Sept. 27, 1932. J. E. GERNELLE-DANLOY 1,879,897

GRINDING AND MIXING APPARATUS

Filed April 29, 1929 4 Sheets-Sheet 1

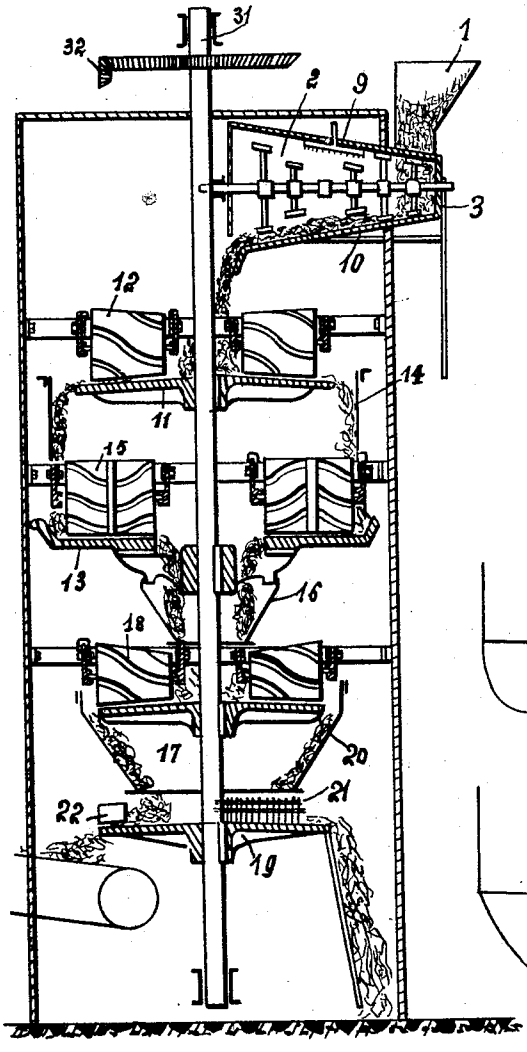


Fig. 1.

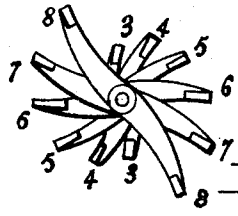


Fig. 6

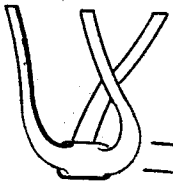


Fig. 7

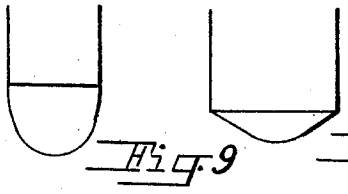


Fig. 9 Fig. 11

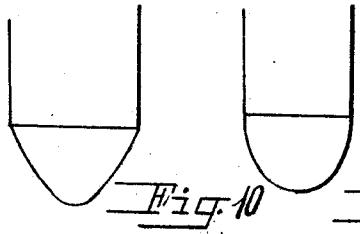


Fig. 10 Fig. 12

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GRINDING AND MIXING APPARATUS

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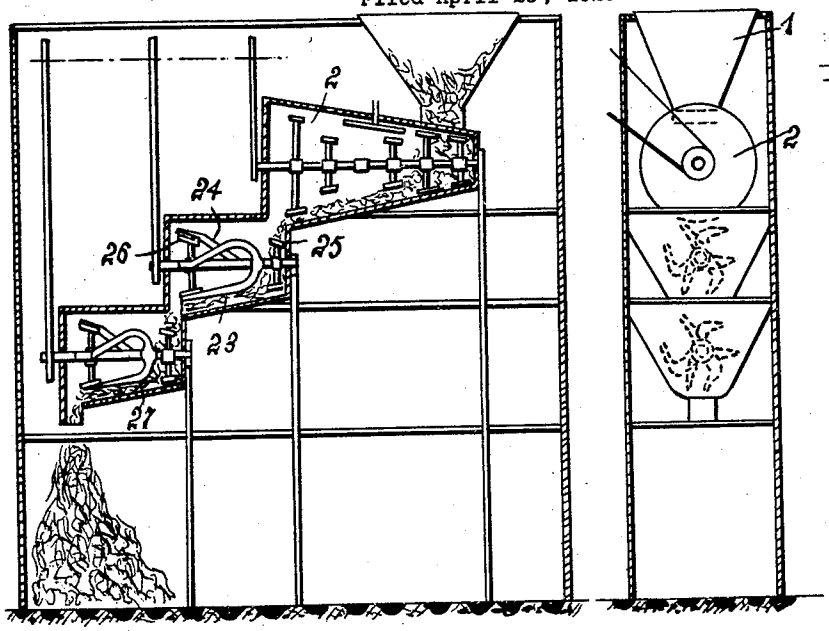


