United States Patent [19]

Brennan, Jr. et al.

[11] **3,823,921**

[45] **July 16, 1974**

[54] **CONTINUOUS PROCESSOR FOR TREATING MATERIAL**

[75] Inventors: **Ambrose K. Brennan, Jr.**, Thomasville; **Michael J. Lewis**, Felton, both of Pa.

[73] Assignee: **Teledyne, Inc.**, York, Pa.

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[52] **U.S. Cl.** **259/192**, 259/104

[51] **Int. Cl.** **B01f 7/08**

[58] **Field of Search** 259/191, 192, 193, 6, 9, 259/10, 25, 26, 45, 46, 109, 110; 425/199, 198, 197

[56] **References Cited**

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Primary Examiner—Robert W. Jenkins

Attorney, Agent, or Firm—Shoemaker and Mattare

[57] **ABSTRACT**

A continuous processor for treating material comprising elongate tubular chamber means, inlet means at one end of said chamber means for introducing a material into the chamber means, outlet means at the other end of the chamber means for discharging material from the chamber means, means in said chamber means for treating material therein and for causing the material to flow from the inlet to the outlet, and adjustable restrictor means in said chamber means between the ends thereof for regulating the flow of material through said chamber means.

14 Claims, 7 Drawing Figures

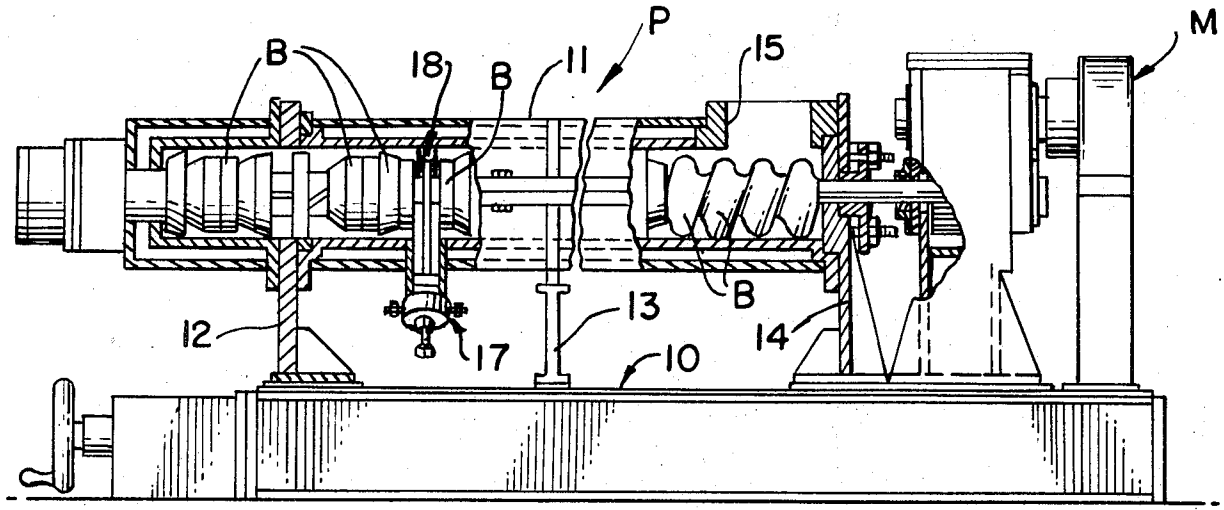


FIG. 1.

