Dec. 29, 1936. M. VOGEL-JORGENSEN 2,066,291

ROTARY KILN

Filed Aug. 22, 1935

Fig. 1.

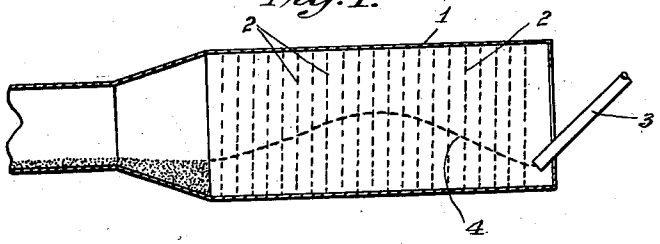


Fig. 2.

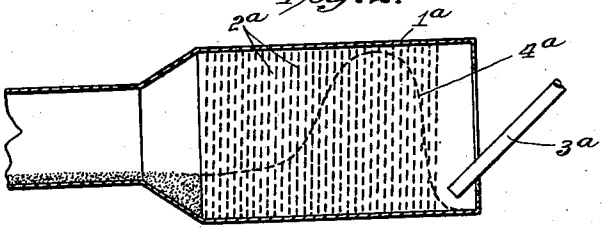


Fig. 3.

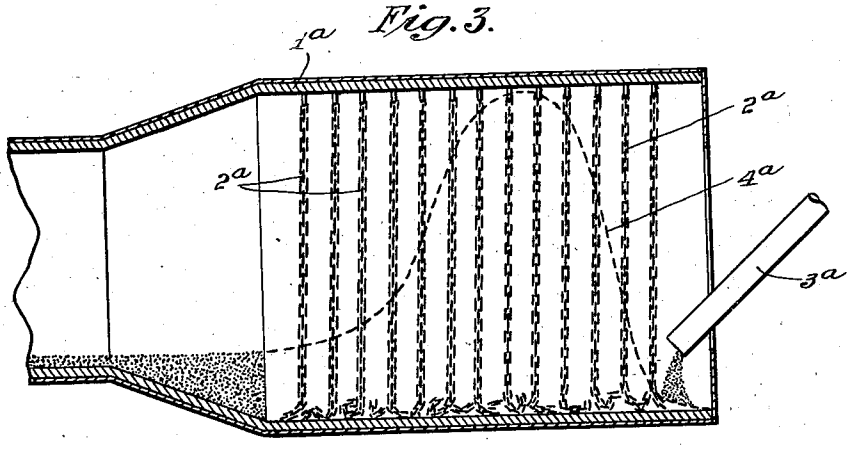
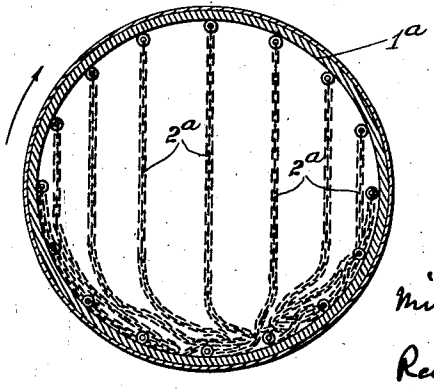


Fig. 4.



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ROTARY KILN

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3 Claims. (Cl. 263—33)

