

United States Patent

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[54] CRUSHING MACHINES

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[58] Field of Search 241/13, 78, 79.3, 98, 138,
241/143, 154, 159, 187, 189 R, 227, DIG. 10

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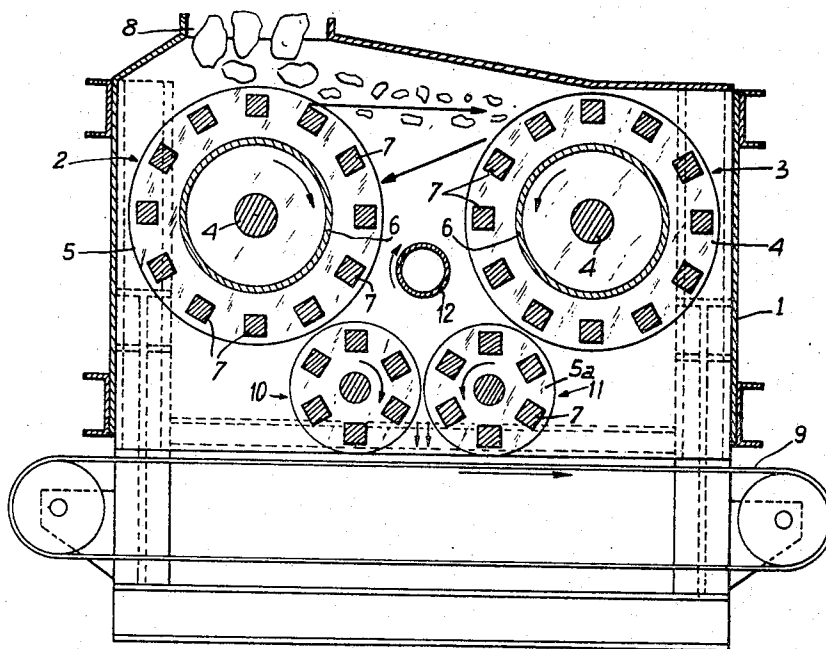
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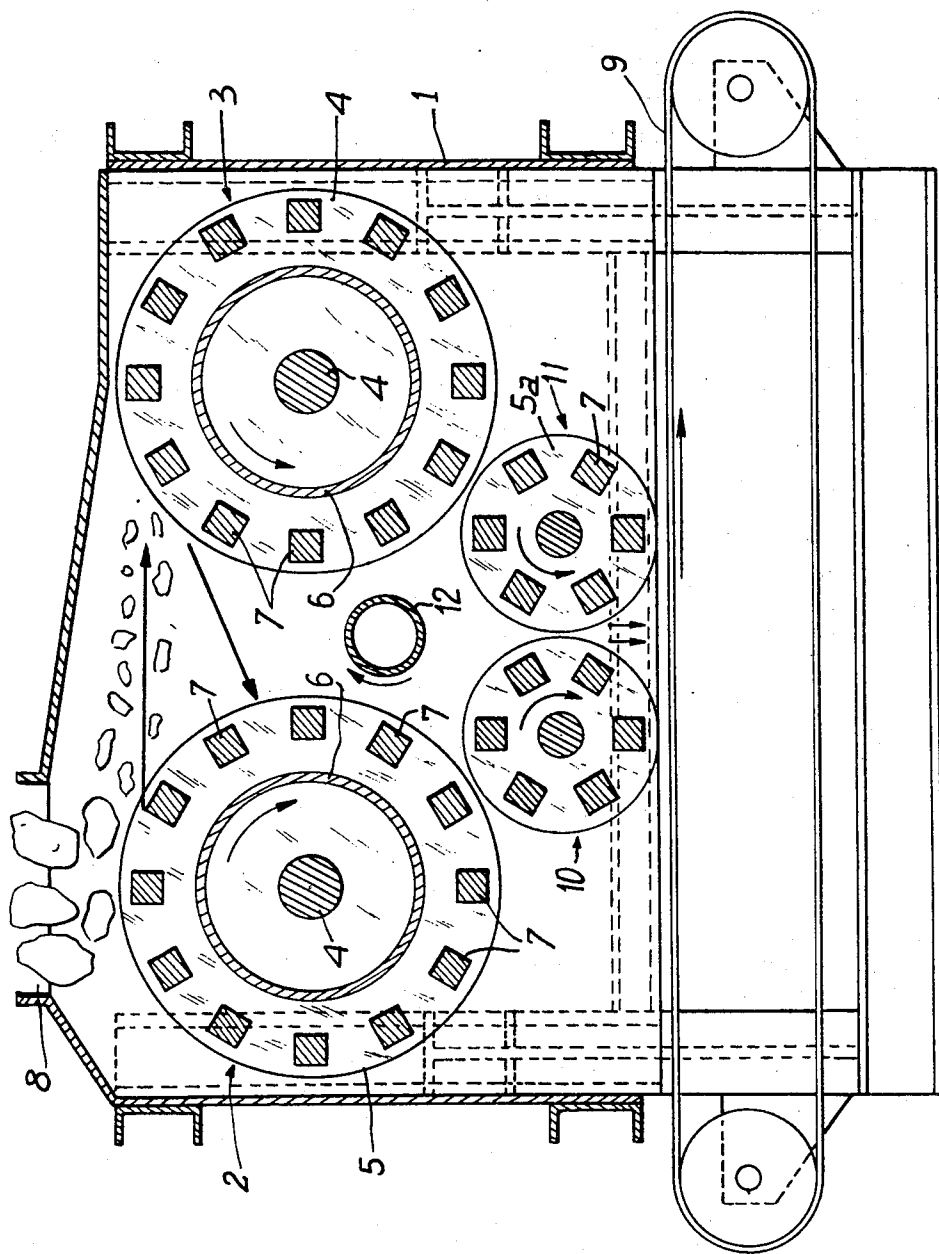
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[57] ABSTRACT

