March 5, 1929. J. E. GREENAWALT 1,704,681

GRATE FOR METALLURGICAL APPARATUS

Filed March 16, 1927 3 Sheets-Sheet 1

Fig. 1.

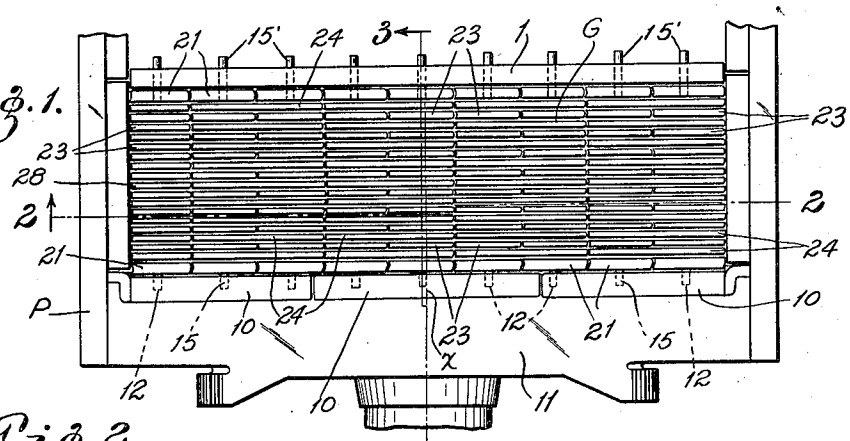


Fig. 2.

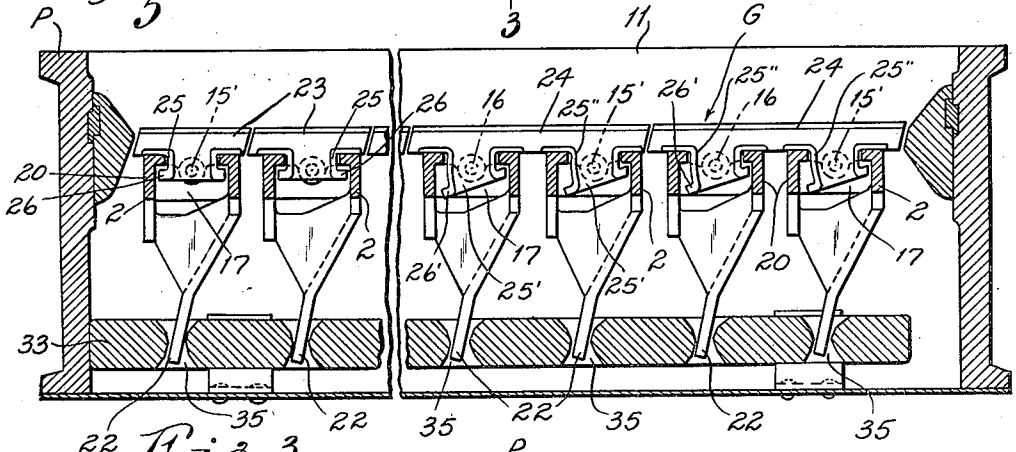
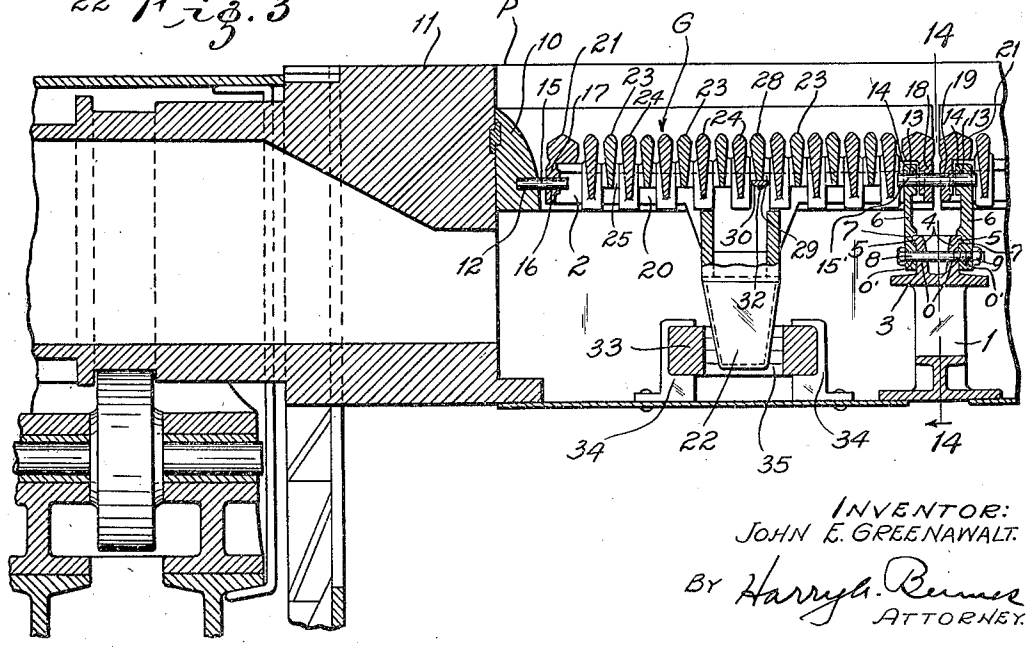


