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GRANULATOR WITH MOVING AND OPPOSED SIFTER MEMBERS
CARRYING STEP-SHAPE MATERIAL PRESSERS

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2 Sheets-Sheet 1

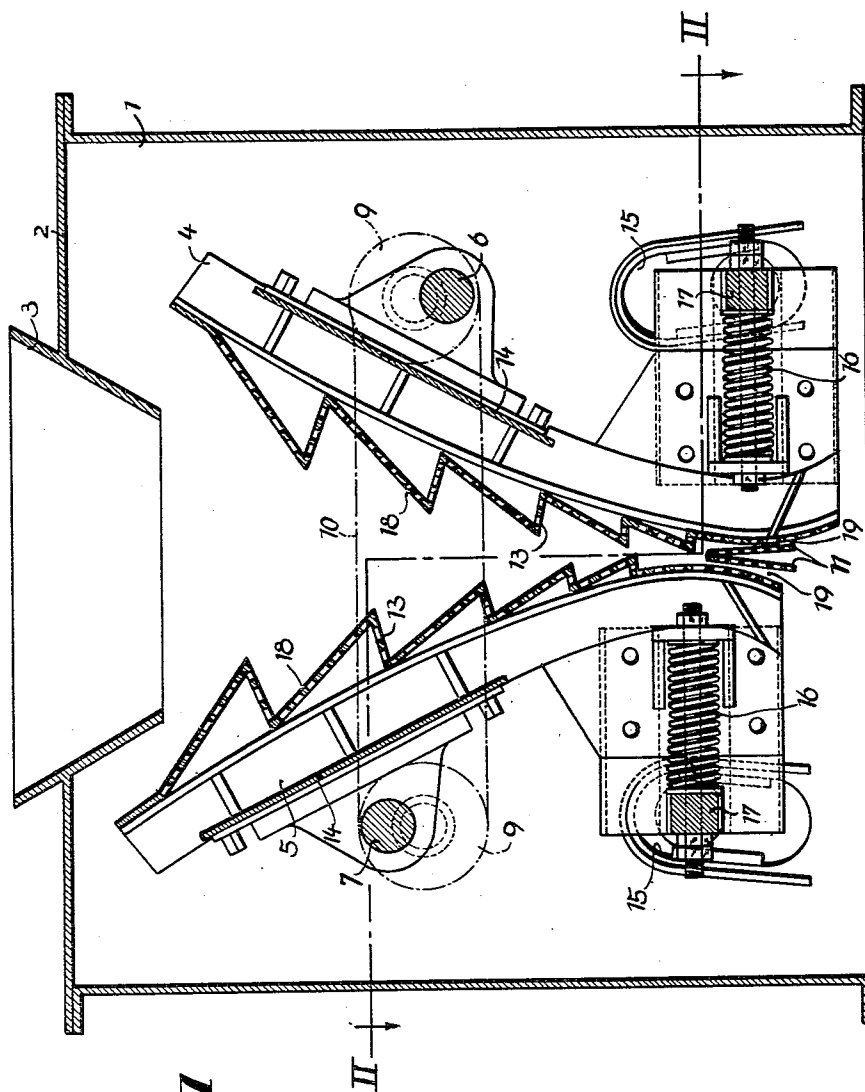


Fig. 1

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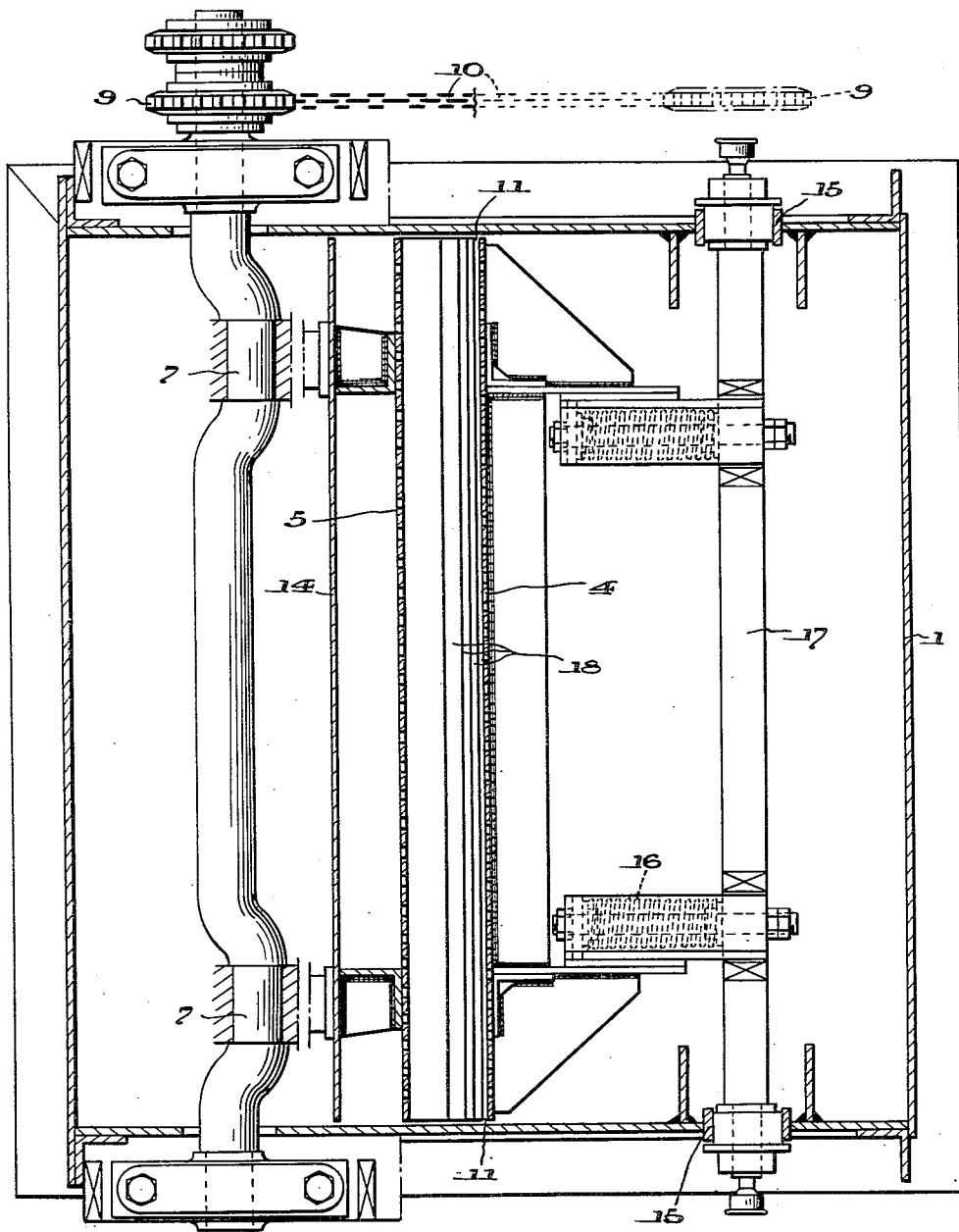


Fig. 2.

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6 Claims. (Cl. 241—94)

This invention relates to a granulation apparatus (granulator) by which a granular but lumpy material may be redivided without changing the grain size of the original granules. The field of application for such a granulator is for instance the treatment of ammonium sulphate, the crystals of which tend to conglomerate or cake thereby forming rather large lumps. It is, however, necessary to divide the large lumps before the ammonium sulphate is used as a fertilizer without substantially changing the grain size of the ammonium sulphate crystals. In order to reduce losses and waste of ammonium sulphate to a minimum it is an object of the present invention to improve the known granulation equipments which mostly cause a destruction of the original grain size.

A recent apparatus disclosed and claimed by me in the copending application Serial No. 204,173, filed January 3, 1951, now Patent 2,707,081, provides for the granulation of salt crystals or other granular materials which effects a granulation without substantially changing the initial grain size of the material.

