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R. F. HILL.

PROCESS OF DESULFURIZING AND AGGLOMERATING PYRITES CINDER AND THE LIKE.

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Fig. 1.

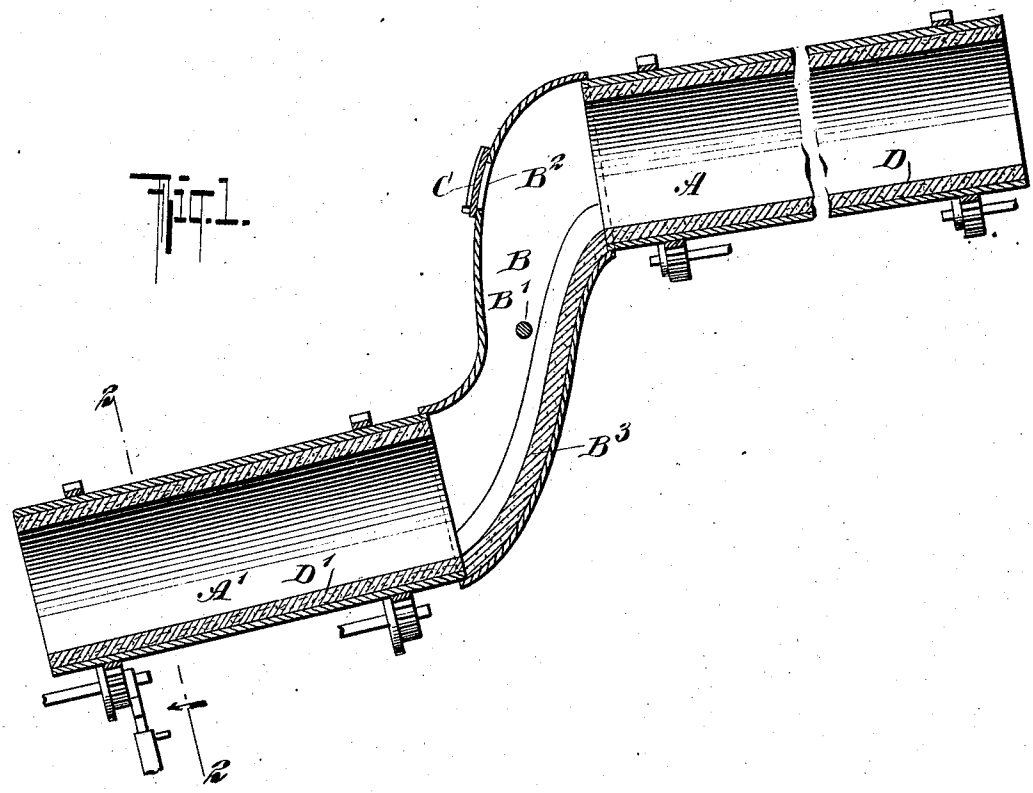
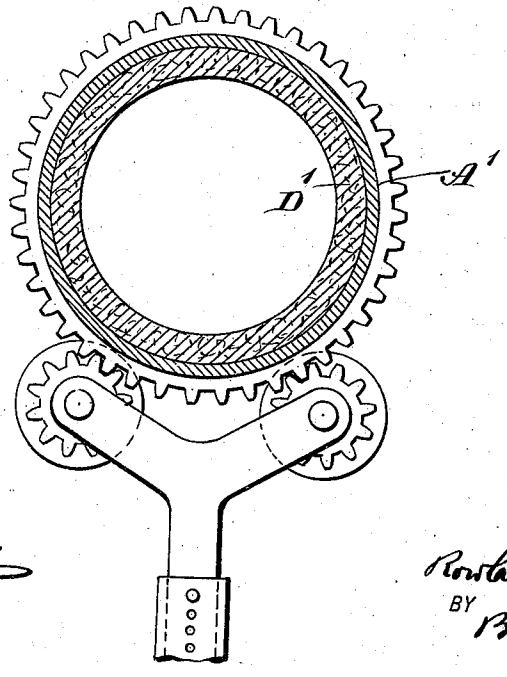


Fig. 2.