Fig. 3



INVENTOR:
JOHN E. GREENAWALT.

BY Harry A. Benner
ATTORNEY.

March 5, 1929. J. E. GREENAWALT 1,704,681

GRATE FOR METALLURGICAL APPARATUS

Filed March 16, 1927 3 Sheets-Sheet 2

Fig. 2a

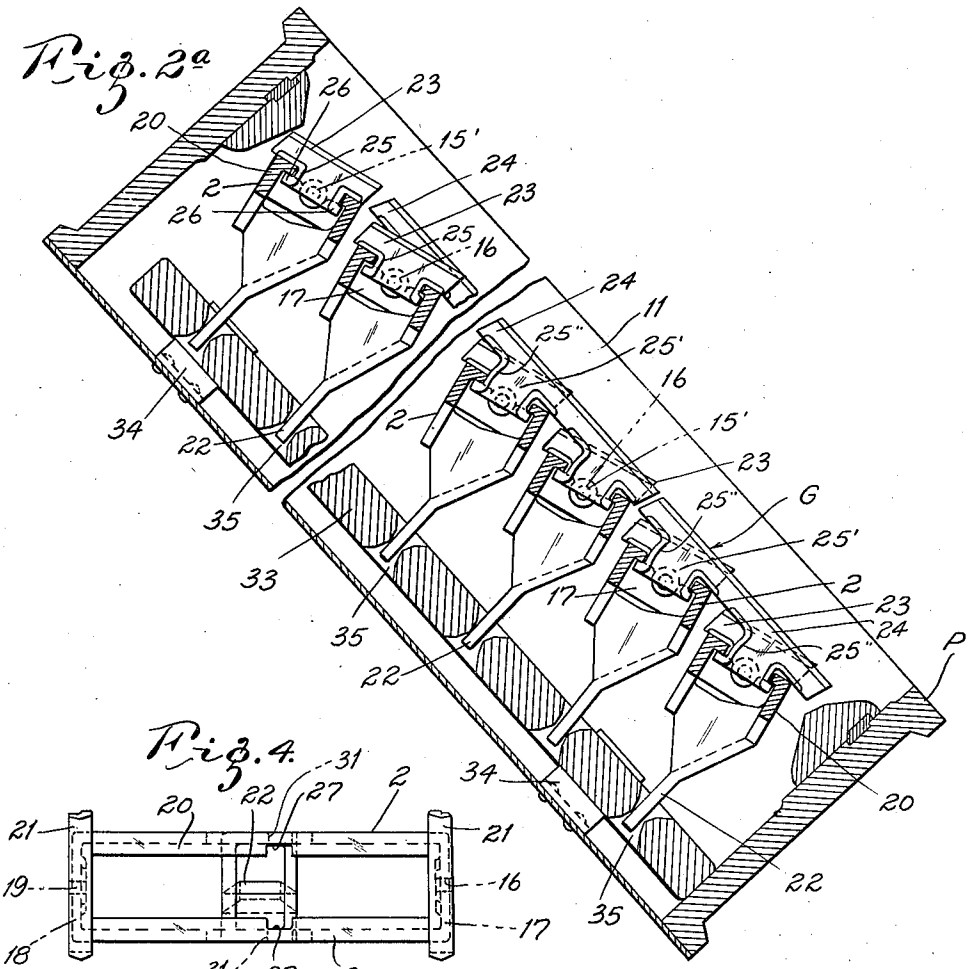


Fig. 4.