The said new granulator shows two granulating members which may be moved in opposite direction and consists of a number of stairs, the steps of which are constructed as sifters or riddles in order to let a preferred granular size material pass.

According to the invention of said copending application the granulating members of the granulator are arranged so as to close in upon their lower ends while simultaneously the width of the steps of the stair is reduced from the top of the apparatus to its bottom.

The preliminary object of the present invention consists in arranging between the granulating members at the discharge end a stationary peaked sifter with two oppositely inclined surfaces. This sifter comprising two inclined surfaces which meet to form an apex, is located close to the two granulating members. In this manner the sifting surface is increased where the residual material is ground down or where the material is pressed through at the lower discharge end of the apparatus, respectively, so that also a considerable higher throughput is obtained.

A further object of the invention is to provide the motive power of the reversely swinging granulating members by means of cam gears or cranks in such a manner that the granulating members which are curved within reach of the discharge end will move past the stationary sifting surfaces at a constant distance so that the grinding of the material and thus the performance of the equipment is further improved.

Furthermore, the almost or generally horizontally arranged crushing ledges of the stair-like granulating members are made according to the invention also of sifters.

Finally, the invention consists yet in flexibly arranging both granulating members at the discharge end by means of compression springs whereby these springs are supported against one supporting member each extending through the housing. The supporting member is held in slots of the housing which permit an up- and downward

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movement of the compression springs with the granulating members.

The accompanying drawings forming a part of this specification and showing for purposes of exemplification a preferred form of apparatus and mode of operation in which the invention may be embodied and practiced represents in Fig. 1 a diagrammatic vertical section of the granulator according to the present invention, and in Fig. 2 a horizontal sectional view taken on the line II—II of Fig. 1.

The granulator consists of a housing 1, the cover 2 of which is fitted with a hopper 3 for filling the material to be crushed into the granulator.

Beneath the hopper 3 the two granulating members 4 and 5 are provided, each of which is supported at their upper ends by crankshafts 6 and 7. The crankshafts are supported in the walls of the housing. Driving gears 9, which are connected e. g. with a chain drive 10 and driven by a drive, not shown in the drawing, are arranged at the one end of both crankshafts.

The two granulating members 4 and 5 close in upon their lower ends. At the narrowest point between the two granulating members 4 and 5 a sifter 11 comprising two inclined surfaces is arranged, which is rigidly connected to the walls of housing 1.

The lower ends of the granulating members 4 and 5 are curved. The shape of the curve is adapted to the swinging motion caused by the eccentrically arranged crankshafts 6 and 7 in such a manner that always an equal space is maintained between the stationary sifter and the periphery of the curved granulating members 4 and 5. This spacing is so adjusted that the salt to be granulated which does not pass through the meshes of the stair-like arranged steps 18 and the sifting surfaces 11 is discharged through slots 19 between the granulating members and the stationary sifter without destruction of the grain size.

The granulating members 4 and 5 are secured at said spacing from the stationary sifter 11 by means of compression springs 16. This arrangement permits both granulating members 4 and 5 or one of the latter to yield in case any foreign matter as scrap iron or the like should get into the equipment. Springs 16 rest against supporting members 17 which consist of rods extending through slots 15 in both walls of the housing 1. The supporting members 17 are secured in these slots in such a manner that they together with the compression springs 16 can follow the motion of the granulating members 4 and 5.

At some space behind the stair-like steps 18 of the granulating members 4 and 5 are attached thereto guide plates 14 which direct the salt passed through the meshes of the steps downwards.

The granulating members 4 and 5 are operated in reciprocating fashion preferably up- and downwards whereby the material is pressed downwards by the almost horizontally arranged, sifter-like crusher ledges or risers 13 below the stair-like arranged steps or treads 18.

When the lumpy granular material is fed into the hopper 3 it will be crushed and ground between the granulating members 4 and 5 after the crank machinery 9 has started moving. The large lumps are broken and the small pieces and crystals fall down through the meshes thus escaping from the operating area of the granulating members 4 and 5. It is obvious that this manner of crushing is the best to preserve the material to be treated. The smaller lumps of the material sink down to a lower part of the granulator where they are caught and crushed by corresponding smaller sifting surfaces 13.