Fig. 4

Fig. 5

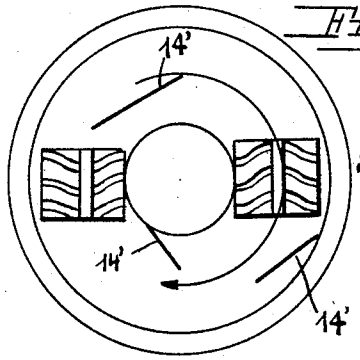


Fig. 2.

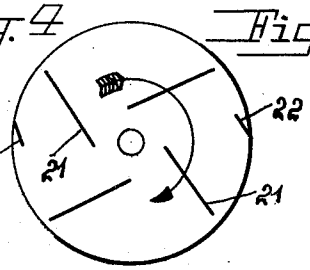
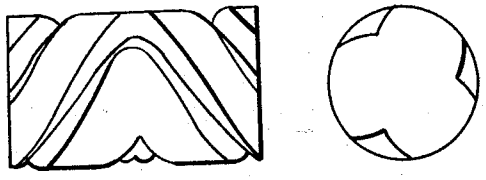


Fig. 3



Fig. 8

Fig 13



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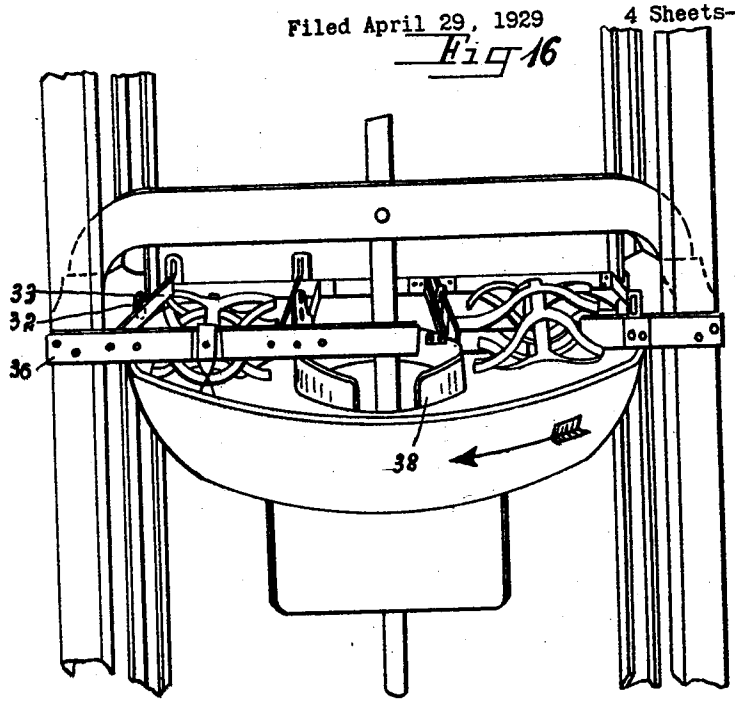
BY [signature] ATTY.

