United States Patent

[11] 3,601,369

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[21] Appl. No. **811,798**
[22] Filed **Apr. 1, 1969**
[45] Patented **Aug. 24, 1971**

[54] **APPARATUS FOR MIXING PARTICULATE MATERIALS**
5 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **259/2,** 259/72
[51] **Int. Cl.** **B01f 11/00**
[50] **Field of Search** ..... 259/78, 93, 174, 2, 13, 17, 35, 56, 59, 10, 9, 178, 92, 94, 72, DIG. 41, 12, 29, 54

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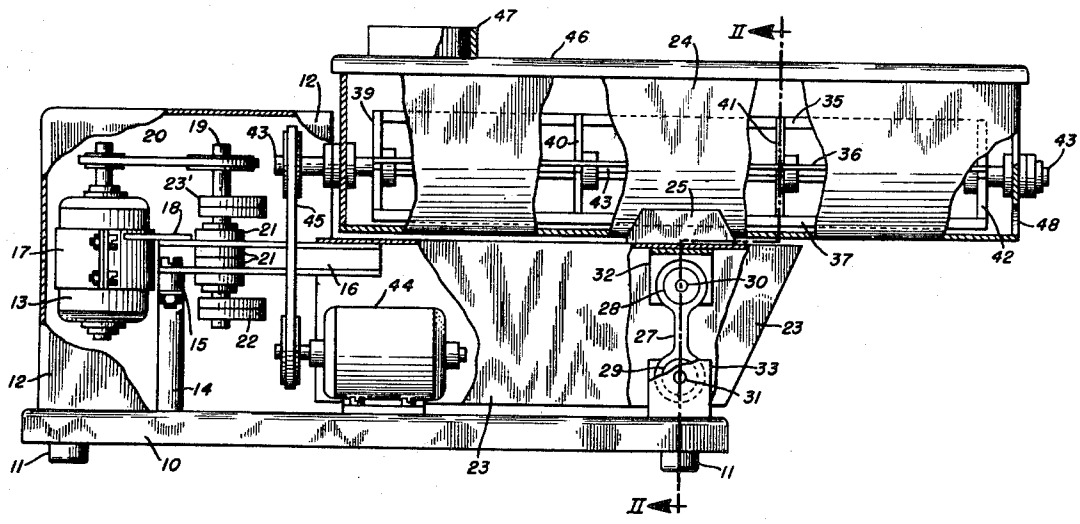
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ABSTRACT: Apparatus for receiving two or more streams of powdered or granular materials includes means to stir the received materials while such materials are vigorously vibrated and to discharge the mixed materials at a rate which is equal to the inlet rate.