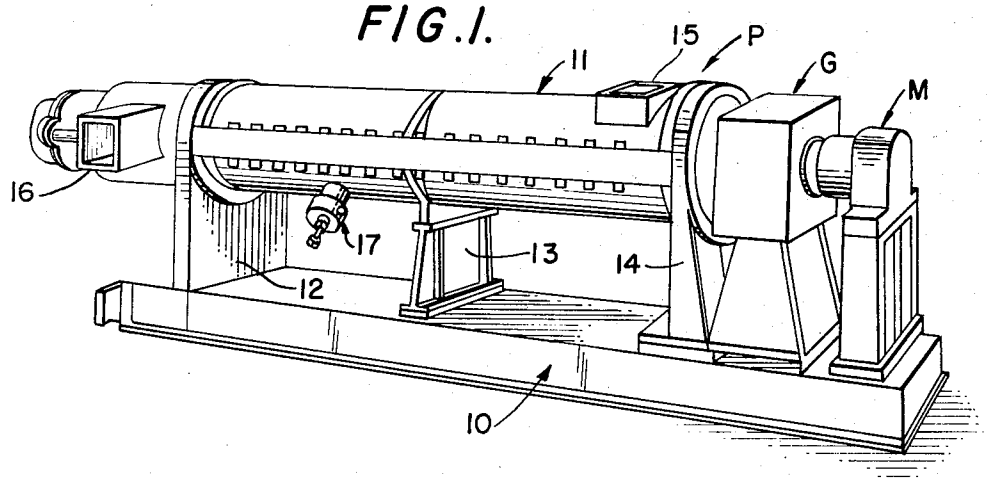


FIG. 2.

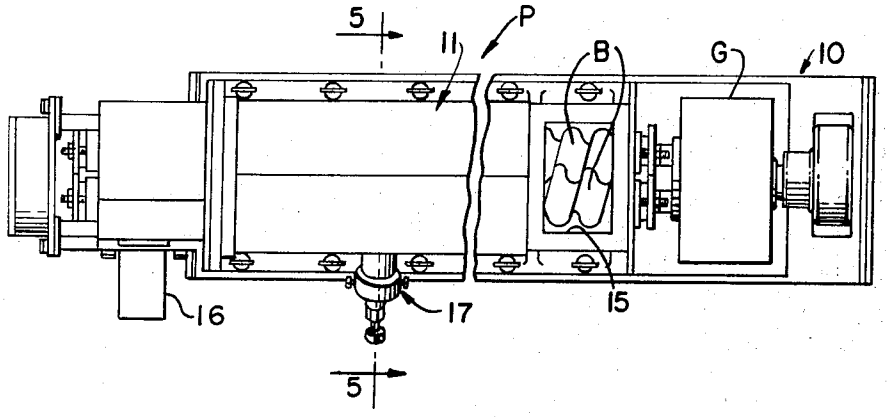
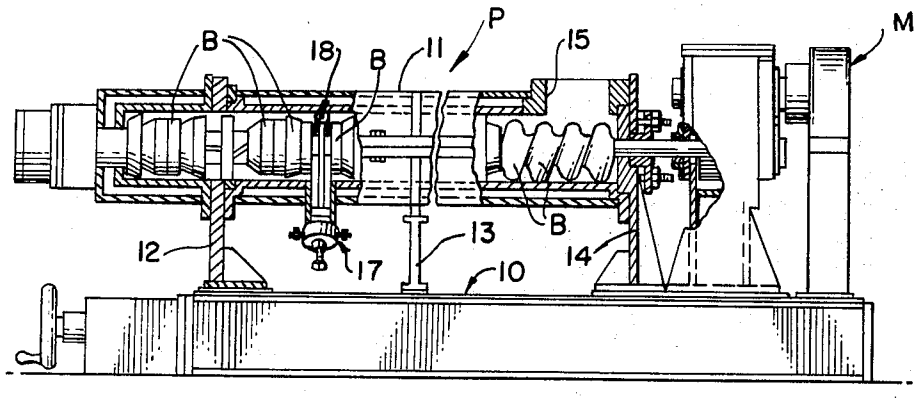


FIG. 3.



