March 26, 1929. T. RIGBY 1,706,749

TREATMENT OF SLURRIES IN ROTARY KILNS

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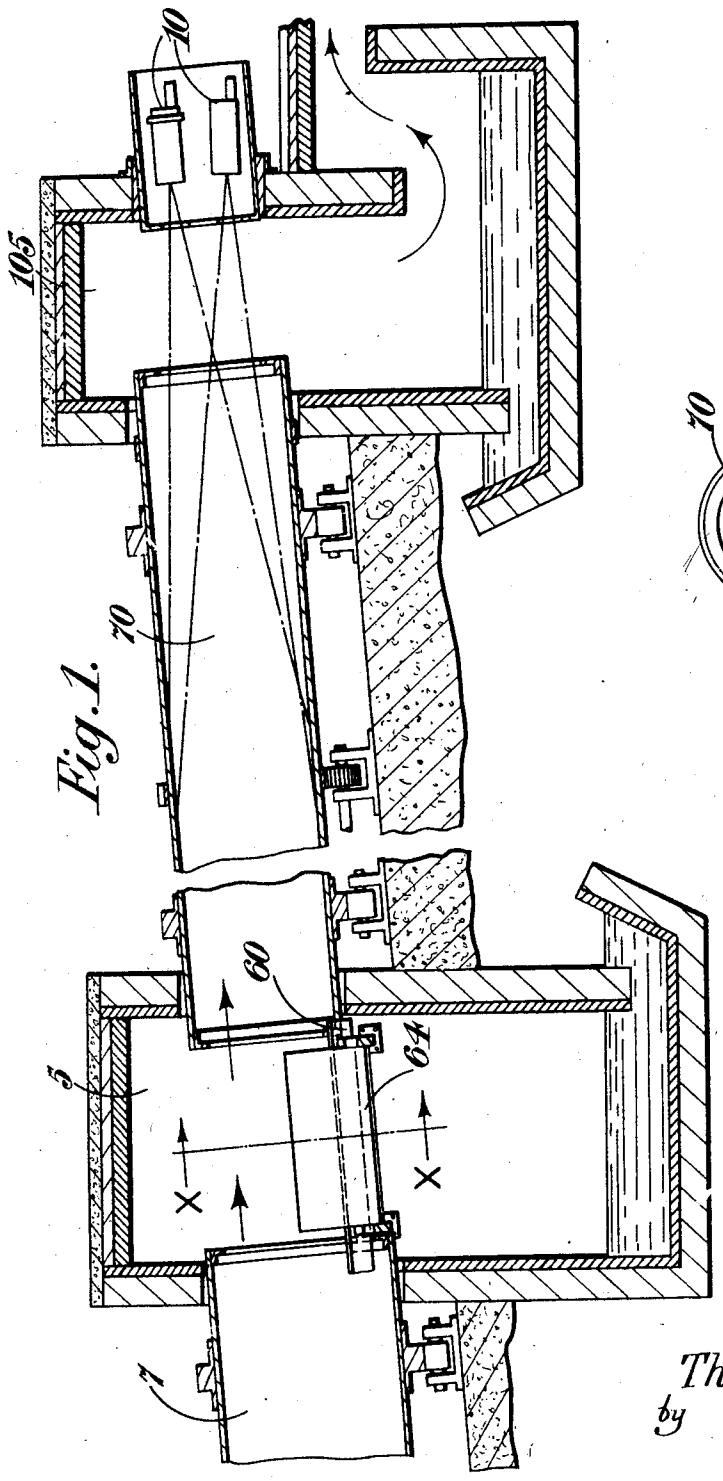


Fig. 1.

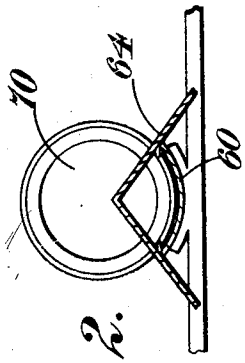


Fig. 2.

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Fig. 3.