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GRINDING AND MIXING APPARATUS

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Fig. 16



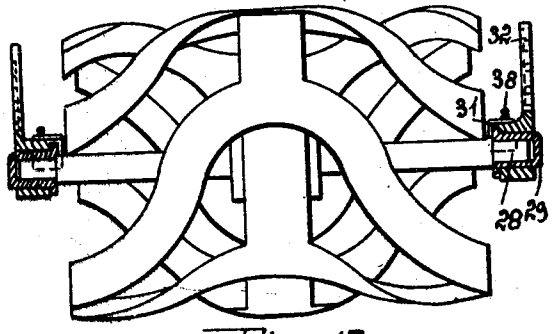


Fig. 17

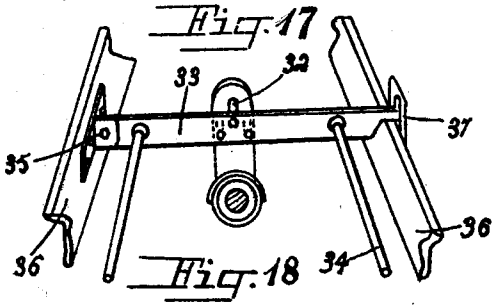


Fig. 18

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GRINDING AND MIXING APPARATUS

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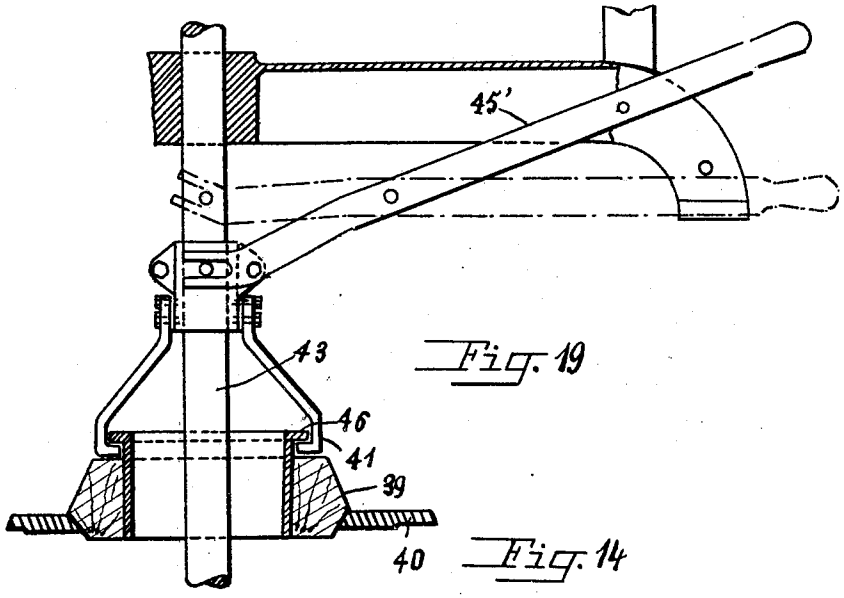


Fig. 19

Fig. 14

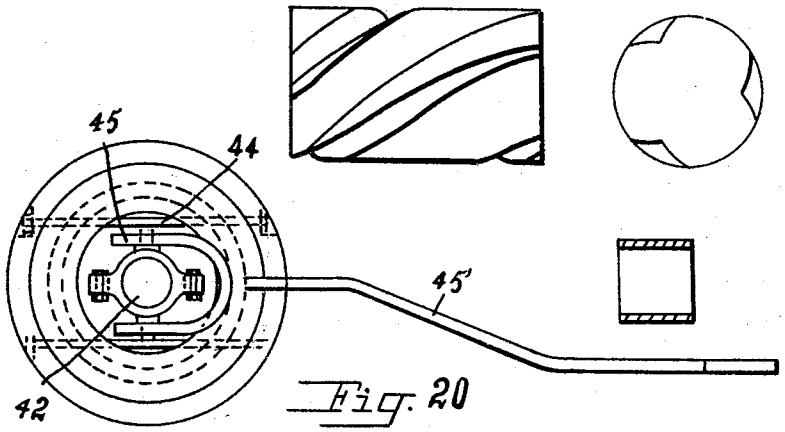


Fig. 20

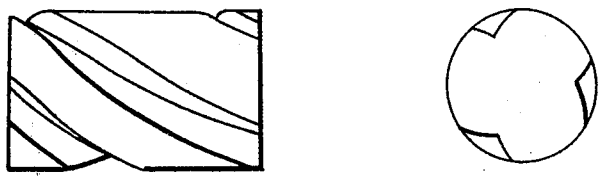


Fig. 15

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Patented Sept. 27, 1932

1,879,897

UNITED STATES PATENT OFFICE

JOSEPH EMILE GERNELLE-DANLOY, OF ROUEN, FRANCE

GRINDING AND MIXING APPARATUS

Application filed April 29, 1929, Serial No. 359,019, and in France May 9, 1928.