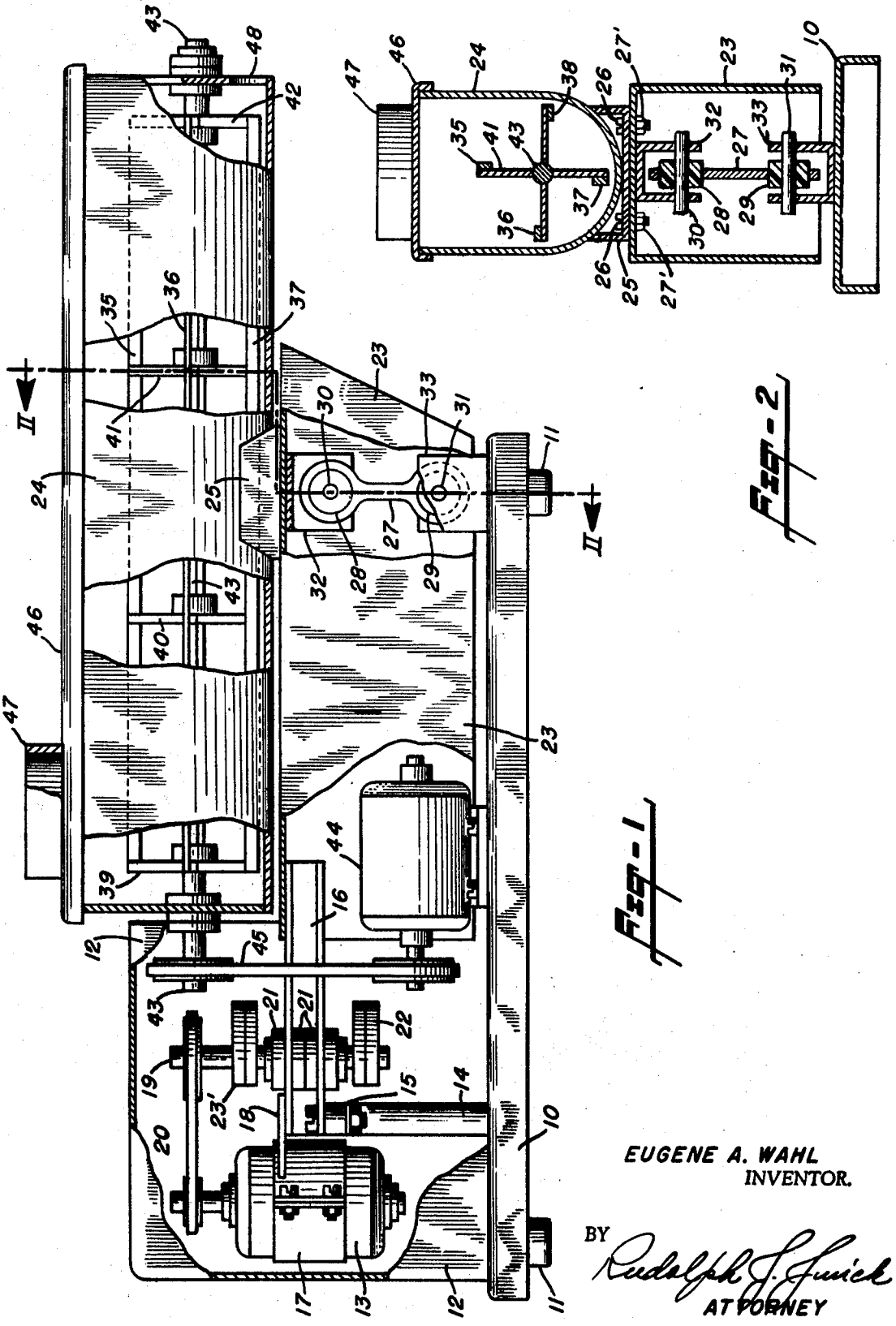


Fig - 2

Fig - 1

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APPARATUS FOR MIXING PARTICULATE MATERIALS

BACKGROUND OF THE INVENTION

Apparatus is available for receiving powdered or granular material from a supply hopper and discharging the material at a predetermined, constant feedrate. In many processes, it also is necessary to provide an intimate mixture of two or more materials in predetermined proportions and as a continuous stream. In general, prior mixing apparatus is bulky and expensive, is not easily disassembled for cleaning, and does not provide an intimate and rapid blending of the materials coupled with gentle action. Also, previous continuous mixers are of the positive displacement type wherein discharging of the materials is effected by a rotating screw or like device which governs the material retention or mixing time.

SUMMARY OF THE INVENTION O

Continuous streams of materials to be mixed are directed into one end of an elongated trough containing a rotating paddle wheel arrangement, said trough being vibrated to reduce the container materials from a solid state to a fluid state, in which condition the materials are more readily miscible. Due to the fluid character of the material, the translation of the material from the inlet end of the trough to the outlet end thereof takes place by reason of the difference in the static head of the material at the trough ends, whereby the discharge rate of the apparatus always balances the inlet rate.

An object of this invention is the provision of improved apparatus for intimately mixing powdered or granular materials and discharging the mixed materials at a rate governed only by that at which the materials are supplied to the apparatus, thereby providing for maximum retention or mixing time.

An object of this invention is the provision of apparatus for receiving continuous streams of different materials, simultaneously vibrating and stirring the materials, and continuously discharging the mixed materials at a rate which at all times balances the rate at which materials are being supplied to the apparatus.

An object of this invention is the provision of mixing apparatus having a tubular member provided with a material inlet and a material outlet, a rotatable paddle wheel arrangement within the tubular member, and means for vibrating the tubular member and paddle wheel arrangement to impart a fluidlike characteristic to the material contained within the trough.

The above-stated and other objects and advantages of the invention will become apparent from the following description when taken with the accompanying drawings. It will be understood, however, that the drawings are for purposes of illustration and are not to be construed as defining the scope or limits of the invention, reference being had for the latter purpose to the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings wherein like reference numerals denote like parts in the several views:

FIG. 1 is a side elevational view of mixing apparatus made in accordance with this invention, with parts broken away; and

FIG. 2 is a cross-sectional view taken along line II—II of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the apparatus is supported on a base **10** provided with rubber feet **11**. Disposed within a removable guard **12** is a vibrator motor **13**. Secured to the base are a pair of vertical, L-shaped brackets, only the forward bracket **14** being visible in the drawings. Each bracket has an offset upper end and carries a conventional rubber-in-shear isolator **15** comprising a rubber plug having a metal plate bonded at each end as by vulcanizing. Such isolators support an I-beam **16**, said beam and isolators being secured to the brackets by means of bolts and nuts. Thus, the I-beam and the brackets are held apart by the isolators and can move parallel to one another within the stretch limits of the rubber. A circular clamp **17**, secured to the motor housing, has welded thereto a plate **18**, which plate also is welded to the I-beam. The drive shaft of the motor is mechanically coupled to a shaft **19** by means of pulleys and a belt **20**, said shaft **19** being rotatable in bearings **21**, carried by the I-beam, and said shaft having secured thereto spaced, eccentric weights **22** and **23'**. Upon energization of the motor, the rotating weights impart vigorous vibrations to the I-beam.

