March 18, 1924. 1,487,208

G. C. COOKE ET AL

AGITATING AND MIXING DEVICE

Filed Dec. 13, 1922

Fig. 1.

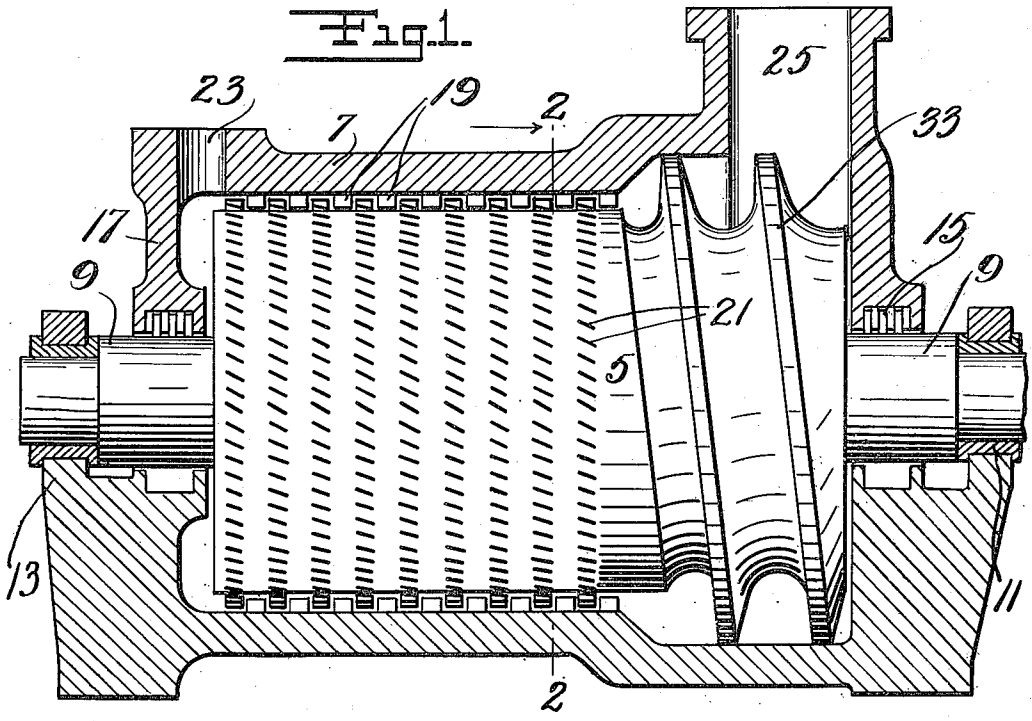


Fig. 2.

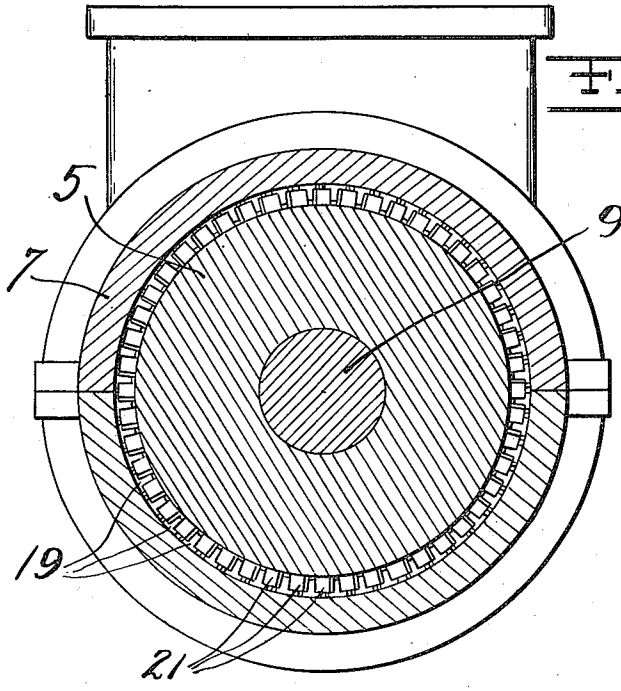
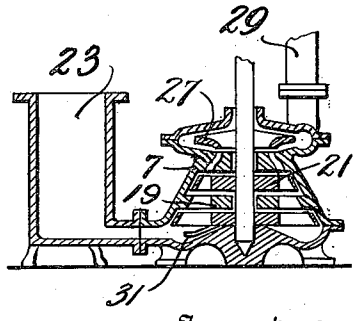


Fig. 3.



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UNITED STATES PATENT OFFICE.

GORDON C. COOKE, OF PATERSON, NEW JERSEY, AND JAROSLAV A. MICHAL, OF BROOKLYN, NEW YORK, ASSIGNORS TO THE TURBINATOR COMPANY, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

AGITATING AND MIXING DEVICE.

Application filed December 13, 1922. Serial No. 606,585.

To all whom it may concern:

Be it known that we, GORDON C. COOKE and JAROSLAV A. MICHAL, citizens of the United States, and residents, respectively, of Paterson, in the county of Passaic and State of New Jersey, and of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Agitating and Mixing Devices, of which the following is a specification.