Known grinding and mixing apparatus are in use which are applied chiefly for the treatment of moulding sand, chemical products and all industries requiring the grinding mixing, friction and subdivision of material. Such apparatus usually comprise grinding rollers of various types whose axles are stationary and which rest directly upon a rotating vessel. With apparatus of this class, the work is necessarily intermittent, and the output is hence reduced.

The invention has for its object to provide an apparatus whose operation is continuous.

The apparatus according to the invention comprises one or more superposed rotatable vessels, or a plurality of rotatable disks, in the superposed and combined position, mounted on a vertical shaft which is rotated by gearing, as shown in Fig. 1.

The material is supplied to the hopper 1 in the known manner, and it drops thence into a mixing vessel 2 provided with arms or paddles 3, 4, 5, 6, 7, 8 which are shown in end view in Fig. 6, in which it is mixed, and if necessary, moistened by means of a shower 9.

The material is discharged from the said mixing vessel by the set of paddles or scrapers 3 to 8, and also due to the inclined walls 10 of the vessel.

The material is thus supplied to the centre of the disk 11 and is acted upon by the grinding rollers 12 having curved branches, and which have a tapered form with circular base, thus fitting upon the inclined disk 11. The said rollers are rotated by the disk which also draws forward the material.

The material travels from the centre to the periphery by centrifugal action, also due to the inclination of the disk and to the effect of the curved branches of the said drums.

It is thence dropped into a shallow vessel 13, being guided by a circular sheet metal device 14. In the said vessel the material travels from the periphery to the centre, due to scrapers 14′ (shown in Fig. 2 which is a plan view of said vessel), which send the material from one to the other, and the last scraper send it into the central aperture. During their travel in the said vessel, the material is acted upon by the cylindrical grinding rollers 15, the bottom of the said vessel being horizontal. The said drums rotate in the same manner as the rollers of the disk 11.

From the vessel 13, the material drops automatically (guided by a funnel 16) to the middle of the disk 17, similar to the aforesaid disk 11 and provided with grinding rollers 18 similar to the rollers 12, being treated in the same manner as above mentioned. The automatic circulation of the material from such disks to vessels, and vice versa, may be repeated as often as desired.

From the disk 17, the material drops to the middle of a disk 19 (shown in plan view in Fig. 3), which is provided with disintegrating rakes 21 (Fig. 3) when a very finely divided product is to be obtained.

The product is then discharged at one or more points by means of the scrapers 22, and it drops into a silo from which it can be removed by known mechanical means.

In another construction, shown in lengthwise section in Fig. 4 and in cross section in Fig. 5, the material is supplied to the hopper 1 from which it drops into the grinding device 2 which is similar to the one shown in Fig. 1, thence falling into the vessel 23 of special form, substantially half-tapered with horizontal and whose section below the middle line may be represented by a half-circle, or by a half-ellipse (Fig. 9), a parabola (Fig. 10), a hyperbola (Fig. 11), an oval curve (Fig. 12), or other suitable curve of regular or irregular form.

The said vessel is provided with a tapered grinder 24 having several branches (shown in perspective in Fig. 7 and in end view in Fig. 8), coinciding practically with the bottom of

said vessel 23, so that the material pushed by the scraper 25, will be subjected to the action of the branches of the grinder, and it is circulated due to the special form of the vessel, also by the impelling action of the branches of the grinder and by the said scraper 25. It drops thence into another vessel 27 of like construction, and the operation can be repeated as many times as is necessary in order to obtain a homogeneous product which falls automatically from the last vessel either into a silo or otherwise, and can then be removed by known means.

