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Hartwig

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[54] **GRATE CONVEYOR**

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[52] **U.S. Cl.** ..... **34/217,** 34/236, 110/40 A

[51] **Int. Cl.** **F26b 19/00**

[58] **Field of Search** ..... 34/57 C, 217, 236; 110/40

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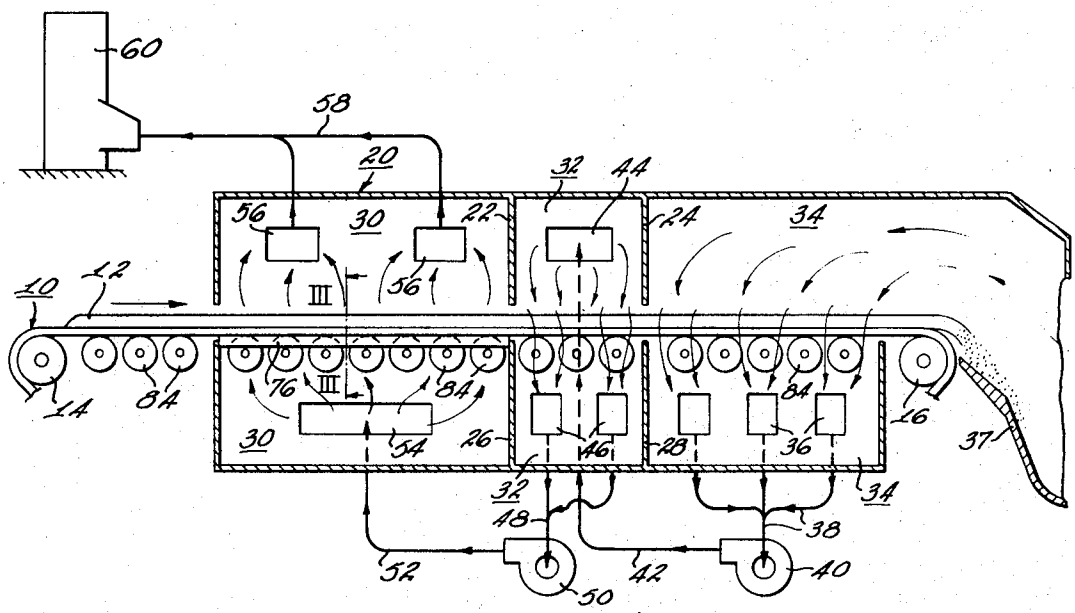
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Assistant Examiner—James C. Yeung
Attorney—Robert C. Sullivan et al.

[57] **ABSTRACT**

A traveling grate of the type used to convey material through an apparatus such as a dryer, a preheater, a cooler, a furnace, or the like, in which the pivotally mounted grate castings are provided with an "anti-flip leg" which cooperates with an underlying skid bar to prevent undesired pivotal movement of the grate castings to an open position in which they may become interlocked with contiguous grate castings.