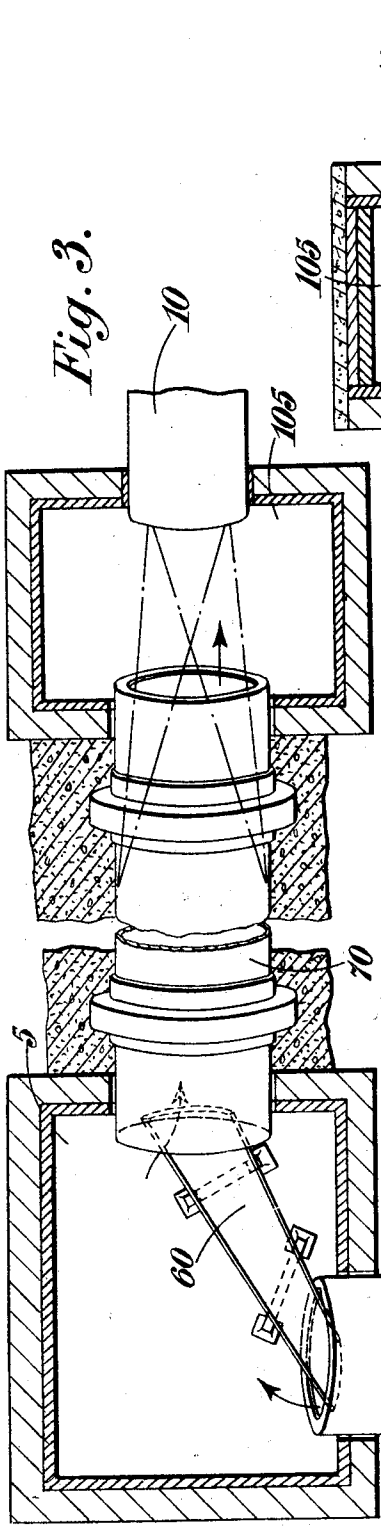
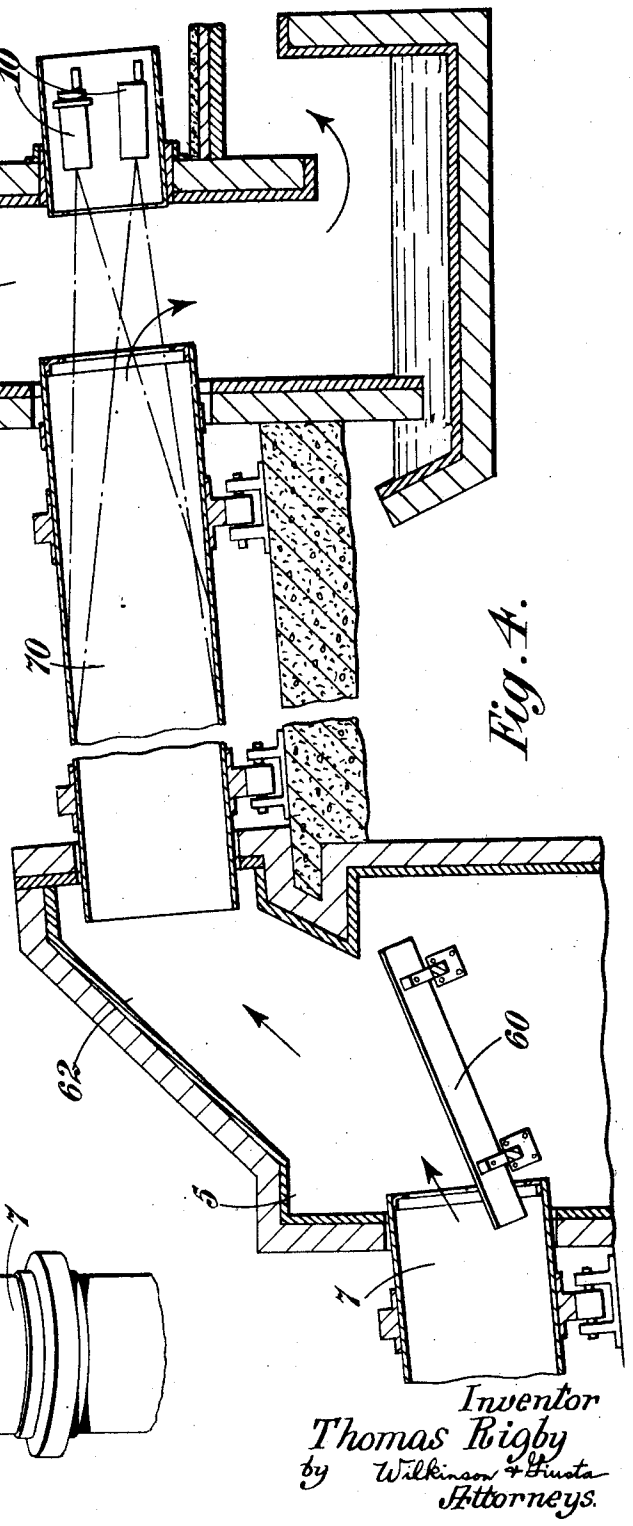


Fig. 4.



