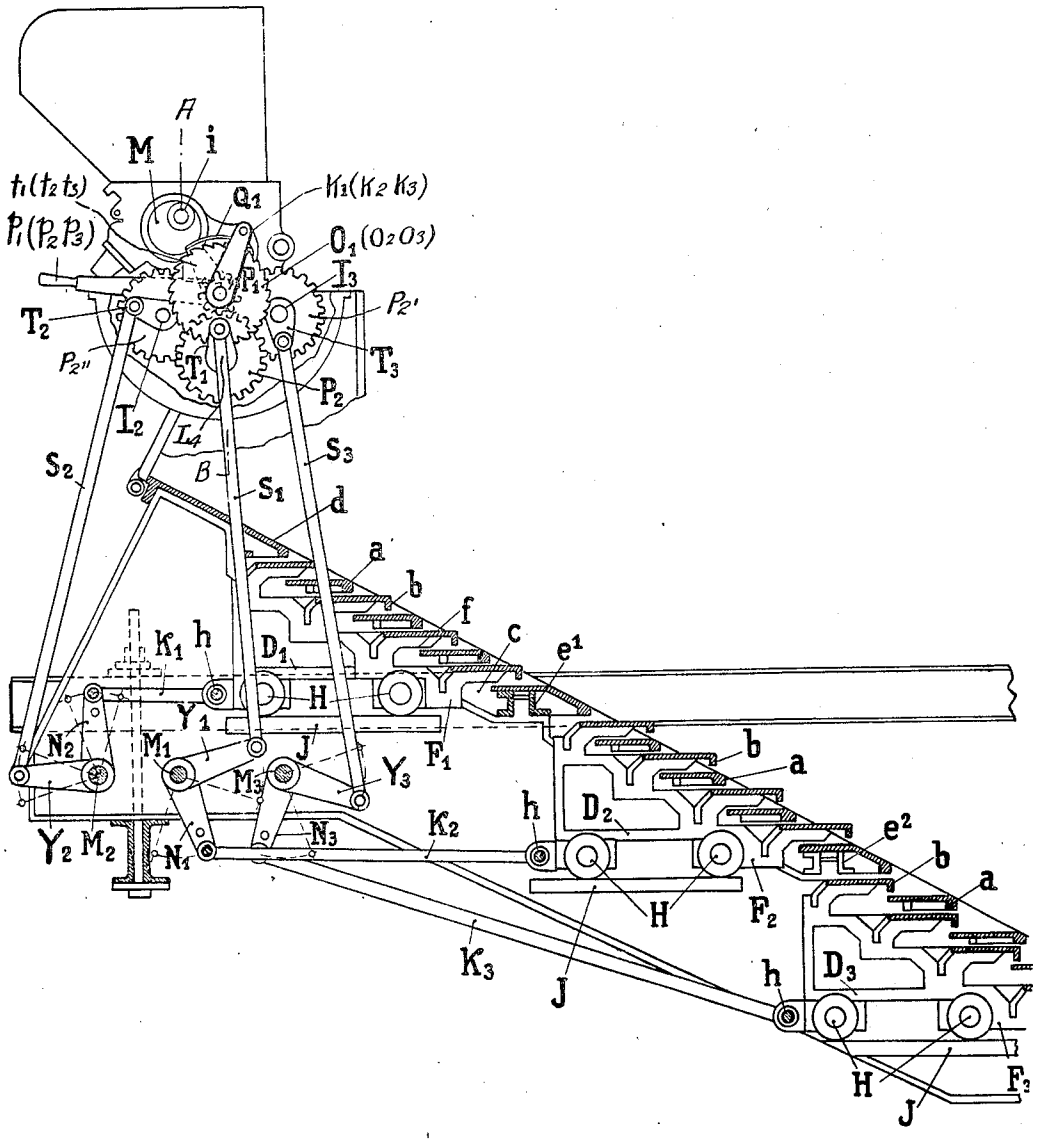
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F. SEYBOTH

STEPPED FURNACE GRATE

Original Filed Aug. 23, 1921 5 Sheets-Sheet 1

Fig. 1.



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Inventor:

by Mock & Blum, his attorneys

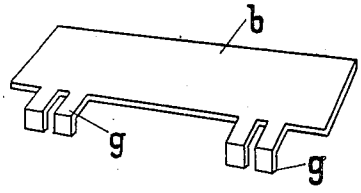
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F. SEYBOTH

STEPPED FURNACE GRATE

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Fig.3.