This invention relates to apparatus for rapidly and efficiently blending together different liquids, semi-liquids, solids, or liquid and solid substances, and particularly to apparatus that will function in continuous, as distinguished from batch, operations.

It is well known that many manufacturing processes involve at one or more stages of their progress mixing operations in which different substances are mixed or blended together. In many cases the materials to be mixed together are united or blended only with the greatest difficulty because of lack of natural affinity on the part of the materials for uniting with each other, or for other reasons connected with the character of the materials. The stirring or agitating apparatus heretofore used for this purpose not only was wasteful of time in producing the necessary fineness or thoroughness of mix of refractory materials but the prior apparatus has been almost invariably operated on the batch principle, so that the step of mixing or blending has delayed or impeded subsequent operating steps in the process with the result that the efficiency of the manufacturing or other process, as a whole, has been impaired.

It is a general object of the present invention to provide mixing apparatus which will be free from the objections referred to and which will function rapidly and efficiently and with a continuous delivery of thoroughly mixed material.

The invention includes a drum having relative rotation inside an enclosing casing, the outer periphery of the drum and the inner surface of the casing being provided with a great number or stirring blades which pass between each other at high velocity to produce an exceedingly intense and effective agitation of the material. In addition to thoroughly agitating the material by the stirring action referred to, provision is made for compressing or condensing the material as it undergoes the agitating operation to thereby increase the blending action between the ingredients of the material. The condensing action may be produced in various ways which preferably include a restriction of the size of the discharge opening as compared with the size of the inlet opening, in combination with means for causing the material to pass through the casing at a rate that will cooperate with the restricted size of the discharge opening to produce the desired pressure effect in the casing.

The pressure producing means may operate inside the casing and take the form of a screw feed operating near the inlet end of the casing. A like result may be secured by so mounting the stirring blades that they will have relative inclinations that will cause the material to be fed toward the discharge end of the casing at the same time that the agitation is taking place. A centrifugal impeller may be employed to produce relatively high pressure immediately at the discharge opening. Means external to the casing such as a pump or overhead tank may be used and any desired combination of the pressure-producing means referred to may be utilized for the purpose. The action may be assisted by a converging conformation of the machine casing.

Other features of the invention will be hereinafter referred to.

In the drawings, in which a preferred form of the invention has been selected for illustration,

Figure 1 is a view in vertical longitudinal section of a mixing machine embodying the invention.

Figure 2 is a view in transverse section of the machine shown in Figure 1.

Figure 3 is a view in vertical section of a device embodying a modified form of the invention.

Referring to the drawings for a more detailed description of the invention, in Figures 1 and 2 is shown an embodiment of the invention including a rotor or drum 5 adapted to be rotated at a suitable speed in a casing 7. The rotor 5 is provided with shaft extensions 9 journaled in bearing 11 formed in the end frame members 13 of the machine,

and interengaging oil flanges 15 may be provided on coacting parts of the shaft extensions 9 and the end wall members 17 of the casing 7.

The inner wall of the casing 7 is provided with a number of annular rows of inwardly projecting blades 19 seated in fixed position and the periphery of the rotor 5 is also provided with rows of material agitating and stirring blades 21 which project outwardly to pass between the inwardly projecting fixed blades 19 on the casing. The stirring blades 19 and 21 may be varied as to the number used to suit the requirements of different material. However, a number of blades such as will produce a spacing between the blades substantially equalling the width of the blades themselves will, when operated at a suitably high speed, produce an agitating effect sufficiently intense and thorough to intimately mix and blend materials that are relatively difficult to mix by known methods.

In addition to the agitating and stirring effect of the material, provision is made for producing a relatively high pressure in the mixed material as it approaches the outlet end. For this purpose the outlet port 23 of the casing is considerably smaller in cross-section than the cross section of the elliptical inlet port 25, with the result that material entering the comparatively large inlet port is forced to pass through a much smaller delivery port 23 under corresponding pressure.

In the entrance end of the casing near the inlet port 25 a screw feed device 33 may conveniently form part of the rotor 5 or be carried by the rotor shaft as is most convenient. The action of the feed device, as will be clear, forces material entering at the port 25 into the zone of operations in which the blades 19 and 21 function to agitate and stir the liquids or liquid and solid materials.

In Figure 3 of the drawing, a modified form of the invention is shown in which the rotor operates about a vertical axis instead of a horizontal axis as in Figure 1. To assist in obtaining the pressure effect adjacent the casing outlet end, the casing has a converging conformation toward the outlet end as indicated.

In addition to the means already referred to for feeding material through the casing and producing the desired pressure conditions therein the stirring blades themselves may be used to provide a feeding action of the material. For this purpose the blades may be positioned at any desired angle in their seats to produce a progressive feeding of the material successively from row to row of the blades from the inlet to the outlet end of the casing. The angle or inclination of the blades may be varied at will to fit the requirements of the work. It will be seen that the construction of the machine is not unlike the construction of a steam turbine in reverse.

