L. PETERSEN

SUPPORTS FOR ROTARY KILNS AND DRUMS

Filed Aug. 24, 1956

FIG. 1

FIG. 2

FIG. 3

FIG. 4

Inventor:

By

Attorneys
This invention relates to rotary kilns and drums, which are driven by a pinion meshing with a master gear encircling and secured to the kiln shell, and the invention is concerned more particularly with novel supporting means for such a kiln, which protects the driving mechanism against damage resulting from the warping and twisting of the shell when the kiln is in use and may also protect the seal between the kiln and the hood at the hot end of the kiln.

Rotary kilns have heretofore been commonly supported for rotation on a plurality of pairs of supporting elements, such as rollers or slide shoe bearings, which engage circumferential tires distributed along the kiln shell. Frequently, certain of the supporting elements have been resiliently mounted, while others have rigid mountings, and the use of resilient supporting elements makes it possible to keep the stresses on the kiln shell and elements within desired limits when the shell warps and twists, while rigid elements prevent shell movements.

The kiln-supporting means of the invention includes both rigid and resilient supporting elements and the elements are so arranged that the engagement of the driving pinion with the master gear is protected against damage arising from warping of the shell. Also, if desired, protection against similar damage may be afforded to the seal between the kiln and the hood at the hot end of the kiln, that is, the end of the kiln into which the combustible mixture is introduced and near which the highest temperatures within the kiln are reached. The desired result is obtained by employing at least two substantially co-axial rigid supporting elements, which engage respective tires and lie on the same side of the kiln as the driving pinion, that is, on the same side of a vertical plane through the kiln axis as the pinion. The master gear is disposed at approximately the center of gravity of the kiln and the tires engaged by the rigid elements lie on opposite sides of the gear with one tire adjacent the gear and the other near the end of the kiln. The common axis of the rigid elements is close to the axis of the pinion and the second element of each of the pairs, which engage the specified tires, may be rigid or resilient with rigid elements preferred. When a pair of rigid elements engage the tire adjacent the gear toward the cool end of the kiln and a second pair of rigid elements engage the tire at the hot end of the kiln, the teeth of the gear and pinion are protected against damage because of improper movement arising from warping of the kiln, and the seal between the kiln and the hood at the hot end of the kiln is similarly protected. If the tires referred to are engaged by a rigid element and a resilient element and the rigid elements lie on the same side of the kiln as the pinion and their common axis lies at the axis of the pinion, movements of the kiln resulting from warping will take place about the common axis of the elements, and such movements will, therefore, have no effect on the driving mechanism.

The invention will be more fully understood by referring to the accompanying drawing, in which:

Fig. 1 is a side elevation, with parts broken away, of a rotary kiln provided with the supporting means of the invention;

Fig. 2 is a diagrammatic plan view of the kiln and its supporting units, which are shown as rollers;

Fig. 3 is a sectional view on line 3--3 of Fig. 1; and

Fig. 4 is a diagrammatic plan view of the kiln with supporting units in a different arrangement.

The rotary kiln shown in Fig. 1 includes a long cylindrical shell 1 mounted for rotation at a small slope and having its lower end within a hood 2. A seal is provided between the outside of the kiln shell and the wall of the opening, through which the shell extends into the hood, to prevent the admission of air into the hood through the opening. A burner pipe 3 for supplying a fuel-air mixture extends through the hood and into the lower end of the kiln and combustion takes place a short distance upward from the hood, so that at the end of the kiln, into which the combustion mixture is introduced, is commonly referred to as the hot end. The upper or cool end of the kiln lies within a smoke chamber 4, and the feed pipe 5 for the introduction into the kiln of the raw material extends through the chamber 4 and into the end of the kiln.

The shell is provided with a plurality of circumferential tires 6, 7, 8, and 9, which are distributed along the shell and are employed in a number, which depends upon the length of the kiln. The kiln is supported by pairs of elements, which engage the tires from beneath with the elements lying on opposite sides of the vertical plane through the kiln axis. In the installation shown, the elements are rollers 10, 11, 12, and 13, which engage respective tires 6, 7, 8, and 9 on the near side of the kiln, as seen in Fig. 1, while the remaining rollers 14, 15, 16, and 17 of the respective pairs engage the tires on the far side of the kiln.

The rollers 10, 13 and 14--17, inclusive, are resiliently mounted, so that they can move up and down as the parts of the kiln have an eccentric or wobbling movement caused by warping or twisting of the kiln shell. The resilient mounting for each roller includes a frame 18 mounted at one end on a shelf 19 supported in bearings 20 on a pier or foundation 21. The opposite end of the frame is connected to a piston rod 22 attached at its lower end to a piston within a cylinder 23. The lower ends of the cylinders of the pairs acting on the mountings of rollers 10, 14, and 13, 17 and of the single cylinders acting on the mountings of rollers 15, 16 are connected by piping 24 to respective accumulators or pressure tanks 25. Each of the tanks is supplied with a fluid medium, which is maintained at a substantially constant pressure regardless of the positions of the pistons within their cylinders. The rollers 11 and 12, which form pairs with rollers 15, 16, respectively, are rigidly supported with their trunnions mounted to lie substantially in a common axis in bearings 26 secured to the top of pier 21a.

A master gear 27 encircles and is attached to the kiln shell at approximately the center of gravity of the kiln and it lies between tires 7 and 8. In the installation illustrated, the tire 8, which is at the side of the gear toward the cool end of the kiln, is closer to the gear than tire 7. A driving pinion 28 meshes with gear 27 and is supported for rotation in bearings 29 with its shaft connected to a motor not shown. The pinion lies at the same side of the kiln as the rigidly mounted rollers 11, 12 and the common axis of these rollers lies close to the axis of the pinion and preferably the rollers and pinion are coaxial.

