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METHOD OF CLEANING ROTARY KILNS

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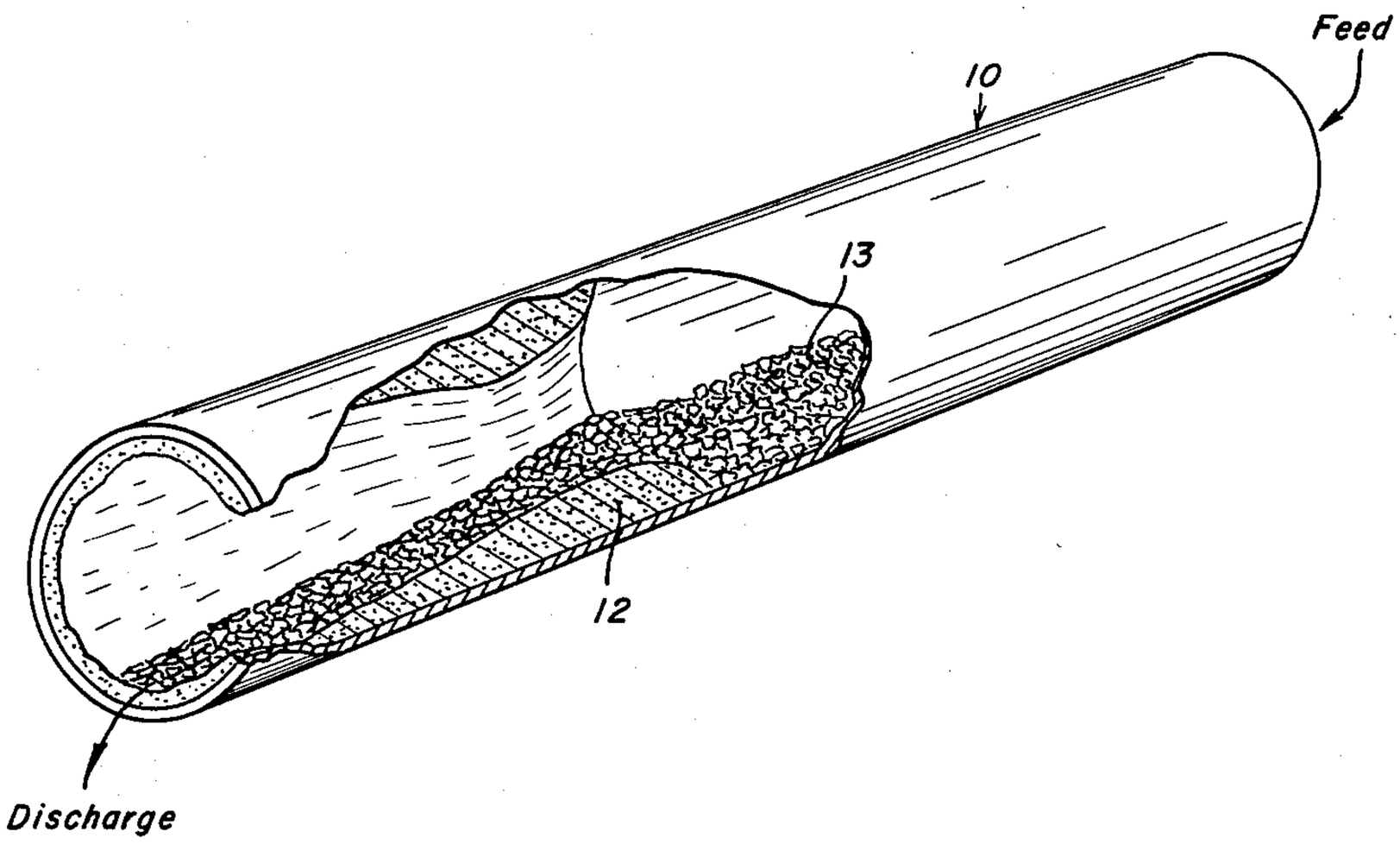

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METHOD OF CLEANING ROTARY KILNS

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This invention relates to an improved method of cleaning deposits from rotary kilns.