A crusher adapted to crush clay for the manufacture of bricks and tiles, even when the raw material is somewhat moist. To this end, two upper rollers are provided each with an annular series of parallel rods to cause the material to be thrown off one rotor on to the other before it is comminuted between two smaller lower rollers and forms a homogeneous mixture.

7 Claims, 1 Drawing Figure





CRUSHING MACHINES

My invention has for its object a machine intended for the crushing of the clay which is to form earthenware such as tiles and bricks.

The raw product used for the brick and tile-making industry is generally coarse and moist and it is necessary for it to assume a fine granulometric structure so that it may be drawn and extruded in the making of hollow bricks and tiles.

Anyone skilled in the art of crushing material is aware of the fact that moisture prevents, practically, a proper crushing in conventional stamping crushers such as those provided with hammers and counter-hammers by reason of the very speedy clogging of the inner walls of the crusher. This clogging appears on the walls which are hit perpendicularly by the material undergoing treatment and this leads, on the one hand, to a considerable increase in the power absorbed by the crusher, as ascribable to the friction between the hammers and the cushion of agglomerated material lining such walls and, on the other hand, to a gradual decrease in the yield and even sometimes to a complete choking of the machine.

It is therefore essential to make the material pass through a drying kiln before it enters the actual crushing means.

Such preliminary drying means are very expensive and it has therefore been proposed to crush the clay through compression between rollers. However, by reason of its moisture contents, the crushed material obtained appears in the shape of broken up chips, so that it is a difficult matter to produce a homogeneous material during the subsequent mixing of different clay grades.

Now, my invention has for its particular object a crusher operating through stamping and which provides, starting from a comparatively coarse, very moist material, a very finely granulated product while the consumption of energy required is very low. In fact, the actual structure of the machine cuts out any possibility of clogging, whereby no drying means are required any longer, while fine pulverulent homogeneous mixtures are obtained starting from clays the moisture of which is high enough for a handful thereof to remain agglomerated when grasped in one's hand.

In order to illustrate my invention, I will now describe by way of example an embodiment of my invention reference being made to the accompanying drawing, the single FIGURE of which is a transverse vertical sectional view of a crusher according to my invention.

Turning to said drawing, it is apparent that my improved crusher includes a substantially parallelipedic casing 1 inside which two pairs of rotors or rollers are housed, to wit the rotors 2-3 on the one hand and the rotors 10-11 on the other hand.