Fig. 5.

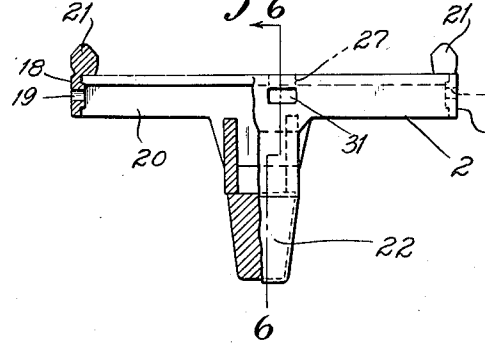


Fig. 6.

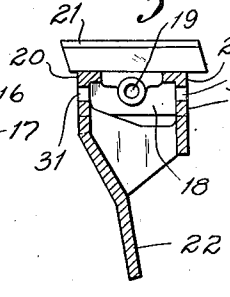
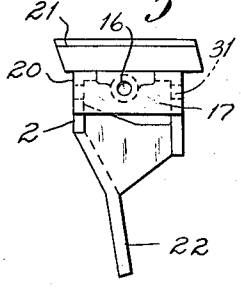


Fig. 7.



INVENTOR:
JOHN E. GREENAWALT.

BY Harry A. Beiner
ATTORNEY.

March 5, 1929. J. E. GREENAWALT 1,704,681

GRATE FOR METALLURGICAL APPARATUS

Filed March 16, 1927 3 Sheets-Sheet 3

Fig. 8.

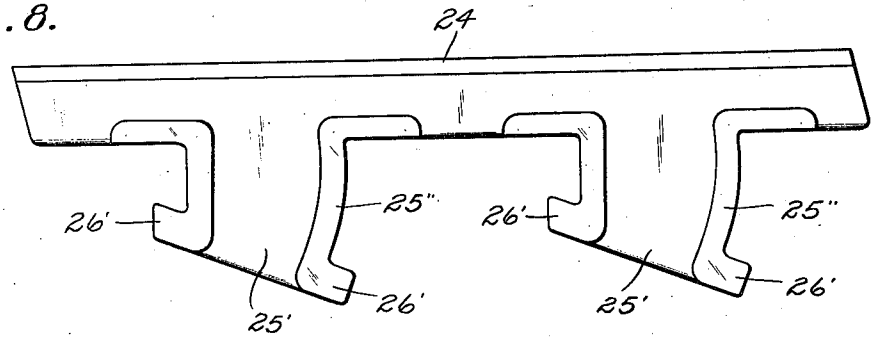


Fig. 9.

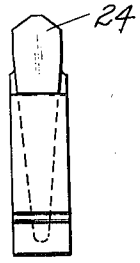


Fig. 10.

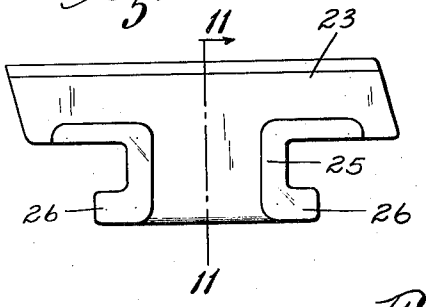


Fig. 11.

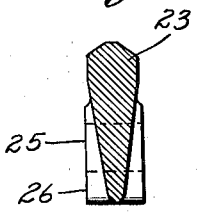


Fig. 12.