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UNITED STATES PATENT OFFICE.

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TREATMENT OF SLURRIES IN ROTARY KILNS.

Application filed November 5, 1926, Serial No. 146,515, and in Great Britain November 13, 1925.

This invention is concerned with the treatment of materials, such as cement-making materials, by wet methods in rotary kilns by atomizing or similarly dispersing a slurry of the material or materials in a finely divided condition in the gases in the kiln so that these latter shall exert a drying action upon and be somewhat cooled by the slurry before it is collected on the internal wall of the kiln.

The invention is particularly (though not exclusively) concerned with improvements in or modifications of the inventions set forth in my pending applications Serial Nos. 44,865 and 121,184.

Figure 1 is a side elevation of one arrangement according to the invention in which the kiln is divided into two separated parts;

Figure 2 is a view on the line X—X of Figure 1 looking in the direction of the arrows;

Figure 3 is a plan view of another arrangement of the type shown in Figure 1; and

Figure 4 is a side elevation of still another arrangement of this type.

In the arrangements illustrated it will be seen that measures have been adopted to structurally separate that hotter portion of a kiln which operates upon the material which has already collected upon the kiln wall from a cooler portion (which may be regarded as a dryer, and may be specially constructed in view of this limitation of its functions) in which is effected dispersal of the material into the gases as spray and its collection on the wall of said cooler portion to continue its travel along the latter to the kiln proper.

The separation of the kiln into two parts in the case of a rotary cement kiln may be such that the customary kiln head is retained and used in the normal operation of the plant merely as a depositing chamber for purposes such as hereinafter indicated and a rotary cylindrical shell of much the same cross-sectional dimensions as the kiln can be provided to rotate, for example, on an axis parallel to the kiln axis but at a somewhat higher level and with its lower end opening into the rear wall of the kiln head aforesaid and its upper end opening into the front wall of an auxiliary kiln head or the like. The partly dried material tumbling out of the lower end of the shell will preferably be allowed to fall across the space in the first-mentioned kiln head into the mouth of the kiln proper over a chute.

Such an arrangement is shown in Figures 1 and 2 wherein the rotary cylindrical shell is shown at 70, the chute leading to the kiln 7 is shown at 60 and an auxiliary kiln head is shown at 105, this kiln head and the customary kiln head 5 each being provided for example with a liquid reservoir at its base to provide therein a vehicle for the ready collection and withdrawal from the kiln head of deposited matter. The liquid in the kiln head 105 from which the kiln gases may leave the system may be slurry afterwards fed to atomizing means, indicated in this case as directing from points 10 two sprays into the cylindrical shell 70 to different regions along it in a manner described in my application Serial No. 121,184.

Such a shell as 70 may, however, discharge, if preferred, into one of the side walls of a kiln head 5 and the transferring chute 60 over which the material tumbles into the kiln head 5 from the shell to the kiln then be suitably modified.

This is indicated in Figure 3, the sprays in that instance being shown as operating in a manner described in my application last mentioned to deliver spray to the same general region in the cylindrical shell 70.

Indeed a shell such as 70 need not open directly into the customary kiln head if that is retained but may as indicated in Figure 4 have its end connected (for the flow of the gas into it and the travel of the deposited material from it) to said kiln head by a fixed gas conduit 62 of appropriate dimensions and arranged so as, or provided with means such as the chute 60, to ensure the proper travel by gravity of partly dried material (possibly of doughy or clayey consistency and apt to cohere and pack into lumps and balls) from the shell 70 to the kiln head 5.

With such latter arrangement, the delivery end of the shell 70 (which shell is preferably but little inclined downwards towards the delivery end) can be at any desired height relatively to the kiln or the axis of the cylindrical shell 70 can lie in a different vertical plane from that containing the kiln axis.

An important advantage of such a separation of the drying alone or of the drying and part of the after treatment or of part of the drying from the remainder of the kilning operation or operations (such as further drying or calcining or clinkering) as is effected in constructions of the kind indicated is the

opportunity that is afforded of taking steps aiming at producing a quality of end product not attainable usually in the wet process. In a wet rotary-kiln process the gases impinging upon wet slurry in the upper part of the kiln leave behind them necessarily in the slurry certain amounts of impurities (such as sulphates) which the combustion of the fuel has introduced into them and of a nature and extent capable in some circumstances of modifying undesirably the character of the product.