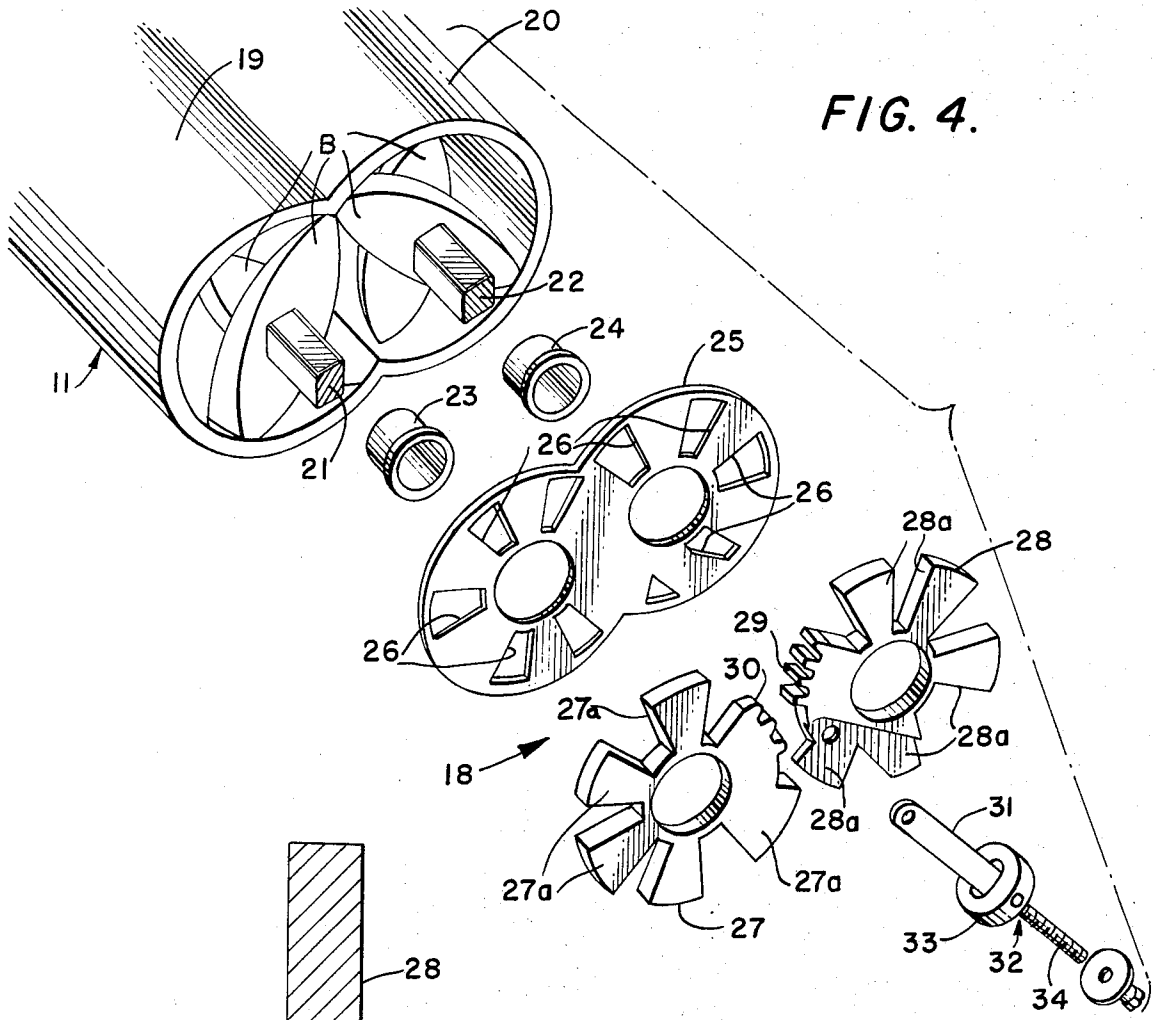

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FIG. 4.

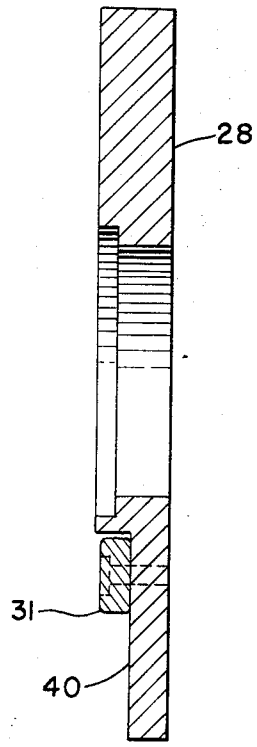

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FIG. 7.

FIG. 5.