4 Claims, 5 Drawing Figures



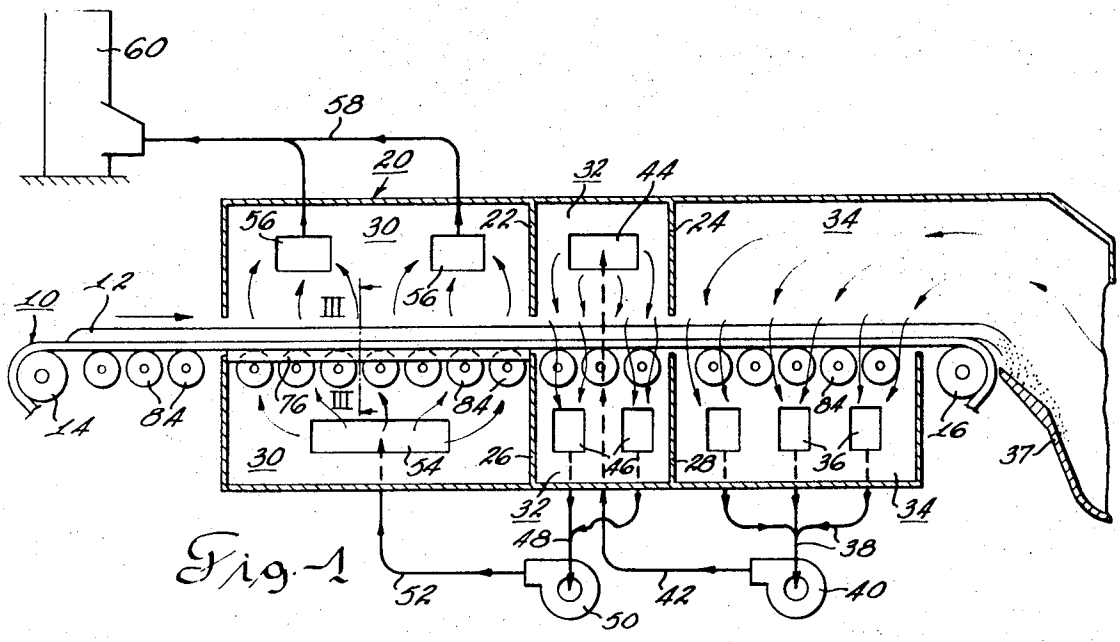


Fig. 1

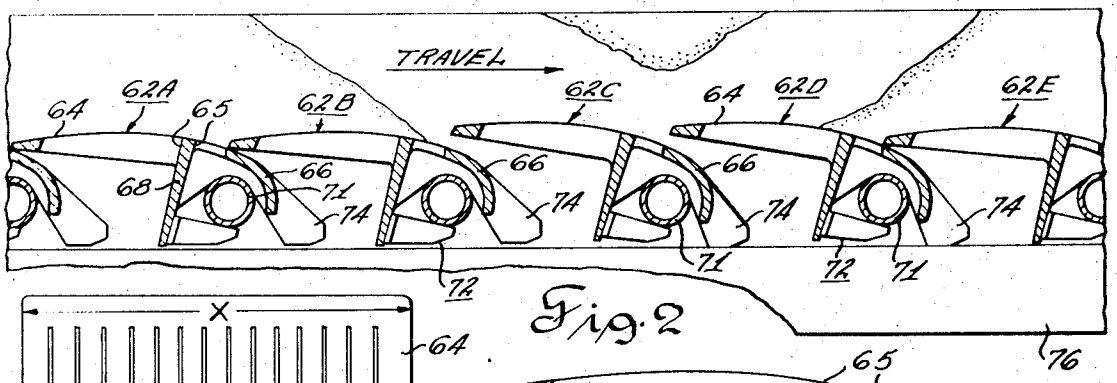


Fig. 2

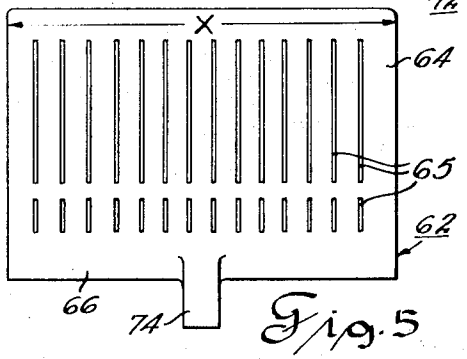


Fig. 5

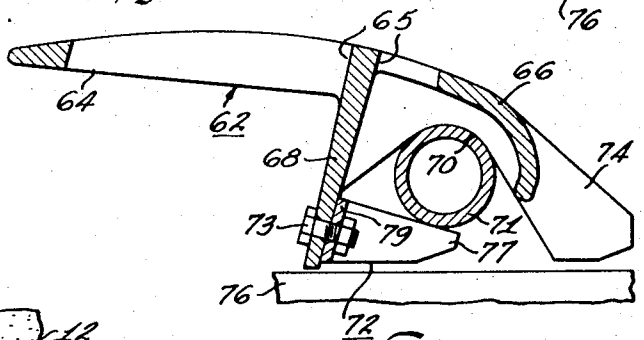


Fig. 4

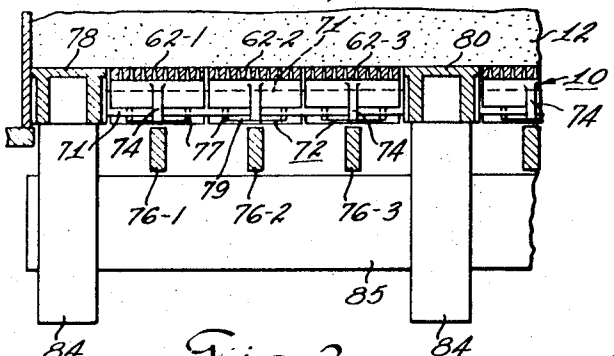


Fig. 3

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GRATE CONVEYOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to traveling grates of the type used to convey material through an apparatus such as a dryer, a preheater, a cooler, a furnace, or the like.

The invention will be described as embodied in a traveling grate associated with a grate-kiln system in which the traveling grate carries load material successively through a drying zone or zones and a preheating zone or zones before discharging the load material into a rotary kiln. While the invention has particular utility in such an environment, the invention is not restricted to use in the described embodiment.

2. Description of the Prior Art

It is well known in the prior art to provide a grate-kiln apparatus in which a traveling grate conveyor carries a pelletized material such as ore or the like from a feed end through a drying section where free water and/or chemically bound water is removed from the feed material, thence through a preheating zone where the dry pelletized material is heated with kiln exit gases, after which the grate conveyor discharges the pelletized material into a rotary kiln. In passing through the drying section, the grate conveyor passes through an "updraft drying section" or zone in which gases pass upwardly through the grate conveyor and through the pelletized load supported on the conveyor. A serious problem has occurred in the prior art upon the occurence of excessive gas pressure beneath the grate conveyor in the updraft drying section, or upon the occurrence of a low or uneven pellet bed with normal pressure, and particularly upon the occurrence of the combination with the higher gas pressure of the low or uneven pellet bed; namely, that any of the foregoing conditions cause the pivotally mounted grate castings of the grate conveyor to swing upwardly about their pivotal support to an open and non-conveying position.

Because of the overlapped relation of contiguous grate castings, the opening up of one grate casting due to one of the factors just enumerated can cause the opening of contiguous grate castings, with the result that a number of the grate castings may ultimately open up or swing about their respective pivotal support axes. The plurality of opened-up castings may interlock with each other in such manner that when the grate conveyor arrives at the horizontal stripper, or chute at the discharge end of the grate conveyor, the interlocked castings may be broken.

It has been known to attempt to remedy this situation by stationing operators at observation ports near the preheat end of the grate conveyor, so that when interlocked grate castings approach the stripper, hydraulic lifters are actuated to move the stripper in such manner as to permit the interlocked grate castings to pass the stripper. Unfortunately, in so doing, the associated pellet bed in the raised stripper area is rejected to the dribble hoppers below.

Many other remedies for this condition of interlocked or opened-up grate castings have been conceived, but to the best of my knowledge, none of these other solutions has proved practical.

STATEMENT OF THE INVENTION

Accordingly, it is an object of the present invention to provide a traveling grate construction which prevents undesired movement of pivotally mounted grate members into an opened position or into interlocked relation with contiguous grates.

It is another object of the invention to provide in combination with a grate conveyor having pivotally mounted grate members and which conveyor passes through an updraft section, of means for preventing undesired opening up or interlocking of the grate members as has occurred in the prior art.

In achievement of these objectives, there is provided in accordance with an embodiment of the invention a traveling grate of the type used to convey material through an apparatus such as a dryer, a preheater, a cooler, a furnace, or the like, in which the pivotally mounted grate castings are provided with an "anti-flip leg" which cooperates with an underlying skid bar to prevent undesired pivotal movement of the grate castings to an open position in which they may become interlocked with contiguous grate castings.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and advantages of the invention will become apparent with the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a schematic view of a grate conveyor conveying pelletized material to be processed through a plurality of zones including an updraft drying zone or section;

FIG. 2 is a view in longitudinal section of the grate conveyor of FIG. 1;

FIG. 3 is a partially schematic view in transverse cross-section along line III—III of FIG. 1

FIG. 4 is an enlarged view in a longitudinal section of single grate casting; and

FIG. 5 is a top plan view of a grate casting.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIG. 1, there is shown a moving conveyor generally indicated at **10**, which receives at the feed end or left hand end thereof with respect of the view of FIG. 1, material such as ore or the like in the form of pellets or compacts which forms a bed **12** on the upper surface of the conveyor. Conveyor **10** is trained around sprocket means or the like **14** and **16** at the opposite ends thereof, and enters and passes through a hooded enclosure generally indicated at **20** which is divided by suitable partitioning means **22, 24, 26** and **28** into an updraft drying section generally indicated at **30**, a downdraft drying section generally indicated at **32**, and a preheat section generally indicated at **34**. A stripper or chute **37** is positioned at the discharge end of the grate conveyor and delivers the material being processed to a kiln or other processing equipment (not shown).

Hot gases discharged from the kiln pass into the upper portion of the preheat section **34** thence downwardly through the pelletized load **12** and through the slotted or otherwise apertured grate **10** into the suction boxes **36** and thence through conduits **38** to the intake of fan **40**. Fan **40** discharges through conduit **42** to a wind box **44** positioned above the load material on conveyor **10** in the down draft drying section **32**. The warm gases are discharged by wind box **44** in a down draft direction and pass downwardly through the load **12** and through the apertured conveyor **10** to the suction boxes

46 beneath the conveyor in down draft section 32. The gases pass from suction boxes 46 through conduit means 48 to the intake of fan 50. The output of fan 50 is directed through conduit 52 to a wind box 54 located beneath conveyor 10 in updraft drying section 30. The warm gas is discharged from wind box 54 and passes upwardly through the conveyor and through the pelletized load 12 on the conveyor and thence into the suction boxes 56 from whence the gas passes through conduits 58 to the exhaust stack 60.

As best seen in the views of FIGS. 2–5, inclusive, grate conveyor 10 is formed of a plurality of grate castings each generally indicated at 62. Grate castings 62 are made of a suitable cast metal such as cast iron or the like. The term "grate casting" is used to designate a grate member which is normally made by a casting process but which is not necessarily so made. Each grate casting 62 comprises a main body portion or tail portion 64 having a plurality of narrow slots 65 therethrough to permit passage therethrough of the heating gases. Body portion 64 extends in a generally horizontal plane during the upper run of the conveyor 10 between sprockets 14 and 16. Grate casting 62 also includes a head portion 66 also having gas passage slots therethrough, and an intermediate leg portion 68. The main body portion 64, the head portion 66, and the leg portion 68 of grate casting 62 each extends for substantially the entire transverse width of the grate casting, that is, in the direction X (FIG. 5) which is at right angles to the direction of conveyor travel. As seen in the drawings, the head portion 66 leads in the direction of travel of the grate castings 62.

The longitudinal dimension of the under surface of main body portion 64 of grate casting 62 in the direction of conveyor travel is substantially longer in horizontal projection than is the corresponding dimension of head portion 66 of the grate casting. Hence, main body portion 64 of the grate casting provides a longer moment arm about the pivotal axis provided by the pipe spacer 71 than does head portion 66 of the grate casting which has little or no moment arm. Hence, any abnormal gas pressure exerted on the under surface of grate casting 62, as previously explained, will tend to rotate the grate casting 62 in a clockwise direction with respect to the views of FIGS. 2 and 4 about the longitudinal axis of pipe spacer 71.

The under surface of head portion 66 of grate casting 62 is arched as indicated at 70. Arched portion 70 includes a portion of substantially arcuate contour which is adapted to rest or bear on the upper surface of a pivotal support means in the form of a pipelike support or "pipe spacer" 71 which is suitably supported at its opposite ends by the conveyor chains as will be described in more detail hereinafter. A grate clip 72 is detachably secured by suitable fastening means 73 to the lower portion with respect to the view of FIG. 4 of intermediate leg member 68 of the grate casting. Each grate clip 72 is of generally U-shape and includes a pair of laterally spaced leg portions 77 which are adapted to underlie pipe spacer 71, and a connecting base portion 79 which is secured by fastening means 73 to intermediate leg member 68. Grate clip 72 does not include any surface portion which bears on skid bar 76, to be described. When grate clip 72 is secured in position as shown in views of FIGS. 2, 3 and 4, grate casting 62 is supported on pipelike support or pipe spacer 71 and is prevented from becoming detached therefrom; but grate casting 62 is free to swing pivotally on pipe spacer 71, except as hereinafter described. Pipe spacer 71 lies in a substantially horizontal plane and extends substantially transverse of the longitudinal axis of the conveyor.

The pitch distance between contiguous pipe spacers 71 may typically be about 12 inches, for example. As seen in FIGS. 2 and 4, in the normal position of the grate castings, the trailing end of the main body portion 64 of a given grate casting overlaps and rests on the head portion 66 of the next contiguous trailing grate casting, with reference to the direction of conveyor travel.

In accordance with the present invention, what will be referred to as an "anti-flip leg" generally indicated at 74 is provided substantially centrally located intermediate the transverse width (or dimension X of FIG. 5), anti-flip leg 74 being integrally cast as an extension of head portion 66 of grate casting 62.

Cooperating with the anti-flip leg 74 is a stationary skid bar 76 which extends in substantially a horizontal plane beneath the upper run of conveyor 10 throughout the length of the updraft drying section 30. Skid bar 76 is suitably supported and lies directly beneath the path of travel of anti-flip leg 74. Anti-flip leg 74 is so dimensioned and skid bar 76 is so positioned relative to the under surface of anti-flip leg 74 that under normal pressure and load distribution conditions there is a clearance of, for example, one-sixteenth inch between the under surface of anti-flip leg 74 and the upper surface of skid bar or rail 76.

Thus, for example, as seen in the view of FIG. 2 which illustrates a plurality of longitudinally contiguous grate castings 62A, 62B, 62C, 62D and 62E, all of which are assumed to be passing through the updraft drying section 30, it will be noted that the respective anti-flip legs 74 of grates 62A and 62B all have the normal clearance between the under surface of the respective flip-leg 74 and the upper surface of skid bar 76, since at least the main body portion 64 of the respective grate castings 62A and 62B underlie a substantially normal pellet bed and thus it is assumed that grate castings 62A and 62B are not subjected to an excessive or abnormal updraft gas pressure condition. However, an abnormal upward gas pressure condition caused by the bare load spots overlying the main body portions 64 of the respective grate castings 62C and 62D, tends to swing grate castings 62C and 62D in a clockwise direction relative to the view of FIG. 2, but grate castings 62C and 62D are limited in their clockwise opening movement when the under surface of the respective anti-flip legs 74 associated with the respective grate castings 62C and 62D have abutted against the underlying skid bar 76, as seen in FIG. 2.

As seen in the schematic view in transverse cross section of FIG. 3, a plurality of grate castings such as 62-1, 62-2 and 62-3 are positioned in side-by-side relation between the chains 78 and 80.

The three grate castings 62-1, 62-2 and 62-3 are each pivotally mounted in the same manner as previously described onto a single common pipe spacer 71 or the like which is supported at its opposite lateral ends by chain pins or the like carried by the two chains 78 and 80. A longitudinally extending skid bar respectively indicated at 76-1, 76-2 and 76-3 is provided in longitudinally extending underlying relation to the path of travel of the anti-flip leg 74 carried by each of the respective grate

members **62-1, 62-2** and **62-3.** It will be understood that a complete transverse section of conveyor **10** may include a greater number of chains and a greater number of grate castings or groups of grate castings in a given transverse section. Each of the chains such as chains **78,** and **80** is trained around sprockets such as **14** and **16** at opposite ends of the run of the conveyor, and, in addition, support rollers such as those indicated at **84** mounted on shaft **85** are provided in underlying supporting relation to the conveyor chains such as **78,** and **80** at various locations beneath the upper run of the conveyor.

From the foregoing detailed description of the present invention, it has been shown how the objects of the invention have been obtained in a preferred manner. However, modifications and equivalents of the disclosed concepts such as readily occur to those skilled in the art are intended to be included within the scope of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A grate member for use with a grate conveyor of the type which moves material being processed through a substantially horizontal path of travel, said grate member comprising a material supporting main body portion and a head portion, said grate member being adapted to be pivotally mounted at said head portion thereof for pivotal movement about a substantially horizontal pivotal axis upon a support means carried by and movable with the conveyor, said material supporting main body portion of said grate member extending on one side of said axis for the major part of the length of said grate member measured lengthwise of the conveyor, and an anti-flip leg forming part of and carried by said grate member at said head portion of said grate member, said anti-flip leg extending on the other side of said pivotal axis opposite said one side, said anti-flip leg being directed downwardly and adapted to engage a stationary skid bar mounted in a substantially horizontal plane in underlying relation to the path of travel of said anti-flip leg, said anti-flip leg being adapted to engage the skid bar at a point of engagement on said other side of said pivotal axis to thus limit upward pivotal movement of said main body portion of said grate member, whereby to maintain said main body portion of said grate member in a generally horizontal material carrying position.

2. A grate member as defined in claim **1** in which the path of travel of the grate conveyor includes for at least a portion of the length thereof an updraft region and the stationary skid bar is mounted in a substantially horizontal plane in the updraft region in underlying relation to the path of travel of said anti-flip leg through said updraft region, whereby engagement of said anti-flip leg with the skid bar is effective to maintain said main body portion of said grate member in a generally horizontal material carrying position while passing through said updraft region.

3. In combination, a grate conveyor for moving material being processed through a substantially horizontal path of travel, said path of travel including for at least a portion of the length thereof an updraft region, said conveyor comprising a grate member including a material supporting main body portion and a head portion, said grate member being adapted to be pivotally mounted at said head portion thereof, support means carried by and movable with said conveyor for mounting said grate member for pivotal movement about a substantially horizontal pivotal axis, said material supporting main body portion of said grate member extending on one side of said axis for the major part of the length of said grate member measured lengthwise of the conveyor, whereby the updraft may tend to swing said main body portion upwardly about said axis, and an anti-flip leg forming part of and carried by said grate member at said head portion of said grate member, said anti-flip leg extending on the other side of said pivotal axis opposite said one side, a stationary skid bar mounted in a substantially horizontal plane in said updraft region in underlying relation to the path of travel of said anti-flip leg through said updraft region, said anti-flip leg being directed downwardly toward said skid bar and being adapted to engage said skid bar at a point of engagement on said other side of said pivotal axis to thus limit upward pivotal movement of said main body portion of said grate member, whereby to maintain said main body portion of said grate member in a generally horizontal material carrying position while passing through said updraft region.

4. The combination defined in claim **3** in which said conveyor comprises a plurality of contiguous grate members, with an end of the main body portion of each grate member overlapping the head portion of a corresponding contiguous grate member.

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