Although our invention is not limited to use with any specific material, it is particularly useful for cleaning a kiln which produces fluxed iron ore agglomerates. When iron ore fines are agglomerated with a fluxing material in a rotary kiln, a ring of hematite crystals and silicate builds up on the inside of the kiln. Unless such deposits periodically are cleaned from the kiln, the product is adversely affected. Heretofore it has been necessary to stop the kiln, empty and cool it, and clean away the deposit mechanically, as with heavy steel bars actuated by air hammers. This procedure requires four to six workmen and six to eight hours time, and necessitates a downtime of the kiln of 25 to 40 percent. The process flows and temperature standards are interrupted, thus necessitating even more delay before an acceptable product can be produced.

An object of our invention is to provide an improved method of cleaning deposits from a kiln and simplifying the operation and reducing both downtime and interruption to the process.

A further object is to provide an improved cleaning method which overcomes the need for heavy equipment and excessive manpower.

In the drawing:

The single FIGURE is a diagrammatic perspective view of a kiln with parts broken away, showing a cleaning operation in accordance with our invention.

The drawing shows a conventional rotary kiln **10** driven by any suitable mechanism, not shown. Material such as iron ore fines and flux, is introduced to the upper or right end of the kiln from a suitable feeder, not shown. The kiln is equipped with any suitable burner, not shown, which raises the temperature of the material sufficiently that it forms fused agglomerates. Finished agglomerates discharge from the lower or left end of the kiln to a suitable receiver, not shown. As the kiln continues to operate, a deposit **12** accumulates in the form of a ring around the inside wall, and periodically must be cleaned away, as already explained.

In accordance with our invention, we introduce to kiln **10** via the usual feeder a quantity of a coarse stone **13** of a chemical and mineralogical make-up that causes deposit **12** to dissolve and preferentially adhere to the stone rather than to the kiln wall. The size of stone can be in the range 1 inch to ¼ inch, but we prefer ¾ inch to ½ inch. In our example of a kiln used to agglomerate iron ore fines, the stone can be limestone or dolomite or else can be of a silicious nature. If we use limestone, preferably it contains at least 45 percent CaO. If we use dolomite, preferably it contains at least 45 percent CaO plus MgO. If we use a silicious stone, preferably it contains at least 75 percent SiO_2. During cleaning we maintain the kiln temperature above the melting

point of the compound formed at the point of contact between the stone and the deposit. This temperature of course varies with different deposits, but commonly is in the range of 2300 to 2650 F., or preferably 2400 to 2550 F. for most applications. The stone passes through the kiln in the same manner as the material usually processed therein, and leaves through the discharge end. We continue passing stone through the kiln until the deposit is effectively cleaned away.

As a specific example to illustrate how our invention works, we produced fluxed iron ore agglomerates in a rotary kiln and allowed a large deposit to accumulate. This deposit formed a ring similar to that shown in the drawing. We then introduced to the feed end of the kiln about 2½ tons of ¾ inch to ½ inch dolomite whose combined CaO and MgO content was about 47 percent, without preheating. As the stone progressed through the portion of the kiln containing the ring, we observed the deposit melted onto the surface of the stone and was carried from the kiln with the stone. About 75 percent of the deposit was removed from the portion of the kiln where the temperature ranged from 2400 to 2550.

From the foregoing description it is seen our invention affords a simple effective method of cleaning a deposit from a rotary kiln. Our cleaning method eliminates need for heavy equipment and excessive manpower. Although we have emphasized the cleaning of kilns which produce iron ore agglomerates, it is apparent our method has application to other materials. For example, deposits can be cleaned from kilns which process limestone, dolomite or cement by using coarse hematitic iron ore as the removing agent. We can also increase the effectiveness of our method by preheating the removing agent.

While we have shown and described certain preferred embodiments of the invention, it is apparent that other modifications may arise. Therefore, we do not wish to be limited to the disclosure set forth but only by the scope of the appended claims.

We claim:

1. A method of cleaning a deposit of hematite crystals and silicate from a rotary kiln used to agglomerate fluxed iron ore fines comprising feeding to the kiln coarse stone selected from the group consisting of limestone, dolomite and silicious stone and being of a size range of 1 inch to ¼ inch, said stone having a chemical and mineralogical make-up to which the material of the deposit adheres preferentially over adhering to the kiln wall, and heating the kiln to a temperature of 2300 to 2650° F.

2. A method as defined in claim 1 in which the stone is limestone having a CaO content of at least 45 percent.

3. A method as defined in claim 1 in which the stone is dolomite having a combined CaO and MgO content of at least 45 percent.

4. A method as defined in claim 1 in which the stone is silicious having a SiO_2 content of at least 75 percent.

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