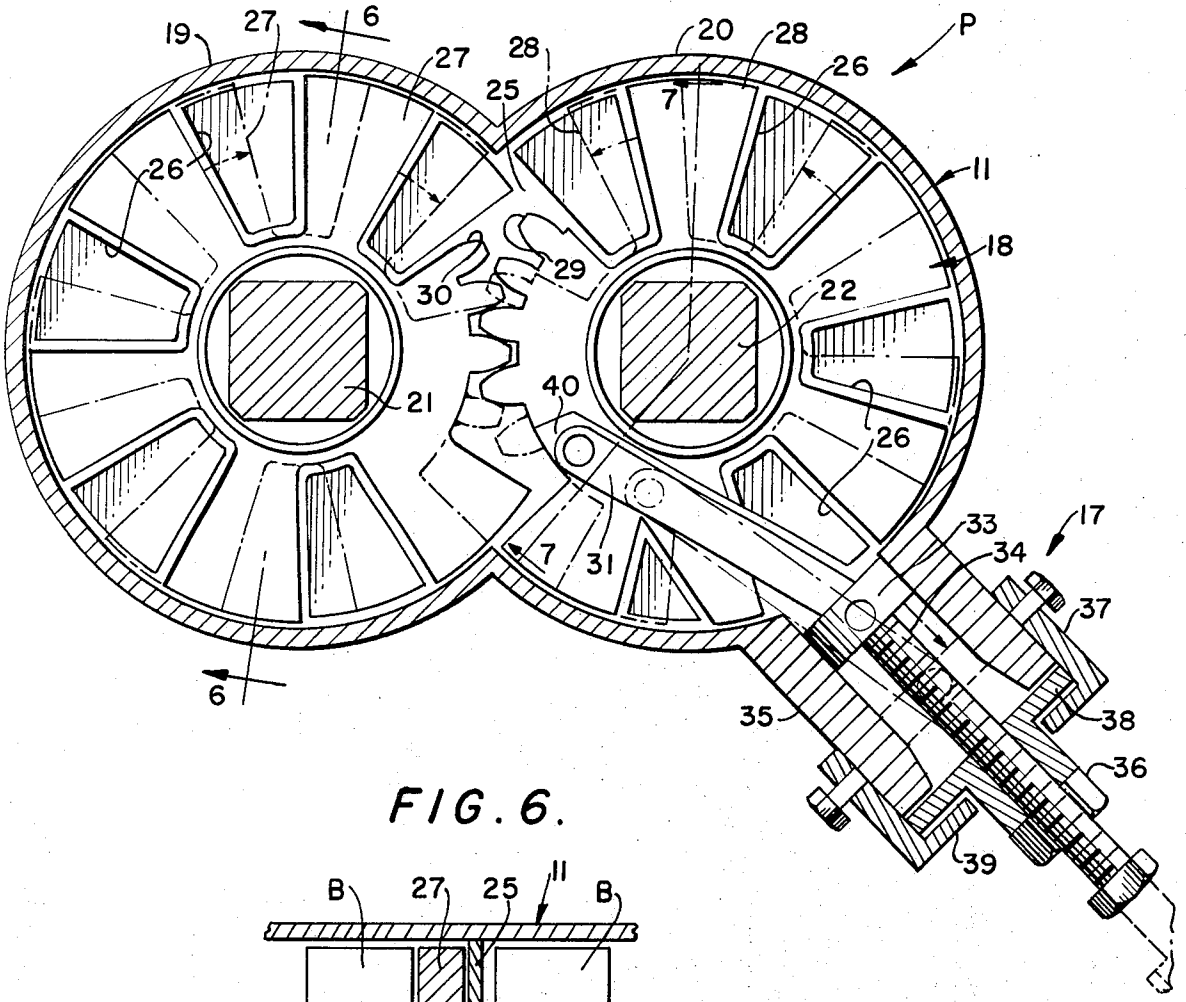
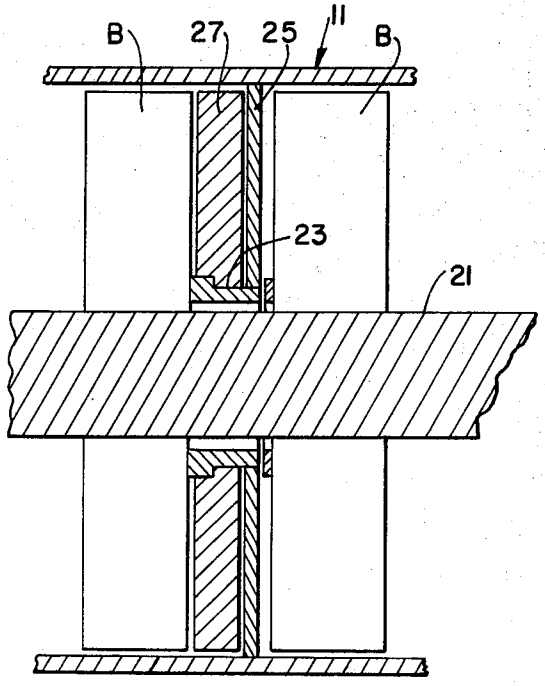

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FIG. 6.