Each of the rotors 2 and 3 is constituted by a shaft 4 carrying at each end a disc or plate 5. The two discs are interconnected by an annular series of parallel stamping bars 7 while a cylindrical shield or screen 6 is fitted coaxially between said discs within the bar structure. The two rotors 2 and 3 lie at the same level and the spacing between their peripheries is slightly smaller than their radius. These rotors revolve in opposite directions so that their portions facing each other may urge downwardly the material fed between them.

The two rotors 10 and 11 lying underneath the rotors 2 and 3 also rotate in opposite directions, the left hand rotors 2 and 10 rotating in one same direction and the right hand rotors also rotating in one same direction.

The structure of the rotors 10 and 11 is the same as that of the rotors 2 and 3 inasmuch as they are constituted by an annular series of parallel bars 7 carried between terminal discs or plates 5a the diameter of which is half that of the upper rotors 2 and 3.

The positions given to the upper, larger rotors 2-3 with reference to the lower, smaller rotors are such that the lower rotors are in practically tangent relationship while the left hand rotors 2 and 10 are also in practically tangent relationship and the same is the case for the right hand rotors 3 and 11.

The purpose of the cylindrical screens 6 consists in preventing clay particles from passing through either rotor 2 or 3 and from forming a cake on the rear surfaces of the bars 7, the rotary speed of the rotors being such that said particles are urged off the peripheries of the screens by centrifugal force.

In the example illustrated, the shafts carrying the rotors 10 and 11 have a sufficiently large diameter with reference to that of the actual rotors for them to play the part of the cylindrical screens 6 in the larger rotors. However, if the diameters of the shafts of the rotors 10 and 11 are too small, it is necessary to insert in said rotors cylindrical screens similar to the screens 6.

A further cylindrical rotative screen 12 is fitted in the space separating the four rotors 2, 3, 10 and 11, approximately at the crossing point between the tangents common to the rotors 2 and 10, to the rotors 3 and 11 and to the rotors 10 and 11. Said screen is constituted by a mere smooth tube adapted to revolve in either direction at a speed which is high enough for the moist particles adhering thereto to be released by centrifugal force.

The upper wall of the casing 1 is provided with an input port 8 the axis of which lies substantially in the vertical plane passing through the axis of the rotor 2. Furthermore, said upper wall slopes slightly, so as to be substantially tangent to the discs 5 forming part of the right hand rotor 3.

The lower wall of the casing 1 forms a conveyor belt adapted to remove the crushed material.

The operation of the crushing machine described hereinabove is as follows: the material to be crushed is poured through the port 8 onto the rotor 2 which, by reason of its rotation towards the companion rotor 3, projects the material towards the latter as a substantially horizontal bundle, the particles of the material which have a tendency to rise being deflected downwardly the sloping upper wall of the casing 1. Since the rotor revolves at a high speed, say about 1,500 r.p.m., the material is subjected thus to a first stamping operation.

The material projected by the rotor 2 impinges against the rotor 3 which also revolves at 1,500 r.p.m., but in the opposite direction, so that the bars 7 of said rotor 3 subject the particles of material to shocks which are substantially twice more energetic than those imparted by the bars of the rotor 2.

The particles are then projected downwardly back towards the rotor 2. By reason of the presence of the rotary screen 12, no particle can reach directly the lower rotors 10 and 11 and the particles jump back

between the two upper rotors 2 and 3. Those which may reach finally one of the lower rotors reach them under an angle such that they are projected towards the other lower rotor or against the upper rotor on the opposite side, in which latter case, they are thrown back onto the part of said other lower rotor in which the bars progress in a direction opposed to that the progression of the upper rotor on the opposite side of the machine.

Consequently, the various particles are subjected to a large number of shocks before they engage the slight clearance between the two rotors 10-11. The latter revolve approximately at the same angular speed as the rotors 2 and 3 and since their diameter is equal to one half that of the latter, the speed of the bars is also equal to one half, the speed of the bars of the upper rotors, so that the rubber or the like conveyor belt at the bottom of the casing is not damaged by the impact of the material falling on it.

Practically, no material passes outwardly between the rotors 2 and 10 or between the rotors 3 and 11, so that no material gathers on the stationary walls of the casing nor on the belt 9, since the latter is continuously moving forwardly and is hit by the particles perpendicularly to its surface.

The material removed by the conveyor belt is sifted and the rougher particles are recycled.