Pressure producing means external to the machine may also be employed, such as a suitable pump or the pressure head produced by an elevated supply source. It will be clear that any or all of the pressure producing means referred to may be used in any desired combination.

Other features of this form of the invention include a centrifugal impeller 27 cooperating with the delivery outlet 23 to discharge the mixed material into the delivery conduit 29 which may lead to the apparatus for performing the next succeeding step in a process. A scraper or stirring blade 31 may also be included for agitating material tending to collect in the lower part of the casing.

In operation the rotor of either the horizontal or the vertical type of mixer described may be rotated at a desirable relatively high speed through a driving pulley mounted on the rotor shaft and it will be seen that an extremely high degree of agitation and stirring is effected in a plurality of stages under relatively high pressure. The combined pressure and agitation effects produce in a rapid and continuous operation thoroughly blended emulsions, or colloidal or other homogeneous mixtures.

It will be obvious that heating or cooling effects can be applied to the material undergoing the mixing operation through the use of a suitable construction having an enclosing relation to the casing of the apparatus. Provision may also be made for introducing liquid material into the machine by way of a hollow shaft and permitting the liquid to be discharged radially through the periphery of the drum while solid or semi-solid material is fed into the machine through the inlet opening shown in the drawing. This arrangement would provide for a successive or alternate feed of the respective ingredients where such an operation would be desirable.

What is claimed is:—

1. In an agitating and mixing device, a rotor adapted to be driven at high peripheral speed and provided on its periphery with a multiplicity of circumferential rows of radially extending blades, and a casing for the rotor provided on its inner periphery with circumferential rows of blades alternating with the rows of blades on the rotor, said blades on the rotor and on the casing being set at inclinations to deflect material from row to row through the device and to present cutting edges against which particles of material are projected.

2. In an agitating and mixing device of the continuous delivery type, a rotor adapted to be driven at high speed and provided

on its periphery with a multiplicity of circumferential rows of radially extending blades, a casing for the rotor provided on its inner periphery with circumferential rows of blades alternating with the rows of blades on the rotor, the radial extension of the blades being relatively small in comparison with the diameter of the rotor and the space between adjacent blades within the rows not substantially exceeding the width of the blades, and the alternate rows of blades being set at reversed inclinations such that material is projected in a zig-zag direction from row to row through the device.

3. In an agitating and mixing device of the continuous delivery type, a rotor adapted to be driven at high peripheral speed and provided on its periphery with a multiplicity of circumferential rows of radially extending blades, and a casing for the rotor provided on its inner periphery with circumferential rows of blades alternating with the rows of blades on the rotor, said blades on the rotor and the casing being spaced from each other in the rows by distances substantially equal to the width of the individual blades, and said rows of blades being inclined in opposite directions in alternation whereby particles of material deflected from the inclined faces of one row of blades are projected against the edges of the blades of the next adjacent row and whereby the material is fed from row to row through the device.

4. In a mixer adapted to produce colloidal dispersions, a high speed rotor provided with a multiplicity of annular rows of cutting blades on its periphery and a casing for the rotor provided with annular rows of inwardly projecting cutting blades in alternation with and in close proximity throughout their length to the rows of blades on the rotor, blades on both rotor and casing being set to propel material in an angular direction with relation to the axis of the rotor, but being in reverse angular setting to cause material particles to be disintegrated by high speed impact against the edges of the blades and to constantly change their direction of travel in their progress through the machine.

5. In an agitating and mixing device, a rotor of substantial diameter adapted to be driven at high speed and provided on its periphery with a multiplicity of circumferential rows of relatively flat blades whose dimensions are relatively small in comparison with the diameter of the rotor, a casing for the rotor provided on its inner periphery with circumferential rows of relatively flat blades alternating with the rows of blades on the rotor, said blades being set to deflect material from row to row progressively through the device, and the number of blades and the clearances between adjacent moving and stationary parts being such that every portion of the material passing through the device is subjected to intense disintegrating action by impact against the flat surfaces of the blades.

6. In a grinding device of the continuous delivery type, a rotor adapted to be driven at high peripheral speed and provided on its periphery with a multiplicity of circumferential rows of blades having relatively flat material engaging surfaces, and a casing for the rotor provided on its inner periphery with circumferential rows of blades having relatively flat material engaging surfaces alternating with the rows of blades on the rotor, the blades in the row and the rows of blades being separated by clearances sufficiently small to prevent substantial slip of the material under high speed of operation and to thereby provide an efficient grinding action thereon.

7. In a grinding device of the continuous delivery type, a rotor adapted to be driven at high speed and provided on its periphery with a multiplicity of circumferential rows of radially extending relatively flat blades set to provide a cutting action, and a casing for the rotor provided on its inner periphery with circumferential rows of relatively flat blades alternating with the rows of blades in the rotor, the revolutions of the rotor per unit of time being sufficient in number to produce high peripheral blade speed and thereby, in conjunction with cutting action of blades, causing grinding action and increasing diminution of particles as material passes successive rows in its progress through machine.

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