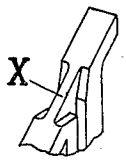


Fig.4.

Fig.2.

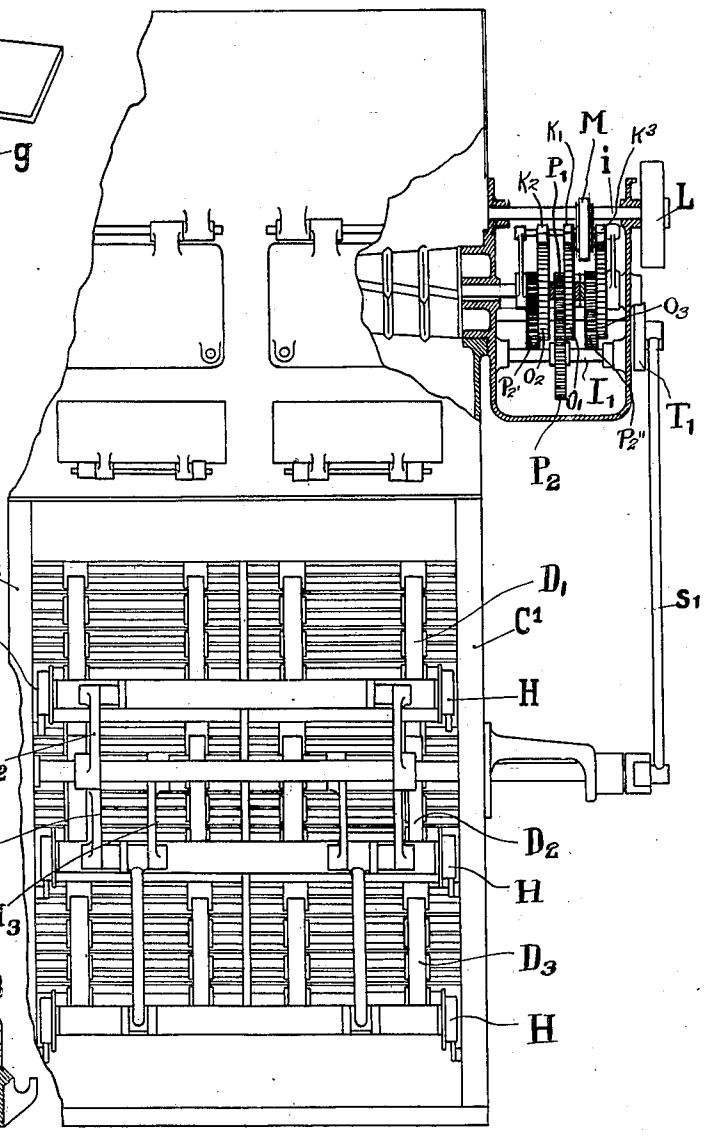
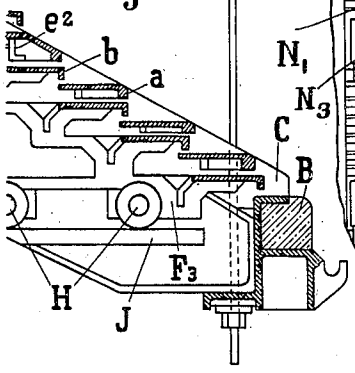


Fig.1a



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F. SEYBOTH

STEPPED FURNACE GRATE

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Fig.5.

