March 11, 1958 O. MOKLEBUST 2,826,403

COOLING ARRANGEMENTS FOR ROTARY KILNS

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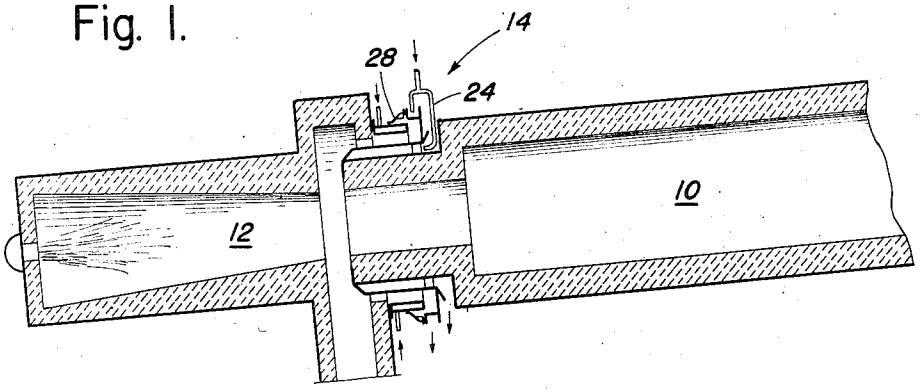
Fig. 1.



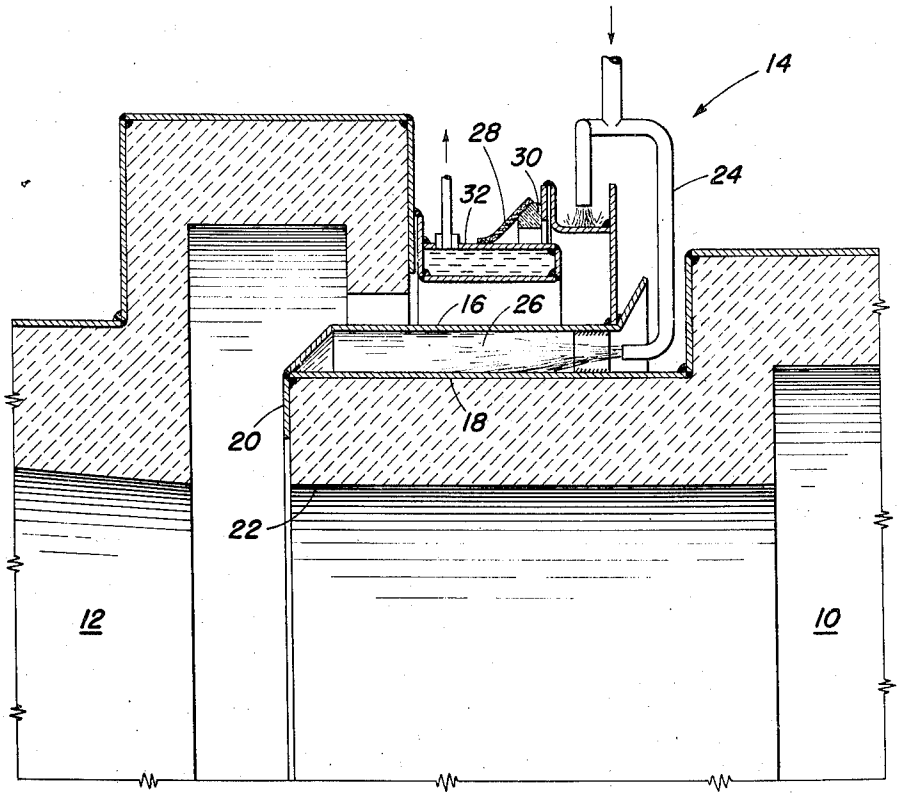


Fig. 2.