In the said grinding devices there are employed solid grinding rollers (of which one is shown in side and end view in Fig. 13), but upon such rollers the recesses have a double thread, and for this reason they are not adapted for the continuous treatment of material of a fluid, viscous, incompressible, dry or moist nature, and thus the output is limited.

To obviate this drawback, the roller comprises helical recesses having a right-hand thread (Fig. 14) or a left-hand thread (Fig. 15), and this feature specially distinguishes this type of grinding roller which is adapted to treat all material of a fluid, viscous, incompressible, dry or moist nature. The said rollers may be rotated by suitable mechanical means in rotating vessels or rotating grinding tubes, or may have a very small size for independent use in grinding tubes, for instance those employed in the treatment of lime and cement chemical products, ores and the like. The roller with the right-hand thread Fig. 14, serves for the circulation of material in grinding tubes with right-hand rotation and the one with the left-hand thread Fig. 15 is used in like manner with tubes having a left-hand rotation.

Due to the circulation of the material which is effected by such grinding rollers, the output of the apparatus is increased, and it is not necessary to give an excessive inclination to the grinding tubes, as occurs in the known construction, this being defective as concerns erection, upkeep and power.

The invention further relates to the method of suspension of the grinding rollers in the crushing and grinding apparatus. In the known apparatus, the shafts of the rollers pivoted at the end next the axis of the machine, whilst the outer end is mounted in a vertical groove in the main frame, or in other cases the shaft of the roller is mounted on the main frame in a strap hanging vertically from an upper cross beam.

These methods of mounting the roller are defective as taking an excessive power in the first-mentioned case, and as lacking effectiveness in the other case, since by reason of the centrifugal force of the material, the rollers mounted in straps will be inclined in the direction of travel and are thus separated from the bottom of the vessel, in which case they are little effective.

By the method of suspending the rollers according to the invention, all such drawbacks will be avoided.

This arrangement is shown in Figs. 16, 17 and 18. Fig. 16 is a general perspective view (with parts broken away) of a crushing and grinding machine comprising the said device. Fig. 17 is a perspective view of a grinding roller, with the details of the suspension arrangement in section. Fig. 18 is a perspective detail view.

The suspension device has the following construction:

The ends 28 of the roller shaft are mounted in bearing sockets 29, which are closed at one end and are interchangeable, these being secured by set screws in the flanged carriers 31; the flange is pierced with three slots 32 for the insertion of the bolts securing the flange to the bars 33 which are connected together by cross members 34. The said bars 33 are pivoted at one end in brackets 35 bolted to the cross-piece 36, and the bar rests at the other end in a slotted guide mounted on the other cross-piece 36.

The general arrangement of one of these bars is shown in Fig. 18.

In this manner, each grinding roller is suspended and it can be vertically adjusted by means of the said slots 32 in the flange of the bearing 31. The closed socket 29 is provided with a suitable lubricating device on the outer side, and it is protected by a sheet metal cover 38.

This arrangement permits the rollers to rise almost vertically during the travel of the material, and this will be more effectively treated, while the bearings are also well protected.

The invention also relates to improvements in the closing of the central discharge aperture of the vessel of the apparatus provided with rotating vessels, during the operation. In all of the known apparatus with rotating vessels, the material is retained by a curved iron member 38′ which is suspended above the vessel in order to protect the central aperture, a gap being left for the circulation of the material when discharged. This arrangement is however not sufficiently tight, and it allows an excessive amount of untreated material to pass through.

To obviate this serious drawback, the apparatus comprises, according to the invention, a tapered stopping device 39 which is shown in vertical section in Fig. 19 and in plan view in Fig. 20. The said stopper 39 is quite distinct from the vessel 40, and even from its lifting claws 41, which are mounted on a collar 42 loosely slidable on a vertical shaft 43 and carrying two trunnions 44 which can be acted upon by the fork for raising purposes. Thus when the lever is in the position shown

by the full lines, the claws 41 are inactive and will allow the wood stopper 39 to rest upon a corresponding part of the vessel 40, so that the stopper will tightly close the vessel while rotating with the latter. When the lever is in the position shown by the dotted lines, the stopper will now be raised, it being suspended by the said claws which have now made contact with the iron flange 46. The collar 42 is held by the trunnions 44, and it allows the shaft to rotate.