Having now described my invention and in what manner the same may be performed I declare that the invention should not be limited to this specific embodiment but I wish to reserve to myself changes or variations which fall within the scope of the following claims.

What I claim is:

1. Granulator for redividing lumpy granular material comprising: two confronting granulating members the vis-a-vis faces of which are formed of inverted stairs, each stair comprising a strong crushing ledge and an inclined sifting surface meeting at an acute angle thus presenting ledges increasing closer to the horizontal from feed to discharge to thereby press the material downwardly upon downward sifting surfaces, said inclined surfaces being upwardly and outwardly inclined with respect to a vertical plane passing through the vertex of the herein-after recited peak sifter, said granulating members being spaced further apart at their upper parts than at their lower parts forming a narrow lower discharge end and being reciprocable about an eccentric axis with an up and down movement in alternation with each other, to cause the smallest particles of the material being granulated to pass through the meshes of the sifting surfaces and escape from the granulating area while the remaining lumpy pieces descend to the lower narrower part of the granulating area and discharge from between the granulating members at the preferred grain size at the lower end of said members; the stairs of each of said confronting faces decreasing in depth toward the lower narrower end of the two members and having the ledges also formed as sifter surfaces, a stationary peaked sifter intermediate the two granulating members at the lower narrower discharge end where the residual material is ground down and is about to be pressed out from the lower discharge end of the granulating member, said peak sifter having downwardly and outwardly inclined sides spaced from curved portions of the two granulating members on opposite sides of the stationary peaked sifter, and having its apex above the lower terminus of the two granulating members in all positions of said members; and means movable upwardly and inwardly and downwardly and outwardly parallel to the sides of said peaked sifter in correspondence with the up and down movement of the two granulating members for yieldably holding the lower ends of the granulating members in a fixed constant spaced relation relative to the sides of the stationary peaked sifter so as to yield to increase the spaced relation under pressure of foreign material.

2. Granulator for redividing lumpy granular material comprising: a plurality of confronting granulating members the vis-a-vis faces of which are formed of inverted stairs, each stair comprising a strong crushing ledge and a sifting surface meeting at an acute angle thus presenting

ledges increasing closer to the horizontal from feed to discharge to thereby press the material downwardly upon downward sifting surfaces, said inclined surfaces being upwardly and outwardly inclined with respect to a vertical central plane between the two confronting members, said granulating members being disposed in upstanding relation to provide a lower discharge end and being reciprocable one relative to the other with an up and down movement to cause the smallest particles of the material being granulated to pass through the meshes of the sifting surface and escape from the granulating area while the remaining lumpy pieces descend to the lower part of the granulating area and discharge from between the granulating members at a preferred grain size at the lower end of said members, and a stationary sifter intermediate the confronting members at the lower discharge end thereof to increase the sifting surface for the preferred grain size material where the residual material is ground down and is about to be pressed out from the discharge end of the granulator.

3. Granulator as claimed in claim 2, wherein the stationary sifter comprises oppositely inclined members meeting at their upper parts to form an apex in the aforesaid vertical central plane and having the members downwardly and outwardly inclined from said plane and spaced from curved portions of the opposite members on opposite sides of the stationary sifter, the apex of the latter being above the lower terminus of the confronting granulating members in all operating positions of the latter.

4. Granulator as claimed in claim 2 wherein the crushing ledges of the stairs of the granulating members are also sifter surfaces.

5. Granulator as claimed in claim 2, wherein the reciprocating granulating members are eccentrically supported.

6. Granulator as claimed in claim 2, wherein the granulating members are flexibly held in constant spaced relation at their discharge ends but so as to yield to foreign material by means of compression springs resting on supporting members which move up and down in a slot provided in a support therefor in correspondence with the up and in and down and out movement of the granulating member that is reciprocated.

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