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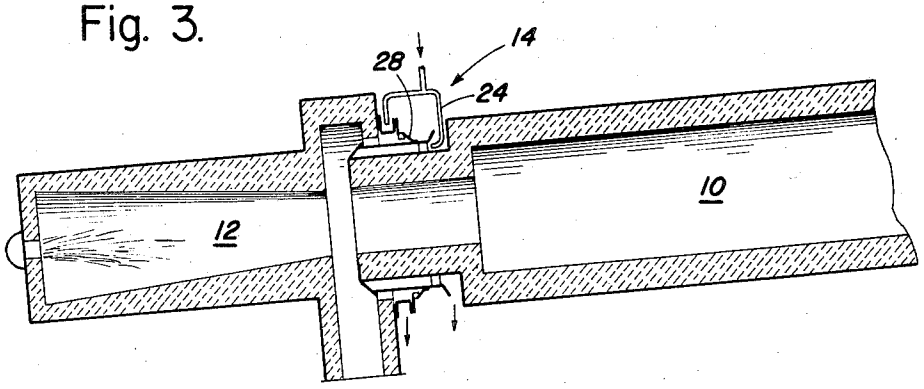
Fig. 3.



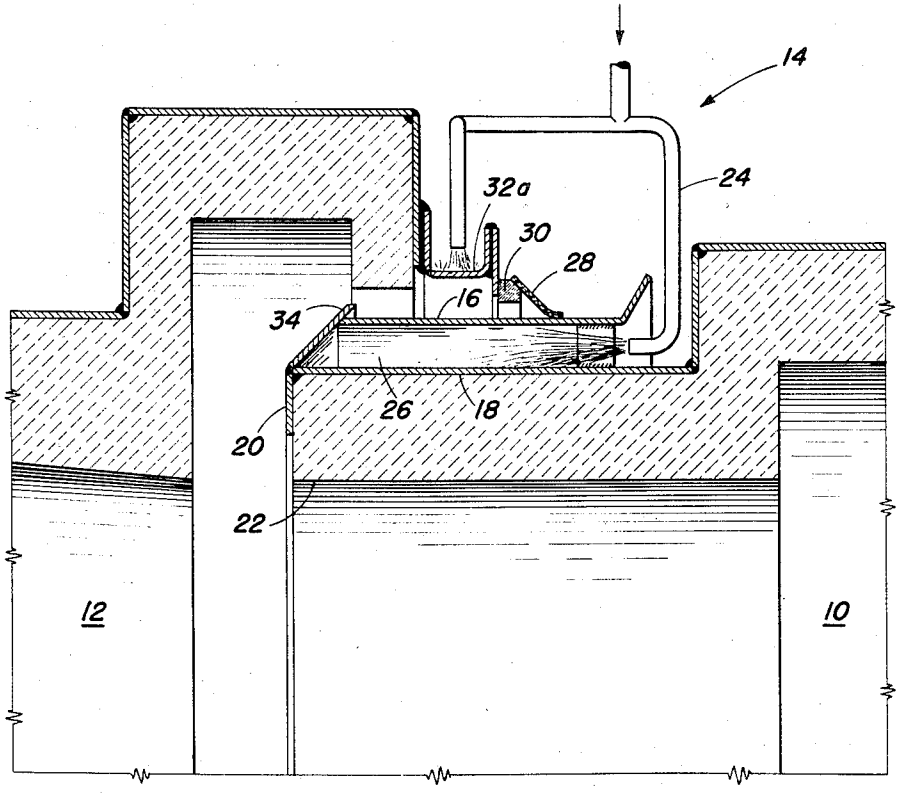


Fig. 4.

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COOLING ARRANGEMENTS FOR ROTARY KILNS

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Claims priority, application Norway July 17, 1954

6 Claims. (Cl. 263—33)

This invention relates to an improved cooling and sealing arrangement in rotary kilns provided with a stationary combustion chamber.

It is recognized that in rotary kilns, especially those which are run at high temperatures, as for example cement kilns, roasting furnaces, agglomerating furnaces, and reduction furnaces, one is likely to encounter difficulties with the rotary part of the firing end of the kiln. The iron casing of the kiln generally expands more than do the refractory bricks of the kiln lining, and consequently the lining ends to loosen and collapse. In kilns where the heating gases are oxidizing, as for example cement and roasting kilns, air cooling is often used for the iron or other metallic casing at this place. The air so employed, however, may enter the kiln along with combustion gases from the burner. In conventional practice a cast steel ring or plates with a low heat expansion is employed to support the outer part of the lining where the strain is greatest. The cast steel elements must usually be bolted to the furnace casing as they cannot be welded. For this reason it is not possible to obtain a completely tight connection between the firing end of the kiln and the combustion chamber. In kilns where an oxidizing flame is employed an air leakage at the firing end is of minor importance with regard to air entering the kiln this way. Direct water cooling of the casing cannot be used at this place in the usual constructions as in that case a considerable quantity of water would be drawn into the kiln and causes much more difficulties than would arise from leakage air when air cooling is employed.

In kilns operating with a reducing flame any leakage will be detrimental. If leakage air contacts with the reducing gases, the gases will burn and strong flames, oevrheating, and uncontrollable gas compositions will result.

An object of the instant invention therefore is to provide an improved cooling and sealing arrangement in a rotary kiln having a stationary combustion chamber. Another object is to provide an effective seal between the rotary kiln and the stationary combustion chamber particularly in connection with the use of reducing atmospheres. These and other objects of the invention will become more clear from the following description and from the drawings:

The arrangement is schematically illustrated in the drawings where:

Fig. 1 shows a rotary kiln **10** with a stationary combustion chamber **12** and the cooling and sealing arrangement generally shown at **14**;

Fig. 2 shows a more detailed section in side elevation of the cooling and sealing arrangement of Fig. 1;

Fig. 3 and Fig. 4 show a modification within the scope of the instant invention but being of somewhat simpler construction.

The instant cooling arrangement consists in a cooling mantle welded to the furnace casing and to the supporting ring for the end of the lining, and a pipe at the top of the kiln through which cooling water is introduced into the cooling mantle. On account of the incline and rotation of the kiln the water will flow towards the end of the kiln and will be distributed all over the furnace casing and will leave the cooling mantle at the lower edge of the kiln.

By such arrangement the following advantages are obtained:

(1) The furnace casing is kept cooler than with air cooling and the danger of the lining collapsing will be reduced especially in kilns with a large cross section.

(2) On account of the welded connection between furnace casing, cooling mantle and supporting ring the connection will be completely tight and will give a good cooling action on the supporting ring, making it unnecessary to use special cast material as the usual quantities of steel may be employed.

Fig. 2 shows in greater detail the firing end of the rotary kiln **10** wherein the cooling mantle **16** is welded to the furnace casing **18** and to the supporting ring **20**. The firing end of the kiln is also provided with a refractory lining **22**. Means **24** are provided for introducing water which is preferably employed as the cooling medium into the space **26** between the cooling mantle **16** and furnace casing **18**. As previously described the cooling water will, on account of the inclination and rotation of the kiln, run towards the end of the kiln and thus be distributed over the furnace casing and will subsequently leave the cooling mantle underneath the firing end of the kiln. The seal or packing **28** which is of a flexible and elastic composition is fixedly attached to the outside of the cooling mantle **16** by conventional means. It may be desirable to place an insert of heat-insulating material **30** between the seal and the mantle in order to improve the life of the seal. The seal slides against a second cooling mantle **32** which is attached to the outer wall of the combustion chamber **12**. The seal **28** may, however, slide directly against the outer wall of the combustion chamber provided there is no unreasonable amount of heat concentrated at the area of contact. According to the construction shown in Fig. 1 and in Fig. 2, the rotary kiln with the cooling and sealing arrangement attached thereto rotates and the end surface of the seal during such rotation continuously slides against the combustion chamber surface or as shown against the second cooling mantle and thus creates a substantially complete and effective seal.

A more simple construction of the instant invention is shown in Fig. 3 and in Fig. 4. In this modification the packing is fixedly attached to the open water cooling mantle **32*a*** which is connected to the stationary combustion chamber and slides against the outside of the cooling mantle **16** when said cooling mantle rotates. In this modification shield **34** is preferably welded to the mantle as shown in order to protect against direct heat radiation, which would tend to lessen the life of the seal.

