises a chain to which said rammer is attached and the link to which the rammer is attached is provided with a longitudinal groove and the rammer is provided with a transverse rib engaging in said groove.

LEBRECHT STEINMÜLLER.