This invention is particularly concerned with the construction of rotary kilns in which are burned cement raw materials and the like, which materials are fed to the kiln in the form of slurry, that is, as a semi-liquid mass, from which the water must be driven off before the materials pass into the calcining zone of the kiln. In order to promote the action of the hot kiln gases, from the sintering and calcining zones of the kiln, in effecting the drying and heating of the raw materials, it is usual to place in that portion of the kiln in which the drying and heating of the material is to be carried on heat transmitting bodies, such as chains, for example, which, in the rotation of the kiln, pass through the slurry as it moves onward in the lower part of the kiln, are coated with the slurry and in the continued rotation of the kiln raise the slurry into the path of the hot combustion gases, the dried slurry eventually falling from the heat transmitting bodies and passing onward into the calcining zones. Usually that portion of the kiln in which the heat transmitting bodies are located is of larger diameter than the succeeding portions of the kiln. In the operation of kilns so equipped with heat transmitting bodies as heretofore it has been found that there is a tendency of the slurry to accumulate near the feed end of the kiln to such an extent that it backspills or escapes at the feed end of the kiln. It has been thought to overcome this tendency, sometimes by arranging the chains or other heat transmitting bodies so as to promote the movement of the slurry, but this expedient has not been found wholly effective. It has also been thought that the difficulty might be overcome by placing the heat transmitting bodies further apart, but this, as might be expected, resulted in the retarding of the drying out and heating of the slurry, with consequent economic loss. Extended study of the problem presented has disclosed the quite unexpected phenomenon that while the placing of heat transmitting chains somewhat closer together than is usual has increased the difficulty referred to, a further increase in the density of the heat transmitting bodies has not only served to promote the action of the hot combustion gases on the slurry, but has materially diminished the tendency to backspill, this result being apparently due in large measure to the complete filling of the interstices between the chains, particularly at the bottom of the kiln, whereby the mass of slurry near the feed end of the kiln is raised to a greater height in the rotation of the kiln than would be the case with a more open chain system. Observation shows that the tendency to backspill increases with accumulation of the slurry to a certain height, when the chains are spaced as usual heretofore, but decreases when, by reason of the greater density of the chain system, the accumulation rises to such a height that it completely fills the cross-section of the kiln, the conveying capacity of the kiln being at the same time increased. This may be due to the fact that the rate of flow of the slurry, as it is progressively dried out, increases toward the discharge end of the kiln. It has been found that the rate of flow of the slurry and the conveying capacity of the kiln increases until the accumulation of slurry, due to the greater density of the chain system, reaches to the top of the kiln completely filling the cross-section of the kiln. Thus the conditions for the transmission of heat to the chains and the slurry reach their optimum value, the kiln gases being then forced through the mass of material and chains filling the entire cross section of the kiln instead of making contact only with the top surface of the slurry mass as heretofore. It will be understood, of course, that the relative movement of the heat transmitting bodies in the rotation of the kiln is continually forming openings through which the kiln gases pass. To accomplish the desired purpose it is desirable therefore that the heat transmitting bodies shall be so densely arranged not only that the material will form a coating on the bodies but that it will be caused to accumulate between the chains throughout the cross section. It is therefore desirable that the chains shall have considerable relative movement as between the chains themselves and that the links of the chains shall also be subjected to substantial relative displacement. To this end the chains should hang freely, preferably secured to the shell of the kiln at one end only their other ends being free and shall have such slack length that the lowermost portions, in the rotation of the kiln, shall rest against one another in the bottom portion of the kiln and on the side which moves upwards during the rotation. A very considerable movement of the chain members therefore takes place with a grinding action which clears the chain links quickly of the adhering material and assists in the conveying of the material through the kiln.

In the accompanying drawing:

Figure 1 is a view in longitudinal section and in outline illustrating diagrammatically the usual

arrangement as heretofore of heat transmitting chains in a rotary kiln.

Figure 2 is a view similar to Figure 1, but illustrating the arrangement of heat transmitting chains in accordance with the present invention.

Figures 3 and 4 are detail views in longitudinal section and transverse section, respectively, illustrating more particularly the relation of the heat transmitting chains in accordance with the present invention.

In the construction illustrated in Figure 1 the upper or preheating portion of a rotary kiln, of ordinary construction, is shown at 1 and for purposes of comparison the relation of heat transmitting chains as heretofore is shown at 2. At 3 is shown a chute through which slurry is introduced at the feeding end of the kiln. The broken line 4 represents the contour of the material in the drying and preheating zone of a kiln in which the heat transmitting bodies are arranged as heretofore.

In the embodiment of the invention illustrated in Figures 2, 3 and 4 the drying and preheating zone of the kiln is illustrated at 1^a and may be relatively shorter as compared with kilns as heretofore arranged. In Figure 2 the heat transmitting chains are represented as much more densely arranged than has been usual heretofore, the chains being arranged relatively close together in each transverse group and the successive transverse groups being arranged close together, the density of the chain system being such that the material is caused to accumulate near the feed end of the kiln to such an extent that it fills the entire cross section of the kiln by reason of the fact that the chains are so close one to another that the material accumulates and fills the interstices between the chains. The accumulation is rapid on its inlet side, the material being retained between the chains and held from backspilling. As the drying out of the slurry progresses the rate of flow of the material increases and the slope is more gradual on the side of the accumulation toward the discharge end of the kiln.

I claim as my invention:

1. In a rotary kiln for the burning of cement raw materials having a kiln shell and heat transmitting chains secured to the shell arranged in a series of successive groups each extending transversely of the kiln, the chains having such slack length that their lower portions will pile up on the bottom of the kiln and being so close together that the portion of each chain so piled up will rest against a piled portion of a chain of the same group whereby the cement material will be caused to accumulate between the chains.

2. In a rotary kiln for the burning of cement raw materials having a kiln shell and heat transmitting chains secured to the shell arranged in a series of successive groups each extending transversely of the kiln, the chains having such slack length that their lower portions will pile up on the bottom of the kiln and being so close together that the portion of each chain so piled up will rest against a piled portion of a chain of the same group, such successive groups being closely spaced, whereby the cement material will be caused to accumulate between the chains.

3. A rotary kiln for the burning of cement raw materials having a kiln shell and heat transmitting chains secured to the shell, the chains having such slack length and being so closely arranged that the lowermost portions of the chains lie substantially in contact with one another upon the lowermost portions of the shell whereby on the rotation of the kiln the material is not only raised into the path of the combustion gases but is caused to accumulate between the chains, the chains being secured to the shell at one end only having the other end free.

MIKAEL VOGEL-JORGENSEN.