In novel constructions such as indicated the customary kiln head may be retained in such a form as to operate in a measure as a settling chamber for these impurities so that by the time the gases enter such a shell as 70 to meet wet slurry therein they have to some extent if not largely been freed of such impurities. In such a case partly dried material tumbling from the shell 70 over a chute 60 or the like in the kiln head 5 is preferably shielded from the settling upon it of such impurities as by a shield 64 (see Figures 1 and 2) while it traverses the stiller atmosphere in the kiln head and liquid, for instance water, passed through the bottom of the kiln head 5 may be used to catch the deposited impurities and act as a vehicle for their convenient withdrawal from such head.

Again constructions such as indicated lend themselves, by the addition to an existing kiln and kiln head of a shell and its own head or the like, to the modification of existing plant with a minimum of interruption of manufacture so as to increase to the maximum possible the output of a given existing plant or to convert a dry kiln plant into one working at very high efficiency on the wet process. Such change moreover, can be made at a low plant cost since the shell (or at least some of it) and its head need not necessarily be adapted to resist relatively high temperatures if provision be made for by-passing the gases from the customary kiln head (and may be pouring slurry directly into the kiln proper) on failure for any reason of cooling action in the shell and these or considerable parts of them may in such a case be to a large extent little more than sheet metal casings merely lagged more or less against heat loss by radiation. Other advantages that accrue from such separation of the kiln parts as referred to are the possibility of determining independently for that part of the kiln in which atomizing is effected (the shell 70 or the like) its inclination, diameter and speed of rotation so as to best suit these to the efficient carrying out of the part of the treatment to which that part of the kiln is devoted.

In any case the slurry lifting shelves or radial plates with which the upper end of a kiln is usually provided can in most cases with advantage be dispensed with in the shell and the inside of the shell left bare.

In any event an important factor to observe is the disposition of the axis or axes of the spray or sprays (which may originate inside the head 105 or the part 70 if desired) in relation to the kiln axis so that wet spray shall while practically, if not entirely filling a cross section of the shell 70, yet not impinge with any appreciable energy upon the kiln wall; the energy of the spray should be substantially exhausted in the shell 70 and if the spray should anywhere impinge upon the wall thereof that should only occur after such a travel of the spray through the gases as ensures the impinging portion having before such impingement occurs been dried to a substantial degree and lost its tendency to form coherent masses on said wall.

I claim:—

1. A slurry treating plant comprising in combination a rotary kiln, a rotary cylindrical shell disposed adjacent the gas exit end of the kiln and through which the kiln gases flow, means for spraying slurry into the cylindrical shell whereby a cross-section thereof is completely filled with a slurry spray at which cross-section slurry from said spray is gently deposited upon the kiln wall and has been so dried by the kiln gases that it has lost its tendency to form coherent masses on the shell wall, and means whereby the material treated is passed from said shell to the kiln.

2. A slurry treating plant according to claim 1, wherein the axis of the rotary kiln is out of alignment with that of the cylindrical shell.

3. A slurry treating plant according to claim 1, and a chute over which the material being treated passes from the shell to the kiln.

4. A slurry treating plant according to claim 1, and a shield above said chute to prevent any material deposited by the kiln gases as they flow from the kiln to said shell from settling upon and modifying undesirably the material passing along the said chute.

5. A slurry treating plant according to claim 1, in which the rotary kiln and the cylindrical shell each open into a chamber having at its base a liquid reservoir for the ready collection and withdrawal from the chamber of deposited matter.

6. A slurry treating plant according to claim 1, in which the kiln opens into a kiln head having at its base a liquid reservoir for the collection of matter deposited from the kiln gases and the cylindrical shell opens at one end into the kiln head aforesaid and at its other end into a second kiln head which is provided at its base with a slurry reservoir which slurry is afterwards fed to the spraying means aforesaid, and the cylindrical shell and the kiln are connected by a chute over which the partly dried material passes from the said shell into the kiln.

7. A slurry treating plant according to

claim 1, in which the kiln opens into a kiln head having at its base a liquid reservoir for the collection of matter deposited from the kiln gases and the cylindrical shell opens at one end into a conduit leading to the kiln head aforesaid and at its other end into a second kiln head which has at its base a slurry reservoir, and a chute over which the partly dried material travels from the said conduit to the kiln.

In testimony whereof I affix my signature.

THOMAS RIGBY.