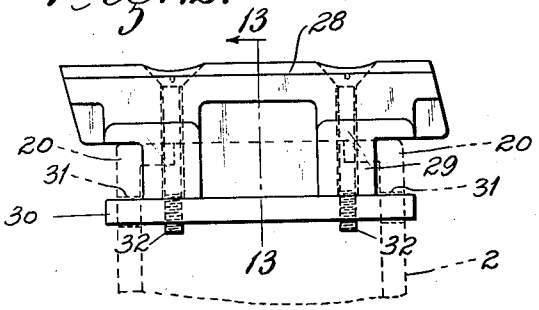


Fig. 13.

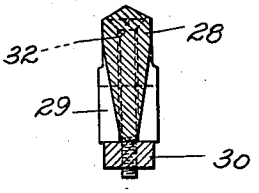
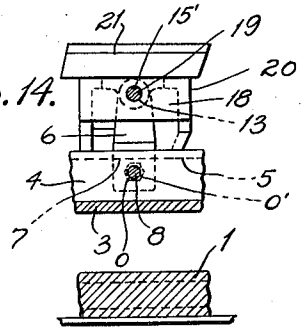


Fig. 14.



INVENTOR:
JOHN E. GREENAWALT.
BY Harry A. Benner
ATTORNEY.

Patented Mar. 5, 1929. 1,704,681

UNITED STATES PATENT OFFICE.

JOHN E. GREENAWALT, OF NEW YORK, N. Y.

GRATE FOR METALLURGICAL APPARATUS.

Application filed March 16, 1927. Serial No. 175,815.

My invention has relation to improvements in grates and consists in the novel features of construction more fully set forth in the specification and pointed out in the claims.

My improved grate is adapted for use in sintering apparatus or other apparatus for the metallurgical treatment of ores, the material from which is discharged or dumped by a tilting movement of the ore holder. In the following description of the invention, I will confine myself to its use in sintering apparatus as the invention is here used to greatest advantage because the grate is particularly adapted to assist in the discharge from the holder of the sintered or agglomerated material. In order to effectively discharge such material from the holder, the grate is composed of a plurality of bars capable of different qualities of movement. For instance, some of the bars are rotatable while others may be moved bodily away from the normal supporting plane of the grate.

One of the objects of the invention is to bring about a differential of movement, as it is called, between the bars without resorting to a complicated structure. In addition to providing a mechanism for actuating the grate bars that is simple, this mechanism must also be durable and reliable in operation. I have also provided a grate construction wherein the individual bars are readily removable for replacement, one in which the bars positively respond to a dumping movement of the holder, and one possessing further and other advantages better apparent from a detailed description of the invention in connection with the accompanying drawings, in which:

Figure 1 represents a top plan of one end of a sintering pan equipped with my improved grate; Figure 2 is an enlarged vertical cross-section taken through the pan on the line 2—2 of Figure 1 with parts broken away; Figure 2ª is a vertical cross-section similar to that shown in Figure 2, the pan P, however, being shown partially rotated to dumping position and the grate bar frames rocked to effect a movement of the grate bars for the purpose of dislodging any material adhering thereto; Figure 3 is an enlarged vertical longitudinal section through the pan taken on the line 3—3 of Figure 1; Figure 4 is a top plan of the frame in which the grate bars are mounted; Figure 5 is a combined side elevation and vertical longitudinal section of the grate bar frame; Figure 6 is a vertical cross-section through the frame taken on the line 6—6 of Figure 5; Figure 7 is an end elevation of said frame; Figure 8 is a side elevation of one of the long bars adapted for movement away from the grate bar frame; Figure 9 is an end elevation of said long bar; Figure 10 is a side elevation of one of the short rocking bars; Figure 11 is a vertical cross-section taken on the line 11—11 of Figure 10; Figure 12 is a side elevation of the grate bar that serves to lock the other grate bars in place; Figure 13 is a vertical cross-section through said bar taken on the line 13, 13 of Figure 12; and Figure 14 is a vertical sectional detail taken on the line 14—14 of Figure 3.

Referring to the drawings, P represents the sintering pan or holder in which the grate G comprising my invention is disposed. The pan P is adapted for rotation about its longitudinal axis denoted by the dot and dash line x, the mechanism for rotating the pan not being shown herein as it forms no part of the present invention, but is fully described in my patent on sintering apparatus, No. 1,617,561 dated February 15, 1927.

