

UNITED STATES PATENT OFFICE.

HENRIK EMIL RÜSAGER, OF COPENHAGEN, DENMARK.

APPARATUS FOR THE TREATMENT OF STONY OR EARTHY MATERIALS.

933,669.

Specification of Letters Patent.

Patented Sept. 7, 1909.

Application filed March 20, 1909. Serial No. 484,611.

To all whom it may concern:

Be it known that I, HENRIK EMIL RÜSAGER, residing at Bredegade 5, Copenhagen, F., in the Kingdom of Denmark, have invented certain new and useful Improvements in or Relating to Apparatus for the Treatment of Stony or Earthy Materials, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

In the manufacture of cement the expense involved in the disintegration of the raw material considerably affects the cost of the final product. It is for this reason of great importance to effect, at a minimum cost, the disintegration of the raw material until the degree of fineness required for the calcining operation is obtained, or to effect the mixing of the raw materials in as fine a state of division as possible. This object I attain according to this invention in making use of a wet treatment, by preliminarily crushing the raw materials with an addition of a certain quantity of water with the aid of crushing mills, such as a ball mill, particularly of the kind in which not only the friction between the material and the balls, but also the pounding force of the latter is utilized, and by subsequently subjecting the crushed material in a sieve device, combined with a centrifugally acting stirring device, to a separation so as to cause the finer particles in the form of slimes to pass through the sieve, while the coarser particles are retained, and recharged into the ball mill. In preference to directly passing the slimes coming from the ball mill and separator, to a rotary kiln or the like, it is advisable to subject them to a further treatment in a roller mill, such as a tube mill or the like. This latter method has proved to be particularly valuable, owing to the fact that a really economical working of the ball mill is obtainable only if the disintegrating operation in the mill is not continued to such an extent as to grind a large proportion of the material directly to the required degree of fineness.

In order to carry out the present invention, I therefore use by preference a crushing plant wherein a sieve or separator, together with a stirring device is so interposed between a ball mill and a tube mill, that the sieve is charged with the material crushed by the ball mill, and conveys the finer particles which pass through the meshes of the

sieve in the form of slimes, to the tube mill, while the coarse particles are retained by the sieve and recharged into the ball mill.

In order to efficiently separate the slimes from the coarser particles, it is preferable to equip the sieve separator on the one hand with hollow arms adapted to feed the material, and on the other hand with flat wings for beating and whipping the material against the walls of the sieve. It is in this connection important that the extent of treatment of the charge admitted to the sieve separator should be controllable at will. To this end the driving gear of the crushing and stirring device is capable of being so coupled with a discharging device for the treatment of the coarse material retained by the sieve, that the speed of the discharging device is adjustable to any desired degree without, however, necessitating throwing the driving gear of the stirring machinery out of action.

The invention is illustrated by way of example in the accompanying drawings:

Figure 1 shows, diagrammatically, a crushing plant arranged according to this invention. Fig. 2 is a vertical axial section of the sieve separator. Fig. 3 is a horizontal section on the line 3—3 of Fig. 2, and Fig. 4 is a horizontal section on the line 4—4 of Fig. 2.

The ball mill 1 which is shown in side elevation may be of any known construction. 2 designates a sieve separator, also shown in side elevation, consisting of a strong stationary drum and other devices for the separation of the coarse material from the finer particles in the form of slimes as they both come from the ball mill.

3 is a tube mill of any desired construction. The ball mill 1 is charged by a bucket elevator 4 or the like arranged to discharge into the inlet hopper 5 of the ball mill 1. The outlet 6 of the latter is arranged opposite the inlet 7 of the sieve separator 2. The outlet 8 for the coarse material coming from the separator 2 is directly connected with the elevator device 4 by a conduit 9. The slimes separated in the sieve 2 from the coarse material leave the sieve through a discharge outlet 10 communicating with a conduit 11, and through a hollow trunnion 12 enter the rotary tube mill 3, at the other end of which they are discharged in a known manner through slots or the like and delivered through a casing 13.

The construction of a special form of the separator 2, only diagrammatically represented in Fig. 1, is more specifically illustrated in Figs. 2, 3 and 4. In these figures, 14 designates the outer casing or drum, and 15 is the stationary sieve of the separator. The shaft 16 of the stirring device is arranged centrally within the separator. The stirring device consists of hollow tubular arms 17 for feeding the material and of flat wings 18, by which the material on leaving the hollow arms 17 is whipped against the walls of the sieve. 19 is an incline within the casing, over which the slimes, discharged through the meshes of the sieve 15, are conveyed to the outlet opening 20 of the separator. 21 designates an outlet opening for the coarse material retained during the separation within the sieve 15. Communicating with this outlet is a casing 22 containing a feed screw or worm 23 adapted to convey the coarse material to the discharge 24. The worm 23 is driven from the driving gear of the shaft 16 by a belt 26 (Fig. 3) running over the pulley 25 of the worm 23 and driven by a shaft 27. The latter carries at one of its ends a friction disk 28, engaging against a friction collar 29 which is longitudinally movable on the shaft 30 which drives the shaft 16. The displacement of the member which carries the friction collar 29, on the shaft 30 is effected by an arm 31 arranged on a nut working on a screw 32 which is adjustable with the aid of a chain 33, operated at will by a hand wheel 34. 35 is the feed hopper of the separator.