With the arrangement described, the movements of the kiln permitted by the resiliently supported rollers 15 and 16 are restricted by the rigidly mounted rollers 11
and 12 to a rocking movement about the axis of rollers 11 and 12. Since that axis lies close to the axis of the pinion, movements of the kiln, due to warping or twisting, will not produce a substantial change in the meshing of the pinion and gear. The movements of the kiln are ordinarily so small that, if the pinion 28 is mounted on the same side of the kiln as the rigidly supported rollers 11 and 12, the engagement of the teeth of the pinion and gear will not be detrimentally affected by the movements. However, it is preferable to mount the pinion so that the axis of the pinion is the same as the common axis of the rollers, since the driving engagement of the pinion and gear will then be unaffected by any kiln movement.

In the installation shown, the rigidly mounted rollers 11 and 12 engage the tires, which are on opposite sides of and adjacent to the master gear 27. While it is important that the rigid supporting elements engage tires lying on opposite sides of the gear, it is not necessary that both tires engaged by rigid elements lie adjacent the gear. The preferred construction involves the use of a rigid supporting element in engagement with the tire adjacent the gear and on the side of the cool end of the kiln and a rigid supporting element in engagement with a tire adjacent the hot end of the kiln. Such a construction is shown in Fig. 4.

The kiln shown in Fig. 4 includes a shell 30 with its lower end entering a hood 31, through which a burner tube 32 extends into the kiln. At its upper end, the shell lies within a chamber 23 similar to chamber 4. The kiln shell is encircled by a master gear 34, with which a driving pinion 35 meshes, and the kiln is supported for rotation on a plurality of tires illustrated as four in number and designated 36, 37, 38, and 39. The tire 38 lies adjacent the gear on the side of the kiln toward the cool end and the tire 36 lies adjacent the hot end of the kiln.

The tire 36 is engaged by a pair of rigidly mounted rollers 40, 45, which lie on opposite sides of the kiln, and the tire 38 is similarly engaged by a pair of rollers 42, 43 lying on opposite sides of the kiln. The rollers 40, 42 are substantially coaxial and their common axis lies close and is preferably the same as the axis of the pinion 35. Rollers 41, 43 are also substantially coaxial. The tire 37 is supported on a pair of resiliently mounted rollers 44, 45 and tire 39 is supported on a pair of resiliently mounted rollers 46, 47. The resilient mountings of rollers 44—47, inclusive, are the same as those described in connection with the construction shown in Figs. 1–3, inclusive.

With the arrangement of rollers illustrated in Fig. 4, the movement of the kiln shell is so restricted that improper meshing of the teeth of the gear and pinion, which might result in damage, is avoided and damage to the seal between the kiln and the hood 31 is likewise avoided. If the rollers 41 and 43 were replaced by resiliently mounted rollers, the drive mechanism would be protected against damage resulting from warping of the kiln, since movements of the kiln would take place about the common axis of the rollers 40, 42 lying near the axis of the pinion. However, with rollers 41, 43 replaced by resiliently mounted rollers, the desired protection of the seal between the kiln and the hood would not be provided.

1. A rotary kiln which comprises a shell having a plurality of circumferential tires distributed along its length, a master gear encircling and secured to the shell between a pair of tires, means for supporting the shell for rotation with its axis at a low angle to the horizontal including a pair of supporting elements on opposite sides of the kiln engaging each tire, a rigid mounting for at least one element of the pair engaging the tire adjacent the gear, a rigid mounting for at least one element of a pair engaging a tire on the opposite side of the gear from said adjacent tire, the rigidly mounted elements being substantially coaxial, resilient mountings for the elements engaging the remaining tires, means for rotating the shell including a pinion meshing with the gear at the same side of the kiln as the rigidly mounted elements, and means for introducing a combustible mixture into the kiln at one end.

2. The rotary kiln of claim 1, in which both elements of the pair engaging the tire adjacent the gear are rigidly mounted.

3. The rotary kiln of claim 1, in which the tire engaged by the second rigidly mounted element lies adjacent the end of the kiln.

4. The rotary kiln of claim 1, in which one tire engaged by a rigidly mounted element lies adjacent the end of the kiln, into which the combustible mixture is introduced, and the second tire engaged by a rigidly mounted element lies adjacent the gear and on the side of the gear remote from the first tire.

5. The rotary kiln of claim 4, in which both elements of the pair engaging the tire adjacent the end of the kiln, into which the combustible mixture is introduced, are rigidly mounted.

6. The rotary kiln of claim 1, in which the common axis of the rigidly mounted elements lies sufficiently close to the axis of the pinion to prevent the teeth of the gear and pinion from being damaged as a result of improper meshing.

7. The rotary kiln of claim 1, in which the second element of the pair engaging the tire adjacent the gear and the second element of the pair engaging said tire on the opposite side of the gear from said adjacent tire are resiliently mounted.

8. The rotary kiln of claim 7, in which the two tires engaged by a rigidly supported element and a resiliently supported element both lie adjacent to the gear and on opposite sides thereof.

References Cited in the file of this patent

UNITED STATES PATENTS
1,172,883 Gammeter ------------ Feb. 22, 1916
1,314,994 Wertenbruck ----------- Sept. 2, 1919

FOREIGN PATENTS
17,752 Great Britain ------------ 1906