A plurality of reinforcing ribs 1 extend transversely across the pan P and in addition to acting as stiffening members, they serve also to support a series of grate bar frames 2, 2 etc. The top component 3 of the ribs 1 is U-shaped, each side 4 of said U-shaped component having an outwardly extending flange 5, and there are aligning openings o, o, in the sides 4, 4 of component 3 equally spaced along the length thereof. Supporting arms 6, 6 having grooves 7, 7 to receive flanges 5, 5 are fitted over the outer faces of the components 3, 3 opposite the openings o, o, therein and secured firmly in place by a bolt 8 which traverses openings o', o' in the arms 6, 6 and the openings o, o in the component 3, a nut 9 being passed over the threaded end of the bolt 8. Thus supporting arms 6, 6 extend upwardly in pairs from the component 3 of ribs 2 in equally spaced relation from one side to the other of the pan for the purpose of carrying the grate bar frames 2. Dead plates 10 are bolted to the inside of each end wall 11 of the pan,

said dead plates being provided with sockets 12 in alignment with openings 13, 13 in the heads 14, 14 of supporting arms 6, 6.

The grate bar frames 2 adjacent to the ends of the pan P are pivotally supported on bearing pins 15, 15′, the former being driven into openings 16 in the end wall 17 of each frame 2 and having bearing in sockets 12 of dead plates 10. The pins 15′ traverse openings 13, 13 in the supporting arm 6, 6, and the end walls 18 of adjacent frames 2 are disposed between arms 6, 6 and are supported by the pin 15′ which is also passed through openings 19, 19 in said end walls 18. Thus, the juxtaposed frames 2 between the end wall 11 of the pan P and the next adjacent rib 1 are pivotally supported by the end wall dead plate 10 and next adjacent rib 1, while the intermediate supporting frames 2 are pivotally supported by adjacent ribs 1, 1 (as shown in Figures 1 and 3).

The grate supporting frame 2 (as shown in Figures 4 to 7 inclusive) has side members 20, 20 integrally formed with the end walls 17 and 18, said side walls being in the shape of an inverted L, and terminal grate bars 21, 21 are formed integrally with the side members 20, 20. A pendant arm 22 extends downwardly from said side members. As will be fully explained hereinafter, each frame 2 supports a plurality of short grate bars 23 and each pair of adjacent frames 2 support a plurality of long grate bars 24, the long grate bars alternating with the short ones as shown in Figure 1. The short bars (Figure 10) are each provided with a depending neck or stem 25 terminating in lateral flanges 26, 26. In mounting the short bars on the frame 2, the flanges 26, 26 are passed through oppositely disposed slots 27, 27 in the horizontal components of the side members 20, 20 and the bars are slid along the side members 20, 20 to their respective positions on the frame 2, it being understood that in assembling the bars on the frames, two frames are handled together, and the short bars are alternated with the long ones until all of the bars are on place on two adjacent frames 2, except the last short bars 28 which are positioned over the slots 27, 27. These bars 28 which serve to lock the others in place must be of a slightly different construction and are shown in Figures 12 and 13. Instead of the neck 29 being flanged, a plate 30 is provided, said plate being passed through openings 31, 31 in the members 20 before the bar 28 is put in place, and the bar 28 is then secured to the plate 30 by means of screws 32, 32. Thus, all of the bars, both long and short, are mounted on adjacent frames 2, 2, the short bars being secured to the frames so that any movement imparted to the frames will be participated in by the short bars, while the long bars are capable of independent movement on the frames as will be apparent when the mechanism for rocking the frames is described.

A sliding weight 33 is mounted in oppositely disposed raceways 34, 34 extending transversely across the pan beneath each panel between adjacent ribs 1, 1, and there are slots 35 formed in the weight 33 to receive the lower ends of pendant arms 22 of the frames 2, 2, etc. The slots 35 are narrowest at the center of the weight 33 and flare outwardly toward the top and bottom surfaces thereof to accommodate the different positions of the pendant arms 22 as they are rocked by a movement of the weight 33 to be more fully described in connection with the operation of the invention.