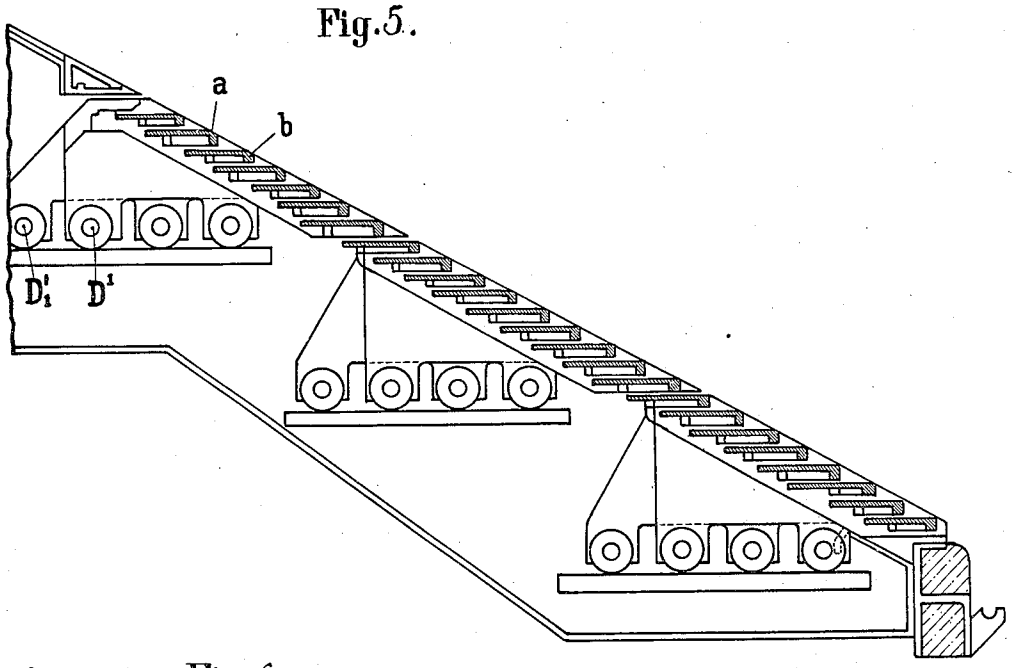


Fig.6.

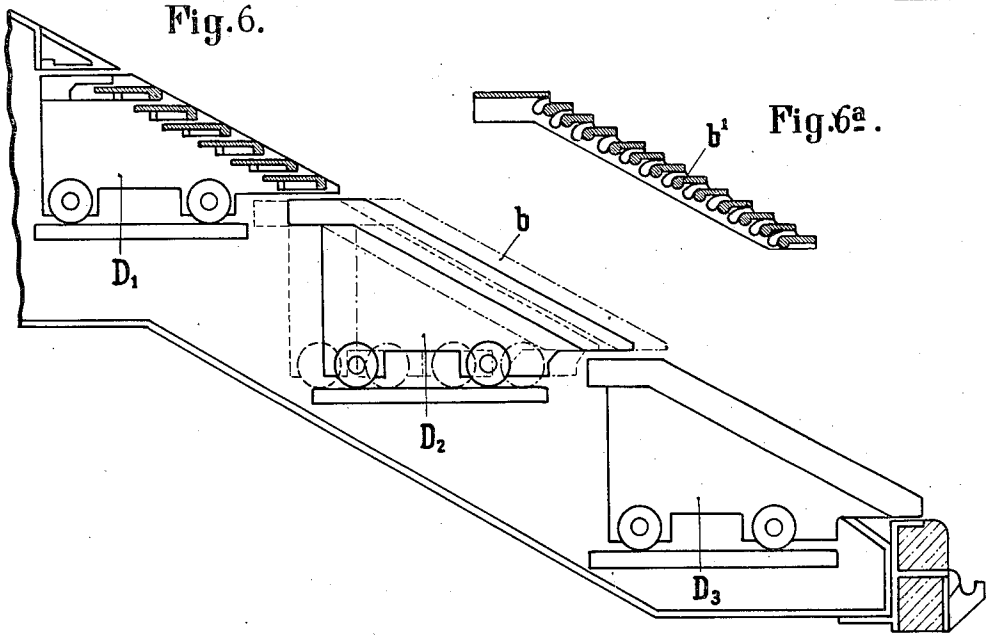


Fig.6a.

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STEPPED FURNACE GRATE

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Fig. 7.