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PROCESS OF DESULFURIZING AND AGGLOMERATING PYRITES-CINDER AND THE LIKE.

No. 847,664. Specification of Letters Patent. Patented March 19, 1907.

Original application filed December 20, 1905, Serial No. 292,557. Divided and this application filed June 26, 1906. Serial No. 323,437.

To all whom it may concern:

Be it known that I, ROWLAND F. HILL, a citizen of the United States, and a resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Processes for Desulfurizing and Agglomerating Pyrites-Cinder and the Like, of which the following is a specification.

Pyrites-cinder and other pulverulent metal-bearing materials on account of their dust-like nature have been incapable of being treated in the same manner as ordinary crushed or lumpy ore. To recover the metal from such pulverulent materials, it has been proposed to subject them to a desulfurizing and agglomerating treatment, whereby they are formed into coherent lumps, masses, or nodules, which may then be treated in a blast-furnace or otherwise. This desulfurization and agglomerating treatment has been carried out in an inclined rotary kiln, and in the practical working of the process serious difficulties have been encountered on account of the tendency of the pasty or semi-fused mass to adhere mechanically to the lining of the kiln or to adhere thereto by combining chemically with the kiln-lining.

The object of my invention is to avoid the sticking of the material to the kiln-lining either mechanically or chemically and to do this without either injuring the kiln-lining or interrupting the operation of the process.

In the accompanying drawing I have shown in Figure 1 a longitudinal section of an apparatus suitable for the purposes of my invention, and in Fig. 2 a cross-section thereof on line 2 2 of Fig. 1.

There are two rotary kilns or drums A and A′, respectively, both inclined and one arranged at a higher level than the other. The kilns may be arranged stepwise, as shown, and in the same vertical plane. Both kilns may have the same inclination, or the lower kiln may be inclined more steeply, and the lower end of the lower kiln may be adjusted vertically, so as to vary the inclination. Any suitable mechanism may be employed for rotating the kilns, the means for rotating the lower kiln being preferably independent, so that the speed of one kiln may be varied without affecting that of the other. The upper kiln will, as a rule, be considerably longer than the lower kiln.

The connection between the two kilns is effected in any suitable manner. I have shown a connecting-pipe B pivoted at B′ and adapted to have its ends abut against the adjacent ends of the two kilns. This pipe may be provided with a valve or damper, either simply controlling the connection from one kiln to the other, or, preferably, the valve or damper C controls an air-inlet B^2, as shown.

The upper kiln A has a lining D, of ordinary fire-brick or any other suitable material; but the lining D′ of the lower kiln A′ should be basic, or at least neutral—that is, non-acid. Such lining may be made, for instance, of chrome, magnesite, bauxite, carborundum, or steel brick.

In operation the pyrites-cinder or other pulverulent material is fed at the upper end of the upper kiln A, while the fuel (as a coal-dust flame) enters at the lower end of the lower kiln A′. The hot gases pass through the two kilns and the connecting-pipe B, the temperature increasing as the ore or like material approaches the lower end of the lower kiln. Within the upper kiln A the temperature should be sufficient to desulfurize the ore, but not high enough to melt the sulfid or cause the ore to sinter into lumps. In the lower kiln A′ the temperature is sufficient to produce superficial fusion of the desulfurized material, and on account of the agitation produced by the rotation of the kiln the partly-fused material will form coherent lumps or nodules, the size of which will depend on the inclination of the lower kiln A′ and also on the speed with which it is rotated.

Since I use a basic or neutral lining in the lower kiln, there is no danger of a chemical combination occurring between the ore and the kiln-lining. I thus prevent erosion or destruction of the lining and also the sticking of the fused mass to the kiln owing to chemical reactions. Still it is possible that in some cases the fused material might adhere to the lining of the lower kiln mechanically. If this should happen, the remedy would be the application of an increased heat in the lower kiln, so as to melt the adhering mass away from the kiln-lining. Of course this increase of heat in the lower kiln should not be accompanied by any increase of heat in the upper kiln sufficient to fuse, or partly fuse, any material therein.