By referring to Figure 8, it will be seen that the long bars 24 have a pair of depending stems 25′, 25′ spaced to correspond with the spaces between adjacent frames 2 since these long bars are received by two adjacent frames as above pointed out. The flanges 26′, 26′ are inclined from the plane of the bar, the longer side 25″ of each stem 25 being arcuate for a purpose to be more fully apparent hereinafter.

In describing the operation of my improved grate, we will assume that the sintering pan P has been moved to the position shown in Figure 2ª to effect a dumping of the contents of said pan. The tilting of the pan to this position overcomes the friction of the weight 33 in the raceways 34, 34 and the weight 33 slides to the position shown in Figure 2ª imparting to the pendant arms 22 and to the grate bar frames 2 a rocking movement in which the grate bar frames are rotated from their normal position shown in Figure 2. Owing to the fact that the short bars 23 are snugly fitted into the frames 2, these short bars will participate to the full extent in the rocking movement of the frames 2. However, the long bars, which as we have seen, are each supported in two adjacent frames 2, 2, cannot rock with either of said frames, but instead of rocking, will be lifted by the corresponding sides 20 of the frames 2, 2 that are moved upwardly. As these corresponding sides are raised, obviously, the opposite sides of the frames 2 will be lowered and the great length of the sides 25″ of the stems 25′ will permit of free movement in opposite directions of the downwardly moving side members 20 and upwardly moving grate bars 24, all of which is clearly illustrated in Figure 2ª. The differential of movement caused by the short bars rotating and the long bars moving bodily away from the normal supporting plane of the grate will operate to forcibly break loose any material that has been caused to adhere to the grate bars dur-

ing the metallurgical treatment given to the material while on the grate.

Having described my invention, I claim:

1. A grate comprising a supporting frame, a plurality of grate bars mounted in said frame, grate bar actuating means for imparting to some of the bars a rocking movement, and to other bars a movement bodily away from the normal supporting plane of the grate.

2. A grate comprising a supporting frame, a plurality of grate bars mounted in juxtaposition in said frame, actuating means for imparting movement to the frame to effect a rocking of some of the bars and a movement away from the frame of other bars.

3. A grate comprising a supporting frame, a plurality of grate bars mounted in juxtaposition in said frame, means for imparting movement to the frame to effect a rotation of alternate bars, and a bodily movement away from the frame of alternate bars.

4. A grate comprising a supporting frame, a plurality of grate bars mounted in juxtaposition in said frame, grate bar actuating means for rocking said frame and certain of the bars together therewith and simultaneously therewith effecting a movement of other bars with relation to said frame.

5. A grate comprising a supporting frame, a plurality of grate bars mounted in said frame, and means for rocking the frame for imparting a differential of movement between the bars.

6. A grate comprising a supporting frame, means for rotating said frame, a plurality of grate bars mounted in said frame and rotatable therewith, complementary grate bars mounted in the frame and adapted to be moved away from the frame by the rotary movement imparted thereto.

7. A grate comprising a supporting frame, a plurality of grate bars mounted therein to form the grate supporting surface, means for rotating said frame and some of said bars, said means also operating to move other bars out of the plane of the grate supporting surface.

8. A grate comprising a series of supporting frames, a plurality of bars mounted in juxtaposition in each of said frames to form the grate supporting surface, means for imparting relative movement between some of the bars in adjacent frames, and movement to the other bars to a position out of the plane of said supporting surfaces.

9. A grate comprising a series of supporting frames, means for rocking said supporting frames, a plurality of grate bars fixed in each of said frames and adapted to be rocked therewith, other grate bars supported by and extending across two adjacent frames, said last mentioned bars being moved relatively to the frames on rocking the same.

10. A grate comprising a series of supporting frames, means for rocking said supporting frames, a plurality of grate bars fixed in each of said frames and adapted to be rocked therewith, other grate bars supported by and extending across two adjacent frames, said last mentioned bars being moved away from the frames but in parallelism therewith on rocking the same.

11. A grate comprising a series of supporting frames, a plurality of juxtaposed grate bars in each of said frames, the bars of all the frames lying in parallel planes and forming the grate supporting surface, some of said bars being mounted on fixed axes for rotation within said planes, other bars being mounted for movement within said planes in parallelism with the grate supporting surface, and means for imparting to said bars their respective movements.