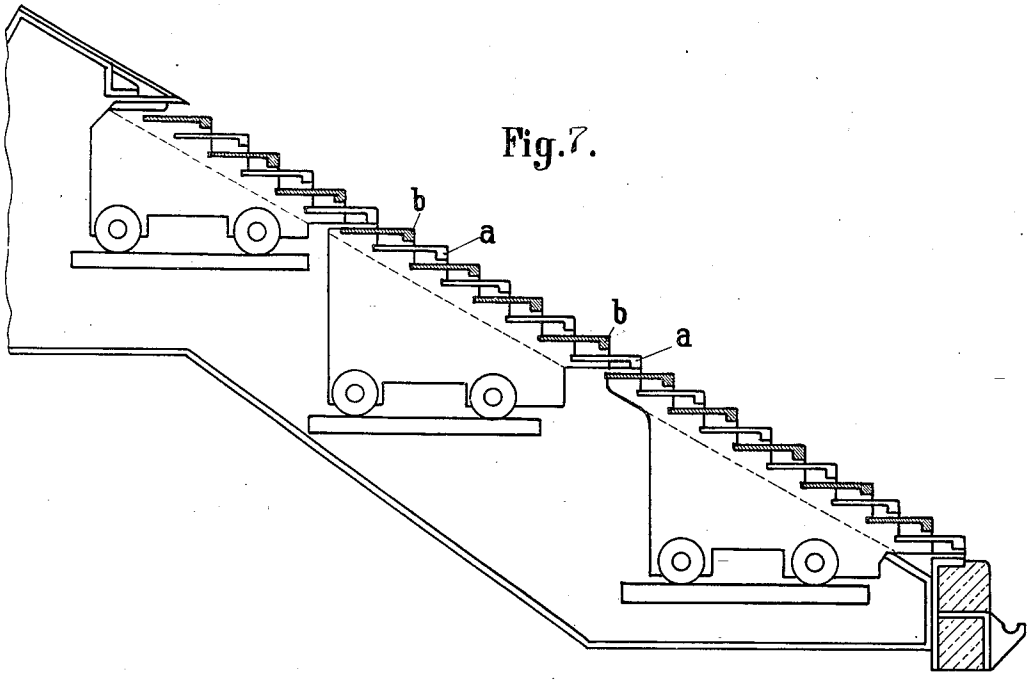
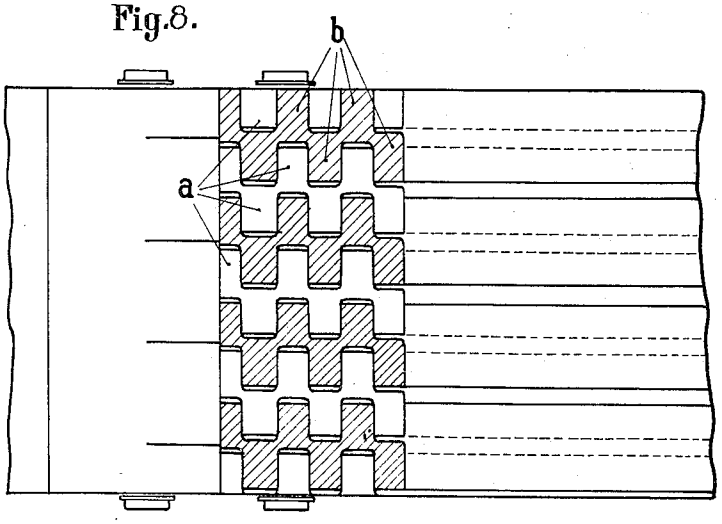


Fig. 8.



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STEPPED FURNACE GRATE

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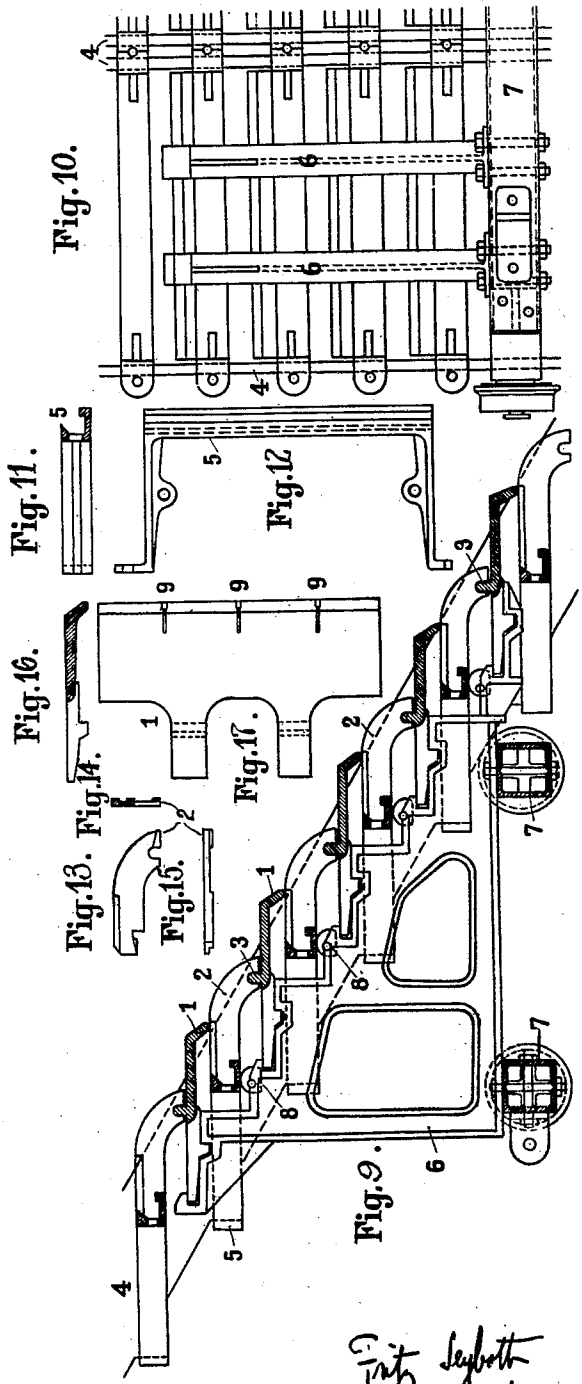