The materials of construction are not particularly critical. It has been found that the cooling mantle construction may be of material suitable for welding to the furnace casing and supporting ring. Alloys and metals such as mild steel have been found satisfactory. The packing or seal should be of flexible and elastic composition such as, for example, rubber.

It is evident that by employing the instant construction it is possible to obtain a satisfactory cooling and sealing arrangement which is particularly desirable when employing a rotary kiln wherein a reducing atmosphere must be maintained.

While the instant invention has been described in the foregoing specification and drawings, it is not expressly limited thereto and is intended to incorporate those

modifications and variations which fall within the scope of the following claims.

I claim:

1. In rotary kiln apparatus having a stationary combustion chamber and a rotary kiln element having an outer furnace casing, an improved cooling and sealing arrangement comprising cooling means fixedly joined to the furnace casing and rotatable therewith, flexible-elastic sealing means attached to said cooling means and being in continuous slidable contact with the outer surface of said combustion chamber during rotation of the kiln.

2. In rotary kiln apparatus having a stationary combustion chamber and a rotary kiln element having an outer furnace casing, an improved cooling and sealing arrangement comprising a cooling mantle adapted to receive and contain a cooling fluid, said mantle surrounding part of the kiln nearest the combustion chamber and being fixedly joined to the furnace casing, a flexible-elastic sealing member having generally the circumference of the mantle, one end of the sealing member being tightly attached to said cooling mantle and thus rotatable therewith, the other end of the sealing member being in continuous but slidable contact with the outer surface of said combustion chamber.

3. In rotary kiln apparatus having a stationary combustion chamber and a rotary kiln element having an outer furnace casing, an improved cooling and sealing arrangement comprising a first cooling mantle adapted to receive and contain a cooling fluid, said mantle surrounding part of the kiln nearest the combustion chamber and being fixedly joined to the furnace casing, a second cooling mantle fixedly attached to a circumferential area of the outer wall of the combustion chamber, a flexible-elastic sealing member having generally the circumference of the cooling mantles, one end of the sealing member being tightly joined to said first cooling mantle and thus rotatable therewith, the other end of the sealing member being in continuous but slidable contact with said second cooling mantle.

4. In rotary kiln apparatus having a stationary combustion chamber and a rotary kiln element having an outer furnace casing, an improved cooling and sealing arrangement comprising cooling means fixedly joined to the outside of the combustion chamber, flexible-elastic sealing means attached to said cooling means, a second cooling means fixedly attached to the furnace casing of the rotary kiln near the combustion chamber, said sealing means being in continuous slidable contact with said second cooling means during rotation of the kiln.

5. In rotary kiln apparatus having a stationary combustion chamber and a rotary kiln element having an outer furnace casing, an improved cooling and sealing arrangement comprising a first cooling mantle adapted to receive and contain a cooling fluid, said first cooling mantle being circumferentially attached to the outer wall of the combustion chamber, a flexible-elastic sealing member having generally the circumference of said first cooling mantle, one end of the sealing member being tightly attached to said first cooling mantle, a second cooling mantle which surrounds that part of the furnace casing of the kiln nearest the combustion chamber, the other end of the sealing member being in continuous but slidable contact with the outer surface of said second cooling mantle.

6. In rotary kiln apparatus having a stationary combustion chamber and a rotary kiln element having an outer furnace casing, an improved cooling and sealing arrangement comprising a first cooling mantle adapted to receive and contain a cooling fluid, said first cooling mantle being circumferentially attached to the outer wall of the combustion chamber, a flexible-elastic sealing member having generally the circumference of said first cooling mantle, one end of the sealing member being tightly attached to said first cooling mantle, a second cooling mantle which surrounds that part of the furnace casing of the kiln nearest the combustion chamber, the other end of the sealing member being in continuous but slidable contact with the outer surface of said second cooling mantle, and shielding means being joined to and extending out from said second cooling mantle and positioned to prevent direct heat radiation against the flexible-elastic sealing member.

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