12. A grate comprising a supporting frame, a plurality of grate bars mounted in juxtaposition in said frame, and grate bar actuating means for rocking said frame to rotate said bars in the planes of their longitudinal axes.

13. A grate comprising a series of supporting frames disposed in closely spaced relation, a plurality of juxtaposed grate bars in each of said frames, corresponding bars of adjacent frames lying in a common plane, and grate bar actuating means for simultaneously rotating the frames to effect a relative movement between the bars lying in the same plane.

14. A grate comprising a supporting frame, a plurality of grate bars removably mounted in said frame, means for locking said bars in the frame and means arranged below said supporting frame for rocking the frames to effect a dumping movement of the grate bars.

15. A grate comprising a supporting frame, a plurality of grate bars mounted in the frame, said frame and grate bars having cooperating formations to hold the bars in the frame, one of said bars serving as a lock bar to prevent displacement of any of the bars, and means for imparting movement to the frame to effect a rocking of said grate bars.

16. In an apparatus for treating ores comprising a holder, a grate disposed within said holder, said grate comprising a series of supporting frames extending from side to side of the holder and rotatably mounted therein, a plurality of grate bars fixed in each of said frames and disposed transversely thereto, the contiguous bars of adjacent frames lying in a common plane extending transversely of the holder, means for rotating the holder on an axis perpen-

dicular to the planes of the grate bars, and means for imparting a partial rotation to the grate bar frames and effecting a differential of movement between the grate bars with a rotation of the holder on its axis.

17. In an apparatus for treating ores comprising a holder, a grate disposed within said holder, said grate comprising a series of supporting frames extending from side to side of the holder and rotatably mounted therein, a plurality of grate bars fixed in each of said frames and disposed transversely thereto, the contiguous bars of adjacent frames lying in a common plane extending transversely of the holder, means for rotating the holder on an axis perpendicular to the planes of the grate bars, and means for imparting a partial rotation to the grate bar frames and effecting a relative movement between abutting ends of the grate bars.

18. In an apparatus for treating ores comprising a holder, a grate disposed within said holder, said grate comprising a series of supporting frames extending from side to side of the holder and rotatably mounted therein, a plurality of grate bars fixed in each of said frames and disposed transversely thereto, the contiguous bars of adjacent frames lying in a common plane extending transversely of the holder, means for rotating the holder on an axis perpendicular to the planes of the grate bars, and means for imparting a partial rotation to the grate bar frames and some of the bars therewith, said rotation of the grate bar frames operating to move other grate bars bodily away from said frames.

19. In an apparatus for treating ores comprising a holder, a grate disposed within said holder, said grate comprising a series of supporting frames extending from side to side of the holder and rotatably mounted therein, a plurality of grate bars fixed in each of said frames and disposed transversely thereto, the contiguous bars of adjacent frames lying in a common plane extending transversely of the holder, means for rotating the holder on an axis perpendicular to the planes of the grate bars, and means for imparting a partial rotation to the grate bar frames to effect a rotation of some of the grate bars and a lateral movement of others.

20. In an apparatus for treating ores comprising a holder, a grate disposed within said holder, said grate comprising a series of supporting frames extending from side to side of the holder and rotatably mounted therein, a plurality of grate bars fixed in each of said frames and disposed transversely thereto, the contiguous bars of adjacent frames lying in a common plane extending transversely of the holder, means for rotating the holder on an axis perpendicular to the planes of the grate bars, and means for rotating alternate bars and imparting a lateral movement to other alternate bars with a rotation of the holder.

21. A grate comprising a supporting member, a plurality of grate bars mounted in juxtaposition upon said member, and means for imparting movement to the member, whereupon said member operates to move the grate bars out of their normal supporting plane.

22. A grate comprising a supporting member, a plurality of grate bars arranged to be movably held on said supporting member, and means operable below said member for imparting a rocking movement to some of said bars and a lateral movement to other bars.

In testimony whereof I hereunto affix my signature.

JOHN E. GREENAWALT.