Fig. 10.

Fig. 11.

Fig. 12.

Fig. 16.

Fig. 14.

Fig. 17.

Fig. 13.

Fig. 15.

Fig. 9.

Fritz Seyboth Inventor:
by Mock & Blum his attorneys

Patented Oct. 11, 1927. 1,644,953

UNITED STATES PATENT OFFICE.

FRITZ SEYBOTH, OF ZWICKAU, GERMANY.

STEPPED FURNACE GRATE.

Application filed August 23, 1921, Serial No. 494,640, and in Germany February 24, 1914. Renewed August 17, 1927.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

Stepped furnace grates having movable and stationary grate bars, of which the former are arranged to be moved at variable speed in order to permit a uniform supply of the fuel corresponding with the progressively increasing state of combustion upon the grate are known. However, the known constructions of this type of grate are possessed of certain disadvantages, and it is the main object of this invention to provide a furnace grate which shall be very efficient in use and in which the disadvantages of the hitherto known grates are absent.

With this main object in view the invention broadly consists in a grate of stepped formation having movable and stationary grate bars and which is subdivided into a number of zones or sections, the movable grate bars of each section representing a group which is bodily moved independent of the other sections at such speed as would be required by the quality of the fuel and the rate of combustion in each section, so as to effect an even distribution of the fuel upon the grate and to thus prevent empty spaces and consequent excess of air at sections of advanced combustion.

Another object of the invention is the provision of means, such as a variable speed gear, for effecting the variable movement of the bars and by which not only the length of the travel of the grate bars but also the number of travels in each section may be varied independent of the other section or sections.

A further object of the invention consists in the arrangement of the grate bars of each section upon a carriage which is adapted to be driven by the said variable speed gear independent of the carriage of the other section or sections and at independently variable lengths and numbers of strokes.

A still further object of the invention is to so arrange the movable grate bars between the stationary bars as to avoid the formation of gaps or clearances within which burning coal or cinders may collect, as these would have a destructive influence on the grate bars. For the supply of the combustion air provision is made in the stationary steps, so that the efficiency of the grate may be maintained without incurring the disadvantages just referred to.

With these and other objects in view the invention consists in a furnace grate of stepped formation embodying the aforesaid features and of which several modifications are diagrammatically illustrated in the accompanying drawings in which

Figs. 1 and 1a illustrate a mixed view of the preferred form of the invention showing the driving mechanism in elevation and other parts in section.

Fig. 2 is a rear view of the invention with the gear box shown in section.

Fig. 3 shows one of the movable grate bars in perspective view.

Fig. 4 is a perspective view of part of a support for the movable grate bars.

Fig. 5 illustrates part of a modified form of the invention, the grate shown having two adjacently arranged systems or groups of movable grate bars in each zone adapted to travel in mutually opposing directions.

Fig. 6 is another modification of the invention and illustrates part of a grate in which a group of movable grate bars is arranged to extend in the longitudinal direction of the grate. Fig. 6a illustrates a special firing grate that can be used in connection with the device shown in Fig. 6.

Fig. 7 shows a partial view of still another modification of the grate in vertical section and

Fig. 8 is a plan view of the same modification, partly in section. In this arrangement the stationary and the movable grate bars are disposed to overlap in checker-like formation.

Fig. 9 is a vertical section through part of a still further modification with loosely inserted movable grate bars.