The length of the connecting-pipe B will allow the heat to become partly dissipated, or, in other words, the temperature at the upper end of the pipe B will always be below that at the lower end of the pipe, so that up to a certain point the temperature may be increased in the lower kiln above the point of fusion without reaching this point in the upper kiln. If it should be necessary to increase the temperature beyond this point to melt an obstruction formed by the adhesion of fused material to the lining of the lower kiln, special means will have to be employed to prevent the increase of heat from causing the fusion-point to be reached in the upper kiln. Thus in the example shown the valve or damper C will be opened more or less, causing a greater or smaller amount of air to be admitted at B^2 and to be mixed with the hot gases, so as to reduce their temperature to the desired point. This valve or damper will be opened partly or entirely whenever the temperature is too high at the upper end of the connecting-pipe B.

The rotation of the upper kiln agitates and turns over the material, so as to thoroughly desulfurize it by the action of the heated gases. As the temperature will always be so regulated as to prevent fusion of the material in the upper kiln, a very thorough desulfurization will be obtained, and there will be no danger of obstructions forming in the upper kiln.

In the lower kiln agglomeration will take place under perfect control, as the inclination and speed of this kiln may be varied without affecting the desulfurizing process going on in the upper kiln. Obstructions cannot be formed by chemical interaction between the lower-kiln lining and the material, since the lining is non-acid, as above set forth. Should any obstructions be formed by mechanical adhesion, they can readily be removed without any injury to the lining by temporarily increasing the heat. This will not, however, necessitate any interruption of the process.

The connecting-pipe B can be swung away from the kiln ends, thus greatly facilitating the making of repairs. I prefer to provide a lining B^3 in the connecting-pipe B or, at least, in the lower portion thereof, such lining being non-acid—that is, basic or neutral—similarly to the lining D'. In some cases if the suction at the opening B^2 should not be sufficient to admit a proper amount of cool air I might employ a blower or like device to force a proper amount of air through said opening.

The present application is a division of another application for patent filed by me on December 20, 1905, Serial No. 292,557, in which the apparatus herein disclosed is claimed.

I claim as my invention—

1. The process of desulfurizing and agglomerating pyrites-cinder and the like, which consists in first subjecting the material to rotary agitation and to a heat below the fusion-point to desulfurize the material, then subjecting the desulfurized material to a gradually-increasing heat, but still below the fusion-point, and finally subjecting the desulfurized material to rotary agitation, in a kiln having a non-acid lining, and to a heat sufficient to fuse or partly fuse the material and cause it to form coherent masses or nodules.

2. The process of desulfurizing and agglomerating pyrites-cinder and the like, which consists in first subjecting the material to agitation in a desulfurizing atmosphere, below the fusion-point, then subjecting the desulfurized material to a gradually-increasing heat, but still below the fusion-point, and finally subjecting the desulfurized material to agitation in a kiln having a non-acid lining, and to a heat sufficient to fuse or partly fuse the material and cause it to form coherent masses or nodules.

3. The process of desulfurizing and agglomerating pyrites-cinder and the like, which consists in first subjecting the material to agitation in a desulfurizing atmosphere, below the fusion-point, and then subjecting the desulfurized material to agitation in a kiln having a non-acid lining, and to a heat sufficient to fuse or partly fuse the material and cause it to form coherent masses or nodules.

4. The process of desulfurizing and agglomerating pyrites-cinder and the like, which consists in first subjecting the material to rotary agitation in a desulfurizing atmosphere, below the fusion-point, and then subjecting the desulfurized material to rotary agitation in a kiln having a non-acid lining, and to a heat sufficient to fuse or partly fuse the material and cause it to form coherent masses or nodules.

In testimony whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ROWLAND F. HILL.

Witnesses:
JOHN LOTKA,
JOHN A. KEHLENBECK.