The product can now be discharged through the central aperture by the known means.

The method of treating the material by allowing it to fall successively from one element or vessel to another, as represented in the two forms of construction and shown in Figs. 1 to 12, offers several important advantages:

1. The material which is regularly supplied by known means, are made to follow a determined cycle by which it is effectively treated by all the operative parts of the apparatus.

2. Since these operative parts are only obliged to treat a moderate and uniform quantity of material, which is constantly renewed, they operate with a constant efficiency.

3. Only a small amount of power is required, since the material circulated principally by gravity, thus practically dispensing with labour and affording a great saving of power.

4. Since the operation is continuous, the plant has a great output.

5. The new device for the horizontal suspension of the grinding rollers enables these to operate in a more approved manner, with a ready and inexpensive upkeep.

6. The closing stoppers for the several elements of the said grinding and mixing apparatus prevents the material from dropping out before it has been entirely treated.

Obviously, the said invention is herein described solely by way of example, and is susceptible of all modifications of its elements and forms, and it can be diversely applied in various industries.

I claim:

1. An apparatus for treating material used in molding comprising a driving axle, a series of superimposed plates arranged in spaced relation on and driven by said axle, grinding means cooperating with each of said plates, the uppermost plate being inclined downwardly toward the periphery to provide for peripheral discharge to the immediately adjacent lower plate and said latter plate being arranged for central discharge to the next immediately adjacent lower plate.

2. An apparatus for treating material used in molding comprising a driving axle, a plurality of superimposed plates arranged in spaced relation on and driven by said axle, the uppermost plate being inclined downwardly toward the periphery to provide for peripheral discharge of the material, grinding means cooperating with said uppermost plate and formed to assist in peripheral feed of the material during the grinding action, the next lowermost plate being substantially horizontal and formed with a central opening to provide for central discharge of the material, grinding rolls cooperating with said latter plate, and scrapers cooperating with said latter plate to gradually direct the material being ground toward the central discharge of the plate.

3. An apparatus for treating material used in molding comprising an annular housing, a vertically driven shaft in said housing, a conical shaped disk carried by and rotated with said shaft, a second flat disk carried by and rotated with the shaft and arranged below and in spaced relation to the first mentioned disk, said first mentioned disk being adapted for peripheral discharge, grinding rolls cooperating with said first mentioned disk, said second disk being arranged for central discharge, grinding rolls cooperating with said second disk, a third conical shaped disk carried by and rotated with the shaft below the second disk, grinding rolls cooperating with said third disk, and means for delivering material peripherally from the third disk.

4. An apparatus for treating material used in molding comprising an annular housing, a vertically driven shaft in said housing, a conical shaped disk carried by and rotated with said shaft, a flat disk carried by and rotated with the shaft and arranged below and in spaced relation to the first mentioned disk, said first mentioned disk being adapted for peripheral discharge, grinding rolls cooperating with said first mentioned disk, said flat disk being arranged for central discharge, grinding rolls cooperating with said flat disk, a second conical shaped disk carried by and rotated with the shaft below the second disk, grinding rolls cooperating with said second conical shaped disk, and means for delivering material peripherally from the second conical shaped disk, each of said grinding means being mounted for limited vertical movement.

5. An apparatus for treating material used in molding comprising an annular housing, a vertically driven shaft in said housing, a conical shaped disk carried by and rotated with said shaft, a flat disk carried by and rotated with the shaft and arranged below and in spaced relation to the first mentioned conical shaped disk, said first mentioned disk being adapted for peripheral discharge, grinding rolls cooperating with said first mentioned disk, said flat disk being arranged for central discharge, grinding rolls cooperating with said flat disk, a second conical shaped

disk carried by and rotated with the shaft below the flat disk, grinding rolls cooperating with said second conical shaped disk, means for delivering material peripherally from the second conical shaped disk, a mounting for each of the grinding rolls, means for adjustably connecting the grinding rolls in said mounting, and means for permitting a limited vertical movement of the mounting.

In testimony whereof I affix my signature.

JOSEPH EMILE GERNELLE-DANLOY.