The operation of the described apparatus is as follows: The slimy charge fed into the hopper 35, Fig. 2, passes downwardly therefrom through the passage shown which forms a common inlet opening for the rotating hollow arms 17, through said arms and is discharged against the sieve 15, and in gliding down along the walls of the latter is constantly beaten and whipped against them. The fine slimes thus driven through the sieve pass along the incline 19 to the outlet opening 20. The coarse residue passes through the outlet opening 21 into the conveyer casing 22 and by the worm 23 is conveyed to the discharge opening 24. The speed of the worm 23 is adjusted by turning the hand wheel 34 according to the desired intensity of treatment of the material within the separator, and on the presence of more or less coarse material in the charge under treatment. The rotation of the hand wheel 34 causes a corresponding rotation of the screw 32, producing a lateral displacement of the nut and arm 31, and consequently of the friction collar 29, thereby varying the distance between the collar 29 and the center of the friction disk 28 and consequently changing the driving speed of the conveyer 23.

For the sake of a better distribution of the

material over the surface of the sieve, several hollow arms 17 may be arranged at different heights, it being, however, always advisable to arrange with each such arm a second arm extending in opposite direction and located at the same height as that arm with which it is to form a pair. By arranging these arms in pairs a better equilibrium is given to the moving masses.

Although the plant above specified has been particularly described in connection with the manufacture of cement, it is obvious that it may, if desired, be used for other industries, such as for instance for the treatment of gold ores or for the disintegration of iron ores, and it is therefore to be understood that the invention is not to be limited by the terms used in the above specification except as the state of art may require.

I claim as my invention:

1. In a device of the class described, an external casing; a stationary sieve cylindrical in form within said casing; a rotary shaft; means for operating said shaft; a stirring device within said sieve and secured to said shaft and having a plurality of hollow arms with a common inlet opening, said arms terminating adjacent said sieve whereby material passing through said arms is discharged against said sieve, said device being provided with a discharge passage leading from the space within said sieve and communicating with said space by means of an outlet opening, and through which opening and passage coarse material is discharged; a crushing mill adapted to supply material to the inlet opening aforesaid; a conveyer for conveying the coarse material discharged from within said sieve to said crushing mill; said device being also provided with a second discharge passage leading from the space between said sieve and said external casing and terminating in an outlet opening through which material passing through said sieve is discharged.

2. In a device of the class described, an external casing; a stationary sieve cylindrical in form within said casing; a rotary shaft; means for operating said shaft; a stirring device within said sieve and secured to said shaft and having a plurality of hollow arms with a common inlet opening, said arms terminating adjacent said sieve whereby material passing through said arms is discharged against said sieve; a conduit leading from within said sieve through which coarse material is discharged; a conveyer within said conduit and operated from said rotary shaft; means for varying the speed at which said conveyer is operated; a crushing mill adapted to supply material to the inlet opening aforesaid; a second conveyer for conveying the coarse material discharged from within said sieve by said first mentioned conveyer to said crushing mill; said device be-

ing provided with a discharge passage leading from the space between said sieve and said external casing and terminating in an outlet opening through which material passing through the sieve is discharged.

3. In a device of the class described, an external casing; a vertically arranged stationary sieve cylindrical in form within said casing; a vertically extending rotary shaft; means for operating said shaft; a stirring device within said sieve and secured to the upper end of said shaft, and having a plurality of hollow arms with a common inlet opening through which the material to be operated upon and water are supplied to the separator, and having separate outlet openings; said arms terminating adjacent said sieve whereby the material passing through said arms is discharged against said sieve; said device being provided with a discharge passage leading from the space within said sieve and communicating with said space by means of an outlet opening, and through which opening and passage coarse material is discharged, and being also provided with a second discharge passage leading from the space between said sieve and said external casing and terminating in an outlet opening through which material passing through said sieve is discharged.

4. In a device of the class described, an external casing; a vertically arranged stationary sieve cylindrical in form within said casing; a vertically extending rotary shaft; means for operating said shaft; a stirring device within said sieve and secured to the upper end of said shaft and having a plurality of hollow arms with a common inlet opening, and separate outlet openings, and having also a plurality of wings located below said hollow arms, said arms terminating adjacent said sieve whereby the material passing through said arms is discharged against said sieve; said device being provided with a discharge passage leading from

the space within said sieve and communicating with said space by means of an outlet opening, and through which opening and passage coarse material is discharged, and being also provided with a second discharge passage leading from the space between said sieve and said external casing and terminating in an outlet opening through which material passing through said sieve is discharged.

5. In a device of the class described, an external casing; a vertically arranged stationary sieve cylindrical in form within said casing; a vertically extending rotary shaft; means for operating said shaft; a stirring device within said sieve and secured to the upper end of said shaft and having a plurality of hollow arms with a common inlet opening, and separate outlet openings, and having also a plurality of wings located below said hollow arms, said arms and said wings terminating adjacent said sieve whereby the material passing through said arms is discharged against said sieve; said device being provided with a discharge passage leading from the space within said sieve and communication with said space by means of an outlet opening, and through which opening and passage coarse material is discharged, and also provided with a second discharge passage leading from the space between said sieve and said external casing and terminating in an outlet opening located below said sieve through which material passing through said sieve is discharged, the wall of said second discharge passage being inclined downward so as to direct the material passing through said sieve toward said discharge opening.

This specification signed and witnessed this fifth day of March, A. D., 1909.

HENRIK EMIL RÜSAGER.

Signed in the presence of—

CIR ENGELHART,
ELIJAH J. KRUGER.

Correction in Letters Patent No. 933,669.

Affidavit having been filed showing that the name of the patentee in Letters Patent No. 933,669, granted September 7, 1909, for an improvement in "Apparatus for the Treatment of Stony or Earthy Materials," should have been written and printed *Henrik Emil Rüsager* instead of "Henrik Emil Rüsager"; it is hereby certified that the proper correction has been made in the files and records pertaining to the case in the Patent Office, and should be read in the said Letters Patent that the same may conform thereto.

Signed and sealed this 20th day of February, A. D., 1912.

[SEAL.]

C. C. BILLINGS,
Acting Commissioner of Patents.

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