Example: the machine described hereinabove has been used in a plant preparing earthenware such as bricks and tiles.

The raw material undergoing treatment with a view to producing bricks is a mixture in substantially equal amounts of so-called rich clay with large contents, say 20 to 25 percent of alumina, of so-called lean clay with contents of about 80 percent of silica and of chalky clay incorporating about 60 percent of limestone.

Rich clay leads to a plentiful clogging when in a moist condition so that it is impossible to crush it with any conventional stamping machine when its water contents rise above 6 percent. Consequently, the plants which were to prepare mixtures of pottery clay were provided hitherto with a system of drying kilns associated with means for remoistening the crushed material, since the material should remain sufficiently moist for it to be possible to be extruded, the moisture contents being preferably 15 percent in the United States and 18 percent in France.

Lean and chalky clay do not clog to any large extent and may be crushed in conventional crushers with moisture contents up to 12 percent.

With the above described improved crusher, it is possible to crush rich clay with water contents as high as 15 percent and lean and chalky clay with water contents up to 24 percent, this last figure corresponding to a maximum since, from that contents, water drips off the clay.

A plant including my improved crusher cuts out the necessity of drying and remoistening means and provides for the production of pulverulent material adapted to be readily mixed in a homogenous manner and to be readily extruded.

The raw material may be introduced into the crusher at the rate of 50 metric tons per hour, one half of the load being cycled after sifting.

The fact that it is possible to treat moist raw material

in the crusher cuts out the formation of dust and this leads to the further advantage of rendering unnecessary all dust-removing apparatus, which were otherwise essential so as to prevent pollution of the atmosphere.

Furthermore, tests made have shown that the bars 7, worn in a manner such that their leading ridges became gradually blunt and rounded while the trailing ridges became more and more sharp. When the wear is large enough, it is sufficient to turn the bars so that the ridges not sharpened by wear may lie in an operative leading position.

I claim:

1. A rotary crusher comprising a substantially parallellepipedic casing, two main equal upper rotors having parallel horizontal axes, adapted to revolve in opposite directions round their axes towards each other, and each of said upper rotors including an annular series of bars parallel with the direction of the axis of the upper rotor, and a smooth cylindrical surface the axis of which is parallel with the direction of the axis of the upper rotor located within said annular series, said upper rotors being spaced horizontally by a distance slightly less than their radius, and two auxiliary lower rotors, the axes of said lower rotors being parallel with those of the upper rotors and substantially tangent in the plane of their axes with a slight clearance therebetween, each of said auxiliary lower rotors including an annular series of bars parallel with the direction of the axis of the lower rotor and being located underneath the corresponding upper rotor in substantial tangential relationship with reference thereto and adapted to rotate in the same direction as said upper rotor.

2. A rotary crusher as claimed in claim 1, including a cylindrical screen adapted to revolve at a high speed and extending in parallel relationship with the upper and lower rotor axes substantially along a line in registry with the crossing of the common planes tangent to the upper rotors and to each of the lower rotors and its corresponding upper rotor.

3. A rotary crusher as claimed in claim 1 wherein the casing includes an upper wall provided with an opening through which material is adapted to be fed vertically onto one of the rotating series of annular bars and said upper wall sloping downward away from said opening whereby clogging of said apparatus by said material is prevented.

4. A rotary crusher as claimed in claim 1 wherein the diameters of the lower rotors are equal to one half that of the upper rollers and said series of annular bars on said upper rotors rotate at twice the speed of the corresponding series of annular bars on said lower rotors.

5. A rotary crusher as claimed in claim 1, wherein the lower and upper rotors all revolve at the same angular speed.

6. A rotary crusher as recited in claim 1 wherein each of said upper and lower rotors comprises a central shaft, a plate carried at each end of said shaft, each of said annular series of bars being held in fixed position between said opposed plates.

7. A rotary crusher as claimed in claim 6 wherein each of said upper rotors includes a cylindrical shield held between said discs and lying in coaxial relationship with said shaft.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,707,266 Dated December 26, 1972

Inventor(s) GERARD J. LLABRES

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 7, after "that" insert -- of --;

Column 3, line 64, delete "cycled" and insert -- recycled --.

Signed and sealed this 24th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents