

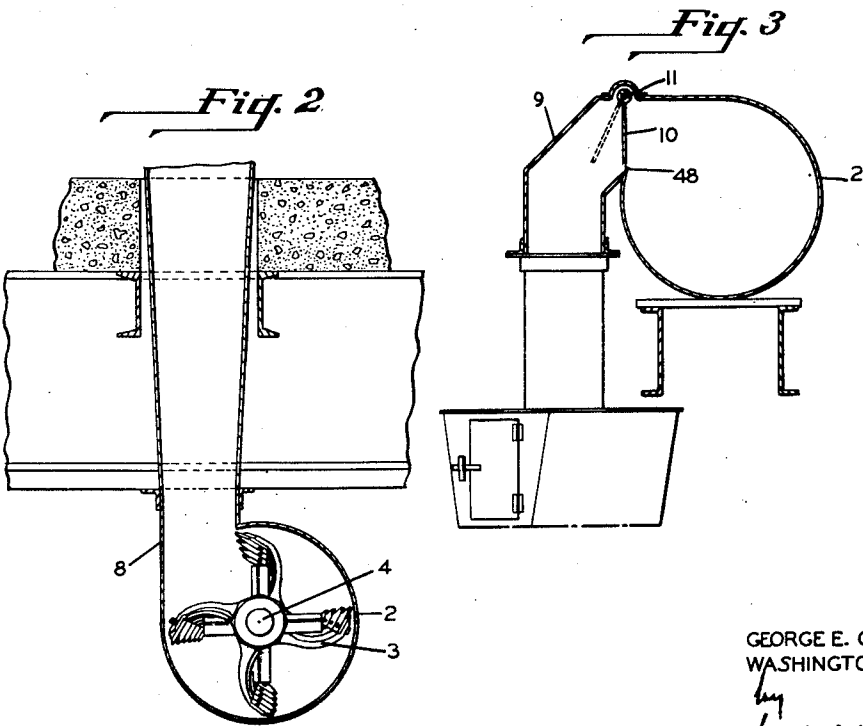
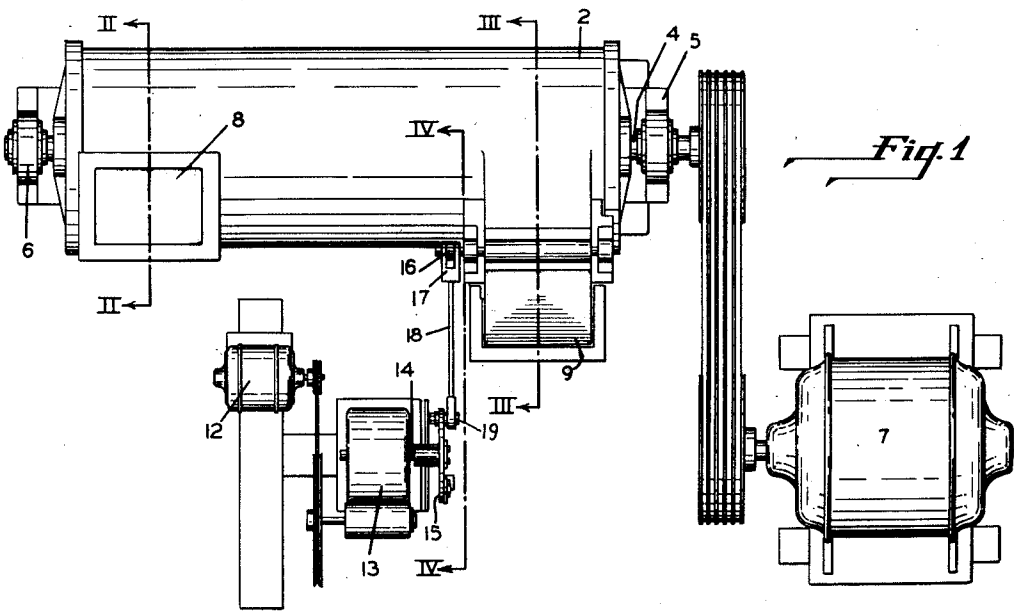
May 13, 1952

G. E. GARD ET AL
MIXER

2,596,672

Filed Nov. 17, 1950

2 SHEETS—SHEET 1



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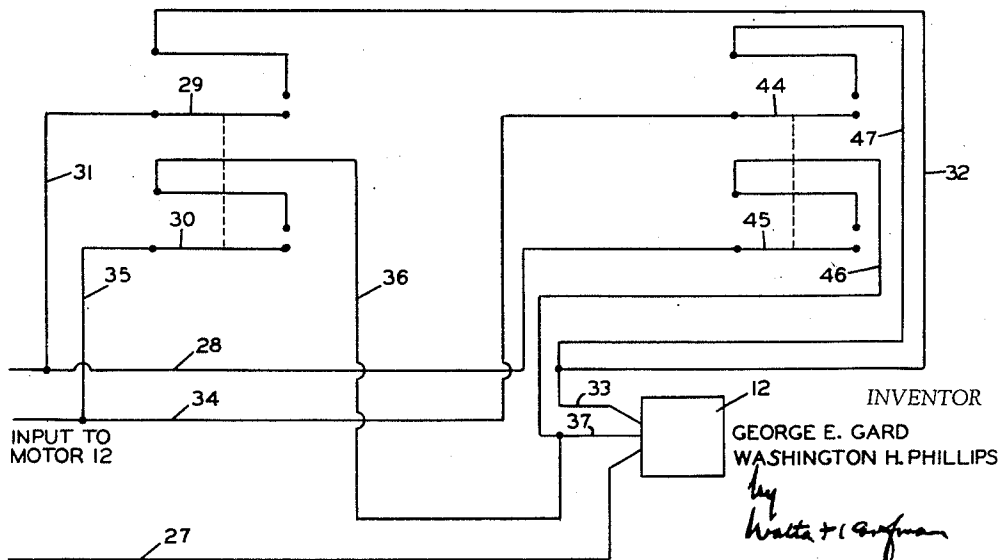
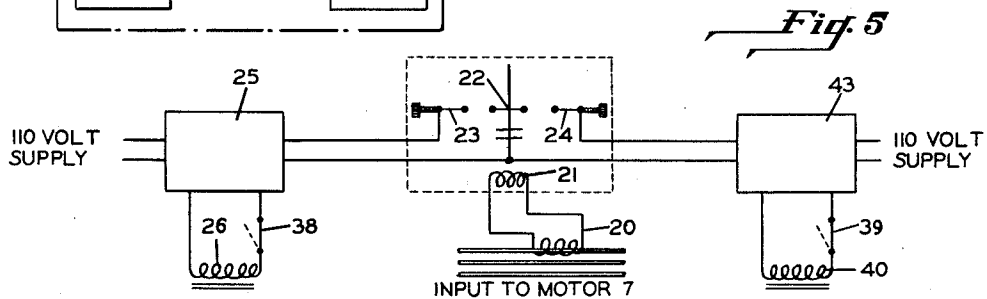
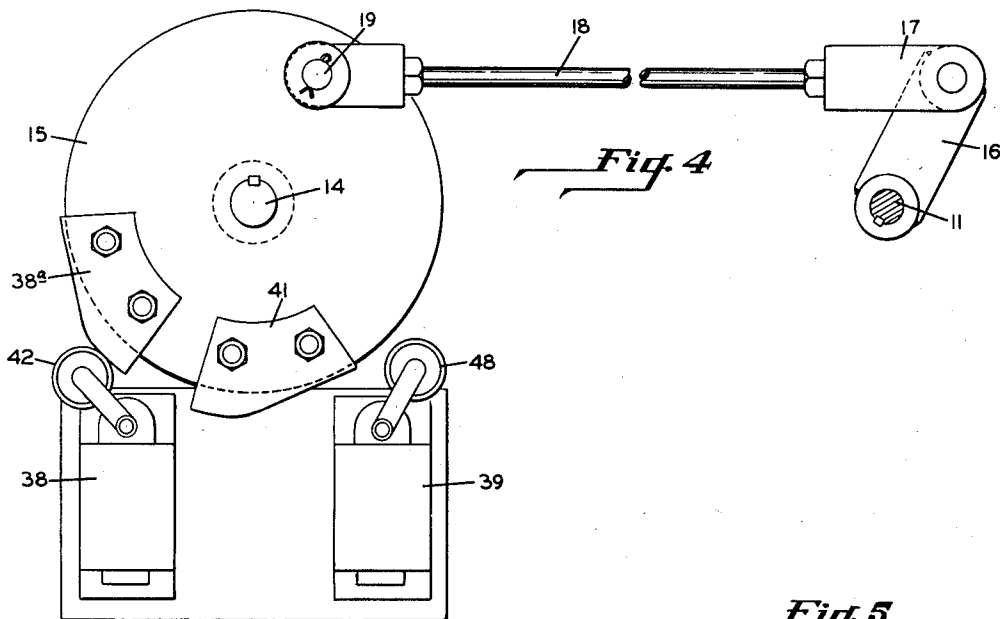
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MIXER

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2 SHEETS—SHEET 2



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2,596,672

MIXER

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7 Claims. (Cl. 259—2)

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This invention relates to mixers and is concerned more particularly with so-called continuous mixers in which the material to be mixed is delivered to and discharged from the mixer as a continuous stream or body.

As disclosed in the copending application of Washington H. Phillips, Serial No. 196,135, filed November 17, 1950, and entitled "Method and Apparatus for Making Cork Compositions and the Like," there is a problem in the manufacture of cork composition which is concerned with the uniform distribution of the binder over the light density particles of cork. In the Phillips application there is disclosed a preblending method and apparatus which delivers cork granules, a substantial portion of which have the binder deposited thereon, to a continuous mixer where the cork particles are mechanically worked, and the binder carried by some of the cork particles is distributed substantially uniformly over all of the cork particles.

It is an object of the present invention to provide a mixer which will rapidly and substantially uniformly distribute a binder or other liquid component over cork granules or other solid component, obtaining a sufficient shearing action of the components of the mix to obtain the desired distribution of the liquid component over the solid component.

An additional object of the invention is to provide a continuous mixer in which the rate of discharge of the mixed mass from the mixer will be controlled in accordance with the power input to the mixer.

Another object of the invention is to provide a mixer which will deliver its charge of material at a relatively constant predetermined temperature, utilizing the energy of the motor which drives the mixer to impart heat to the mass being mixed, by frictional contact of the coated particles with one another and with the walls and blades of the mixer, such energy input to the particles being controlled by an impedance preferably disposed in the discharge zone of the mixer.

A further object of the invention is to provide a mixer in which controlled heating of the mix may be obtained through control of the power input to the mixer to thus maintain adequate heat in mixes which include binders which are heat-sensitive but which may be deleteriously affected by overheating. Glue type binders, for instance, require heat for liquefaction and become too viscous for proper distribution unless there is sufficient heat available to maintain the desired fluid condition in the glue. Where the

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glue is used with glycerine and water as a binder for cork granules, the heat must be developed by mechanical working at the interfaces between the glue and the cork particles; for, as is well known, cork is a nonconductor of heat and possesses a very low heat capacity. However, the glue is usually tanned with formaldehyde which is activated by the application of heat during curing of the cork composition under pressure in a mold. Thus with mixers used in cork composition manufacture accurate control of the temperature of the mass under treatment is essential—too low a temperature resulting in poor binder distribution, and too high a temperature causing premature binder insolubilization.

Further objects of the invention will become apparent from consideration of the following description of a preferred embodiment of the invention which will be described presently.

The mixer of the present invention includes a body member which receives the mass being mixed. Suitable agitating or mixing elements, such as conventional mixer blades, are provided in the mixer body. The body is provided with an inlet orifice, preferably adjacent to one end thereof and a discharge orifice, preferably disposed adjacent to the other end of the body. A motor is provided for driving the mixer blades. An impedance such as a movable gate is provided, preferably in the discharge orifice, to restrict the normal discharge of mix therethrough. Means are provided for controlling said impedance in accordance with the energy absorbed by the mix in the mixer body, such as a sensing control responsive to the mixer motor input current.

A typical embodiment of the invention is illustrated in the accompanying drawing, in which:

Figure 1 is a top plan view of a mixer embodying the present invention;

Figure 2 is a sectional view of the inlet end of the mixer taken along the line II—II of Figure 1;

Figure 3 is a sectional view, with the mixer blade removed, of the discharge end of the mixer taken along the line III—III of Figure 1;

Figure 4 is a sectional view showing details of a portion of the control arrangement taken along the line IV—IV of Figure 1; and

Figure 5 is a control wiring diagram for the impedance control mechanism.

The mixer shown in Figure 1 includes a cylindrical shell 2 within which there is disposed an agitator or mixer blade structure 3 mounted on a shaft 4 which is journaled in bearings 5 and 6. Many different styles of mixing blades may be

used, depending upon the type of materials being mixed. With cork granules to be coated with a glue-glycerine binder, the type shown in Figure 2 which is known as a Sprout Waldron 10-ton Super Duty De Luxe Coldmix High Speed Agitator and is manufactured by Sprout, Waldron & Company, Muncy, Pennsylvania, will perform admirably. The shaft 4 which carries the agitator blades is rotated preferably at about 1200 R. P. M. by a motor 7. With a mixer having a drum about 60" long and about 18" in diameter, with the blades rotating at 1200 R. P. M. and a mass of cork and binder being fed thereto at the rate of about thirty pounds per minute, a 20-horsepower motor will be acceptable for driving the mixer. The mixer is disposed in a substantially horizontal plane and may be fed through an inlet opening 8 disposed adjacent to one end of the body of the mixer, as indicated in section in Figure 2. The mixed material is delivered through a discharge orifice 9 positioned adjacent to the opposite end of the body of the mixer and is shown in section in Figure 3.

With mixers of this type there is a substantial movement of air from the inlet end toward the discharge end, particularly when the mixer body is not completely loaded. In mixing light density materials such as cork particles with a relatively small quantity of binder, there is a tendency for the particles which enter the inlet end of the mixer to be discharged from the opposite end prior to complete mixing which is necessary in order to effect transfer of the binder from one granule to another to obtain substantially uniform coating of the various granules with the binder. In addition to that, it is desirable with some mixes to maintain a mechanical working of the particles adequate to generate some heat therein; enough at least to maintain a substantially constant elevated temperature in the mass as delivered from the mixer for the reasons previously mentioned.

In order to accomplish this result we have provided in the discharge orifice 9 of the mixer an impedance in the form of a gate 10 which is pivoted at 11 for movement to increase or decrease the size of the discharge orifice. In Figure 3, the gate 10 is shown in solid lines in its closed position and in dotted lines in its open position.

In order to control the movement of the gate 10 to restrict the movement of the mix through the mixer and thus obtain the desired mechanical working of the particles disposed within the mixer and travelling therethrough, a sensing arrangement is necessary; and it has been found that this may be the input current to the mixer motor 7. Under no-load conditions the 20-horsepower motor may draw a current of about 10 to 15 amperes, and under full-load condition may draw up to approximately 25 amperes. Intermediate these two, the current will vary, depending upon the energy required to mechanically work the particles; and thus the control of the gate may be effected by utilizing the variations in the current input to the motor 7 to open and close the gate and thus obtain the desired restriction to the free flow of the mass through the discharge orifice.

In Figure 1 there is shown a control arrangement for the gate 10 which includes a motor 12 which drives a gear reduction unit 13 including a stub shaft 14 to which is attached a crank disk 15. The gear reduction unit may be selected to move the crank disk 15 at a rate of about one

revolution in eight minutes. The crank disk 15 only makes a portion of a revolution. The pivot 11 for the gate 10 is connected to the crank disk 15 by a link 16 having an attaching clevis and pin 17, and the clevis receives a connecting rod 18 which is pivoted to the crank disk 15 through a pin 19. Thus rotary motion of the crank disk 15 imparts a rocking movement to the gate 10.

Motor 12 which drives the crank disk 15 to control the operation of the gate 10 may be a $\frac{1}{8}$ -horsepower, 440 volt, 3 phase, 60 cycle type. Operation of the motor 12 is controlled in accordance with the input current to the motor 7. This may be accomplished through the arrangement shown in Figure 5. A pickup coil 20 is disposed around one of the phase legs of the input to the motor 7 and energizes a coil 21 forming part of a contact-making ammeter. In place of a pickup coil, a transformer coil may be provided in a similar relationship to one leg of the input to the motor 7. The contact-making ammeter responds to the input current to the motor 7, actuating a movable contact member diagrammatically indicated at 22. This member 22 carries a pair of contacts engageable with adjustable contacts 23 and 24 attached to the ammeter. As the current input to the motor 7 increases or decreases, the movable contact arm 22 will move to the right or left. For purposes of illustration, it will be assumed that as the current decreases, the contact arm 22 will move to the left; and as the current increases, the contact arm 22 will move to the right.

When the mixer-motor 7 is under no-load, the contact arm 22 will move to bring its contact into engagement with contact 23, thus completing the circuit for a vacuum tube relay 25 which in turn energizes a control relay 26 effective for connecting to its source of current motor 12 for the gate 10 to move the gate 10 toward a closed position. As indicated in Figure 5, one leg 27 of the current input to motor 12 is directly connected thereto. Leg 28, however, is connected only through the relay system; and thus when relay 26 is energized and its points of contact 29 and 30 are elevated, current will flow from leg 28 through a lead 31 and contact point 29, through a lead 32 and a lead 33 to the motor 12. Similarly, the third leg 34 of the current input is connected to the motor through the relay system by lead 35, contact point 30, and leads 36 and 37. Thus when the current input to the motor is at its minimum, the gate 10 will be moved toward its closed position. In order to interrupt the movement of the gate, limit switches 38 and 39 are provided. Switch 38 is in the circuit for control relay 26 and is actuated by a control cam 38a carried by the crank disk 15. Limit switch 39 is in the circuit of a second control relay 40 effective for energizing the motor 12 to open the gate 10, as will be more fully hereinafter described. Switch 39 is controlled by a cam 41 also positioned on the crank disk 15.

Assuming the motor 7 to be operating under no-load and the gate 10 to have been moved to its closed position shown in solid lines in Figure 3 by actuation of motor 12 which has been controlled by vacuum tube relay 25 and control relay 26, and the closing motion limited by engagement of actuating cam 38a with control arm and roller members 42 of limit switch 38, upon the feeding of cork granules carrying a binder through the inlet opening 8, mixing will be accomplished and a relatively small quantity

of material will pass through the discharge opening. As will be noted by examination of Figure 3, this opening is quite constricted when the gate is in its closed position. As feeding continues at a rate exceeding the discharge rate, a mass of cork particles is built up within the mixer, and the load on the motor immediately increases. This building up of particles in the mixer is not sufficient to fill or fully load it, but it does cause substantial working of the particles to be effected, and considerable heat is developed at the interfaces between the particles and the binder. It has been found that relatively close control of temperatures of the mass delivered from the mixer can be obtained through this sensing arrangement. Since the contacting ammeter 21 is responsive to the current input to the motor, by adjusting the contacts 23 and 24, movement of the gate 10 may be controlled to within narrow limits; and a correspondingly close control of temperature of the mass may be effected. Also, of course, the degree of mixing or distribution of the binder over the filler particles is controlled in the same manner. For instance, the contacts 23 and 24 may be set to reverse the direction of rotation of the motor 12 upon a change of five amperes in the input to the motor 7.

Assuming now that the load on the motor 7 has increased by reason of the constriction of the discharge orifice by the gate 10, the contact arm 22 of the ammeter 21 will move toward the right, as viewed in Figure 5, and its contact will approach the contact 24. Upon engagement of the contacts, vacuum tube relay 43 will be energized and it will effect energization of control relay 40. When relay 40 is energized and its points of contact 44 and 45 are elevated, the circuit for motor 12 will be completed from leg 28 through contact point 45 and lead 46 to lead 37. The circuit from leg 34 will be through contact point 44 and lead 47 to lead 33. It will be noted by reference to Figure 5 that this effects a reversal of the leads 28 and 34 with leads 33 and 37, and thus motor 12 will be operated in the direction opposite to its direction of rotation when relays 25 and 26 are actuated. Limit switch 39 previously referred to is effective for limiting the opening motion of the gate 10. It has an actuating roller 48 which is engaged by cam 41 secured to the crank disk 15.

It will be noted by reference to Figure 5 that the movable contact arm 22 of the ammeter 21 has a null position at which it is shown in Figure 5. The contacts 23 and 24 being adjustable, provide for variation of the amount of movement possible by the movable contact 22 while in such null position. As mentioned previously, a difference of about $2\frac{1}{2}$ amperes, plus or minus, affords a satisfactory control.

From the foregoing it will be observed that when the load on the motor 7 increases, the contact arm 22 may move through a limited arc prior to engagement with contact 24 which upon being closed will cause the gate 10 to be opened. As soon as the gate opens there will be a progressive decrease in the load in the motor 7; and in some instances at least, the gate will not move to fully open position for the reason that the load on the motor will decrease to such an extent that the contact arm 22 will move toward the left, breaking engagement with contact 24 and resting in a null position. The gate will be disposed in a position intermediate completely closed or completely opened position. The same condition will exist when the gate is moved to-

ward closed position. The load on the motor 7 may build up sufficiently rapidly to move contact arm 22 away from contact point 23; and while in such null position, no further movement of the gate 10 will be effected.

With the control system for the gate 10 described above, it will be evident that upon interruption of feed to the inlet 8 of the mixer, the mixer will void itself; and as this occurs, of course, the load on the motor 7 will decrease, causing the gate 10 to be closed. Thereupon, the motor 7 may be stopped and the mixer will be in condition for reception of material to be mixed upon its next operative cycle; for instance, after a shut-down for a lunch period or over night. The gate 10 will remain closed until sufficient mix has been introduced into the mixer 8 to adequately load the motor 7 during the mixing operation; and, thereupon, as mentioned previously, the ammeter 21 will be actuated to move the contact arm 22 away from the contact point 23 and into engagement with contact point 24, opening the gate in accordance with the load on the motor 7. It will be observed by reference to Figure 3 that with the gate 10 in closed position there still remains a small opening 48 through which mix may be discharged from the mixer. This opening is necessary in order that the mixer may be voided upon completion of a run; for, otherwise, since the gate closes upon reduction in load on the motor 7, it would not be possible to feed the remaining material from the mixer.

We claim:

1. In a continuous mixer, the combination of a mixer body, a rotatable agitator disposed within the body, motor means for rotating said agitator, said body having an inlet orifice for the delivery of material to the body for mixing by said agitator and a discharge orifice for the delivery of mixed material from said body, a movable gate restricting the flow of mixed material through said discharge orifice, and means for controlling the motion of said gate comprising a crank disk connected to said gate for pivotally moving same, a reversible motor attached to the crank disk through a gear reduction unit, a contact ammeter for controlling the energization of said motor, said contact ammeter including a movable contact and a pair of adjustable contacts fixed with respect to the movable contact, means for coupling said ammeter to the input current to said agitator motor for movement of said movable contact of said ammeter in accordance with changes in the current input to said agitator motor to close said gate upon decrease in current input to said agitator motor and to open said gate upon increase in said current input, a pair of limit switches in the circuit to said motor for said gate, and actuating means for said switches carried by said crank disk for limiting the pivotal movement of said gate by said gate motor.

2. In a continuous mixer, the combination of a mixer body, an agitator disposed within the body, said body having an inlet orifice for the delivery of material to the body for mixing by said agitator and a discharge orifice for the delivery of mixed material from the body, a controllable impedance element in the discharge orifice for limiting the flow of material through the mixer, and means responsive to increase or decrease in energy absorption by said material in the mixer body to control said impedance element.

3. In a continuous mixer, the combination of

a mixer body, an agitator disposed within the body, means for driving the agitator, said body having an inlet orifice for the delivery of material to the body for mixing by said agitator and a discharge orifice for the delivery of mixed material from the body, a variable impedance element in the discharge orifice for limiting the flow of material through the mixer, and means responsive to increase or decrease in energy input to the driving means in accordance with increase or decrease in energy absorption by said material in the mixer body to control said impedance element.

4. In a continuous mixer, the combination of a mixer body, an agitator disposed within the body, an electric motor for driving the agitator, said body having an inlet orifice for the delivery of material to the body for mixing by said agitator and a discharge orifice for the delivery of mixed material from the body, a controllable impedance element in the discharge orifice for limiting the flow of material through the mixer, and means responsive to increase or decrease in the current input to said motor in accordance with increase or decrease in energy absorption by said material in said mixer body to control said impedance element.

5. In a continuous mixer, the combination of claim 4 in which the impedance element comprises a discharge gate and in which the means responsive to increase or decrease in the current input to the agitator motor comprises a second motor for moving said gate.

6. In a continuous mixer, the combination of a mixer body, an agitator disposed within the body, an electric motor for driving the agitator, said body having an inlet orifice for the delivery of material to the body for mixing by said agitator and a discharge orifice for the delivery of mixed

material from the body, a gate positioned in said discharge orifice for restricting the flow of mixed material therefrom, a reversible electric motor for operating said gate, and means responsive to increase or decrease in the current input to said motor for said agitator in accordance with increase or decrease in energy absorption by said material in the mixer body to control the operation of said reversible electric motor for said gate.

7. In a continuous mixer, the combination of a mixer body, an agitator disposed within the body, said body having an inlet orifice for the delivery of material to the body for mixing by said agitator and a discharge orifice for the delivery of mixed material from the body, a pivoted gate partially closing said discharge orifice and pivotally movable to control the flow of mixed material from said body through said discharge orifice, and means responsive to increase or decrease in energy absorption by said material in the mixer body to control pivotal movement of said gate.

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