The other end of the I-beam is welded, or otherwise secured to the top wall of a housing **23**, which housing is open at the bottom and has an inverted, U-shaped, cross-sectional configuration. An elongated trough **24**, having a semicircular bottom portion, is welded to a bracket **25** which is removably secured to the housing **23** by means of the bolts **26** and nuts **27'**. The housing **23** is spaced from the base **10** and is supported therefrom by a vibration-isolating mounting comprising a metal arm **27** having rubber bushings **28** and **29** pressed into the circular ends thereof. Spaced rods **30** and **31** are force-fitted through the rubber bushings and have ends passing through aligned holes formed in the associated mounting brackets **32** and **33**, the upper mounting bracket **32** being secured to the housing **23** and the lower bracket **33** being secured to the base **10**. This arrangement permits unrestricted vibration of the housing **23** in a horizontal plane while minimizing the transmission of vibrations to the base **10**.

The material mixing function is performed by paddle wheels comprising four bars **35–38** welded to the end portions of the spiders **39–42** which are secured to the shaft **43** rotatable in bearings carried by the end walls of the trough **24**. This shaft is mechanically coupled to the drive shaft of motor **44** by means of pulleys and the belt **45**, said motor being bolted to the base **10**. The upper end of the trough is closed by a cover **46** provided with an inlet opening **47**. A circular segment opening **48**, formed in the front wall of the trough **24**, constitutes the discharge opening of the apparatus.

The powdered or granular materials are supplied to the trough through the inlet opening **47**, each material being discharged from a conventional material feeder at a predetermined, constant flowrate. The rotating paddle wheel stirs the received materials while they are vigorously vibrated, such vibration having the effect of converting the materials to a pseudofluid state, in which state the materials are more readily miscible. The function of the straight bars of the paddle wheel is to lift and drop the materials at substantially right angles to the mixer shaft **43**. Translation of the material toward the discharge opening **48** occurs by reason of its fluidization and the difference in the static head of the material at the inlet and outlet ends of the trough **24**. Due to the fluidlike character of the material, induced by vibration, the static head differential serves to maintain a continuous flow of the mixed materials out of the discharge opening. Consequently, the mixing apparatus is self-adjusting with respect to the flowrate, that is, the discharge rate of the apparatus always balances the input rate, while maintaining maximum material-retention time in the mixer.

The described apparatus provides an intimate mixing of powdered or granular materials combined with gentle action. The mixing action is rapid, permitting operation of the apparatus at high flowrates. Also, the apparatus is easily disassembled for cleaning, the latter feature being an important consideration when the materials are pharmaceuticals or dye-bearing mixes.

Having now described the invention, those skilled in this art will be able to make various changes and modifications without thereby departing from the scope and spirit of the invention as recited in the following claims.

I claim:

1. Apparatus for mixing powdered or granular materials and automatically discharging the mixed materials in a continuous stream, said apparatus comprising,

a. an elongated, horizontally disposed tubular member having an outlet opening at one end thereof,
b. a paddle wheel within the tubular member and extending substantially the full length of the tubular member,
c. power means for rotating the paddle wheel, and
d. means for vibrating the tubular member and paddle wheel in a horizontal plane, the intensity of said vibrations being such as to fluidize the materials contained within the tubular member.

2. The invention as recited in claim 1, wherein the tubular member is closed at the ends and has a semicircular bottom portion, wherein the said outlet opening is formed in an end wall of the tubular member at the lower portion thereof, and wherein the paddle wheel is disposed within the semicircular bottom portion of the tubular member.

3. The invention as recited in claim 2, wherein the paddle wheel comprises a plurality of axially spaced spiders secured to a first shaft rotatable in bearings carried by the end walls of the tubular member, and flat bars secured to the end portions of the spiders.

4. The invention as recited in claim 3, wherein the said tubular member is secured to a supporting member vibrationally supported on a base; wherein the said power means for rotating the paddle wheel is a motor secured to the said base and mechanically coupled to the said first shaft; and wherein the said means for vibrating the tubular member and paddle wheel are eccentric weights carried by a second shaft rotatable in bearings and driven by a second motor, the bearings for said second shaft being carried by a rigid member secured to the said supporting member and vibrationally isolated from the said base.

5. Apparatus for mixing powdered or granular materials comprising,
a. a base,
b. an elongated tubular member having a semicircular bottom portion provided with an outlet opening at one end thereof,
c. means forming an inlet opening at the other end of the tubular member,
d. a first shaft extending through the tubular member and having radially extending spiders secured thereto, said shaft being substantially concentric with the said bottom portion of the tubular member,
e. flat bars secured to the end portions of said spiders,
f. means supporting the tubular member on said base, said means permitting axial vibration of the tubular member,
g. a rigid member secured to the tubular member and carrying bearings, said member being supported on the base by rubber-in-shear vibration isolating means,
h. a second shaft rotatable in said bearings and carrying an eccentric weight,
i. a first motor carried by the said rigid member and having a drive shaft mechanically coupled to the said second shaft, and
j. a second motor carried by the base and having a drive shaft mechanically coupled to the said first shaft.