Fig. 10 is a rear view of said device.

Figs. 11 and 12 are a section and a plan view respectively of a supporting frame for the movable grate bars, such as is shown in Figs. 9 and 10 but may be used with any other modification.

Figs. 13, 14 and 15 illustrate a grate bar of a stationary step in side elevation, cross section and plan view respectively.

Figs. 16 and 17 are a cross section and a plan view of one of the stationary grate bars as shown in Figs. 9 and 10.

Referring to Figs. 1 and 2 of the drawings, it will be seen that the grate is subdivided into three zones or sections. The

firing area of each section is provided with stationary grate bars *a* and plate-like movable grate bars *b* of which the stationary bars are carried in supports *c* of substantially known construction. In the uppermost section these supports *c* rest at the top against the stoking plate *d* and at the bottom against the cross bearer e^1. In the central section they bear at the top against the said cross bearer e^1 and at the bottom against a similar cross bearer e^2, the latter serving also as the support for the carrier *c* of the lowermost section which, at its bottom, rests upon the fire bridge B. The cross bearers e^1 and e^2 are supported in the side walls C^1 and C^2 of the grate furnace chamber.

The movable grate bars 3 are arranged upon carriages D_1, D_2, D_3 which, for the purpose, are provided with projecting lugs *f* serving as supports for the bars *b*. To prevent a displacement in longitudinal direction of the grate the said grate bars are provided with depending lugs *g* (Fig. 3) adapted to engage with corresponding notches in the carriages, whilst a displacement in transverse direction is rendered impossible owing to the said lugs *g* being divided and held in position by ribs X arranged on the said carriages.

The carriages D_1, D_2 and D_3 are supported on cross bearers F_1, F_2, F_3 which are provided with wheels H adapted to run on rails J attached to the rigid side walls C^1 and C^2, said cross bearers being also provided with pins *h* by means of which the carriages are connected to the connecting rods K_1, K_2 and K_3.

The grate may, for example, be driven by a belt pulley L arranged externally of the gear box and keyed to the shaft *i*. An eccentric M is arranged upon the said shaft *i* and drives a pair of levers which are provided with pivots and pawls k_1, k_2 and k_3. The latter are adapted to engage with ratchet wheels O_1, O_2 and O_3 loosely arranged upon the shaft. Each of these ratchet wheels actuates a pair of pinions P_1, P_2, P_1', P_2', P_1'', P_2'' of which the larger wheels are singly arranged upon the shafts I_1, I_2, I_3. These shafts are provided with crank arms T_1 T_2 and T_3 which, by means of connecting links S_1 S_2 S_3 and oscillating levers Y_1 Y_2 Y_3, are adapted to rock shafts M_1 M_2 and M_3. These latter, on their part, are furnished with separate oscillating levers N_1 N_2 N_3 in connection with the connecting rod K_1 K_2 K_3 and thereby cause a movement of the carriages D_1 D_2 D_3 to and fro upon their wheels.

In order to vary the stroke of the connecting rods or links, the pins of the cranks T_1 T_2 T_3 or the oscillating levers Y_1 Y_2 Y_3 or N_1 N_2 N_3 are arranged so as to be adjustable.

For the purpose of regulating the speed of the carriages or the number of strokes respectively a shield or a cam guide Q_1 Q_2 Q_3 is arranged above each of the ratchet wheels O_1 O_2 O_3. These cam guides may be adjusted by means of hand levers p_1 p_2 p_3 and levers t_1 t_2 t_3 so that each of the ratchet wheels may be turned independently of the others as desired by one, two, three or four teeth at every revolution of the eccentric.

In the modification shown Fig. 5 the arrangement is such that two sets of movable grate bars *a* and *b* are provided in each grate section, said sets being arranged upon carriages D′ and D_1' respectively, adapted to be reciprocated in mutually opposing directions. The arrangement for effecting such reciprocating movement being the same as in the aforesaid example it has been omitted from the drawing and will not be referred to any more in particular.

In the example shown in Figs. 6 and 6^a the movable grate bars *b* of one or more sections of the grate are arranged to extend in the longitudinal direction of the grate instead of crossways as in the aforesaid examples. If preferred, separately exchangeable grate surfaces *b′* (Fig. 6^a) may be arranged upon the carriages. The arrangement of the reciprocating means for the carriages is the same as above referred to and is therefor not shown in the figure.

The construction shown in Figs. 7 and 8 differs from the preceding in that both the stationary and the movable grate bars *a* and *b* respectively are of serrated or zig-zag formation in such a manner that, in plan view (Fig. 8) they present a checkered appearance. Thus each stationary element is followed by a movable element not only in the longitudinal direction of the grate but also in the transverse direction, with the result, that the formation of longitudinal as well as transverse strips in the layer of burning fuel or slag and clinker is prevented.

In the modification shown in Figs. 9 and 10 2 denotes the bars of the stationary steps and 1 those of the movable steps. 3 are scraping ledges between each two stationary and movable steps, 4 are the side walls adjoining the grate and between which the supporting frames 5 for the stationary bars are fitted and secured as by bolts. 6 is a cast iron standard which is mounted upon axles 7 to form therewith the carriage for one of the grate sections.

As will be seen from the drawings, the supporting frame 5 may be removed from the grate by simply disconnecting the frame bolts. This may be done during work and it may have to be carried out, for example, when an exchange of the grate bars 2 appears necessary. To fit these bars 2 they are merely dropped into the frames 5 without any special fixing means being required, as will be realized from their full representation in Figs. 13, 14 and 15. Each of the supporting

frames is fixed by only one bolt or screw to one of the side walls 4 of the grate. The weight of the stationary steps is taken up by cam-like discs 8 turnably fitted to the side walls by means of bolts. They also serve to adjust the supporting frames when fitting the grate.

The bars 1 have two lugs by means of which they are dropped into the carriage standards 6. It is thus possible, when returning the carriage, to exchange bars even during work.

Owing to the small surface area of the movable grate bars I and owing to their shape, arrangement and their manner of operation they are sufficiently cooled during work and they may, therefor, be made in the shape of plates without entailing the risk of the bars becoming distorted. However, in case of a specially high quality fuel being used, the plates may advantageously be provided with sawcuts 9, as shown in Fig. 17, in order to more effectively protect the front portions of these plates against distortions. As an alternative, the bars 2 may be composed of a number of closely adjoining individual elements, of which each would appear in elevation as does the representation of the section shown in Fig. 16.

I claim:

1. A stepped furnace grate having in combination with a number of fixed grate bars, a number of movable grate bars arranged in a series of groups, movable carriages to support and reciprocate said groups of movable grate bars and means adapted to move the carriages of each group independently of the carriages of the adjacent groups, and means adapted to independently regulate the movement of each carriage with respect to the frequency and length of movement of the strokes thereof.

2. A stepped furnace grate consisting of a series of stationary bars and a second series of movable grate bars, the movable grate bars being arranged in a series of groups, a movable carriage to support and reciprocate each said group of said movable grate bars and means to move the carriages of adjacent groups in opposite directions independently of the adjacent groups, and means for independently regulating the frequency and length of the strokes of each said carriage.

3. In a stepped furnace grate the combination of fixed grate bars and movable grate bars arranged in groups, the said movable grate bars having depending front edges adapted to contact with the fixed bars, and means to move the said movable grate bars with their front edges in sliding contact with the fixed grate bars, means for independently moving each group of movable bars, and means for independently regulating the frequency and length of strokes of each said group.

4. In a stepped furnace grate the combination of fixed grate bars and movable grate bars arranged in groups, and having depending front edges, means to move the said movable grate bars with their depending edges closely above the fixed grate bars, means for independently moving each group of movable bars and means for independently regulating the frequency and length of strokes of each said group.

5. In a stepped furnace grate the combination with a number of fixed grate bars of a number of movable grate bars arranged in groups and having depending front edges, carriages to support each said group of movable grate bars and means to reciprocate the carriages so as to keep the depending edges of the movable grate bars in sliding contact with their adjacent fixed grate bars, means for independently moving each group of movable bars and means for independently regulating the frequency and length of strokes of each said group.

6. A stepped furnace grate divided into zones, each zone having a number of fixed bars and a number of movable bars, said bars having depending edges to prevent the entrance of coal and grit between them, the fixed bars having air passages, reciprocating carriages on which the said movable bars are mounted in groups, and an adjustable crank disc and ratchet mechanism to move the said carriages by means of connecting rods, links and levers so as to vary the frequency of strokes and the length of movement of each group of grate bars independently of its adjacent groups.

In witness whereof I affix my signature.

FRITZ SEYBOTH.