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CONTINUOUS PROCESSOR FOR TREATING MATERIAL

BACKGROUND OF THE INVENTION

This invention relates to a continuous processor for treating material, and more particularly to a continuous mixer for intimately mixing, kneading, blending and/or reacting a wide variety of materials.

Various types of continuous processors are known in the prior art for mixing, kneading, blending and/or reacting materials such as powders, liquids, solids and liquids, polyester resins and fillers, clay and water, bakery dough and the like. All such devices are designed to perform a desired treatment of the particular material being handled in the processor and one important parameter in the treatment of the various materials is the time which the material is retained in the processor. In prior art devices the control of retention time of the material in the processor is frequently accomplished by gates or weirs at the discharge end of the processor. This arrangement is not entirely satisfactory since the effect of such a gate or weir is not obtained throughout the entire processor. Accordingly the material in a major portion of the processor is merely conveyed from one point to another and very little treatment of the material occurs. In fact, in many prior art devices, the retention or retardation of flow of material is effected only over a few inches immediately ahead of the gate or weir at the discharge end of the processor. In some prior art devices, one or more internal restrictors or weirs are positioned in the processor to retard or restrict the flow of material therethrough and thus control the retention time of the material in the processor to effect a more thorough treatment of the material. The size and number of openings or restrictions in the processor are selected for the particular materials being handled and for the desired treatment of the materials being handled by the processor and such restrictors or weirs are inserted at various places inside the processor, as desired or necessary. The processor must be disassembled each time a different restrictor or weir is required to be used in the processor, and this is both time consuming and expensive.

With the present invention, an adjustable gate or weir type resistor is positioned inside the processor, and the size of the restrictor or openings can readily be varied without requiring disassembly of the processor. Therefore, when different materials are passed through the processor or when different treatments are desired to be performed on the materials, the restrictor is simply adjusted to have the desired effect.

The adjustable restrictor of the present invention can be readily provided in existing continuous processors whether they are of the single shaft or double shaft type and regardless of the design of the mixing paddles or blades inside the mixing chamber of the processor.

The adjustable restrictor of the present invention enables effective and ready control of the retention time of the material in various zones of the processor in order to obtain: increased mixing in the entire mixer; closer control of temperature due to better heat transfer when the mixer is full; ability to intensify mixing or heat transfer in specific zones of the mixer; control of premixing certain components prior to adding other ingredients; changes in flow rates of material through the processor; changes in the power input required; and changes in formulation of the materials treated in the processor. All of the above changes are easily and quickly accomplished without disassembling the processor.

Further advantages of the present invention are that the adjustable restrictor in the processor increases the capacity and applicability of conventional continuous processors, enabling the processor to be used in certain applications wherein it would not otherwise be usable and the effectiveness of conventional processors is increased by a factor of at least five in most applications.

OBJECT OF THE INVENTION

It is an object of this invention to provide a continuous processor having an adjustable restrictor therein which can be varied from outside the processor without disassembly of the processor in order to control retention time of material in the processor.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a top perspective view of a processor in accordance with the invention.

FIG. **2** is a top plan view of a processor in accordance with the invention.

FIG. **3** is a view in elevation with parts shown in section of a processor according to the invention.

FIG. **4** is an enlarged exploded perspective view of the adjustable restrictor means of the invention and a portion of the processor.

FIG. **5** is an enlarged view in section taken along line **5—5** in FIG. **2** of the processor and adjustable restrictor of the invention.

FIG. **6** is an enlarged view in section taken along line **6—6** in FIG. **5.**

FIG. **7** is an enlarged sectional view taken along line **7—7** in FIG. **5.**

DETAILED DESCRIPTION OF THE INVENTION

In the drawings, wherein like reference numerals indicate like parts throughout the several views, a continuous processor is indicated generally at P in FIG. **1** and is of the type more fully illustrated and described in U.S. Pat. No. 3,618,902. The processor P includes a foundation or base means **10** on which an elongate horizontally disposed closed tubular mixing or treating chamber **11** is supported by means of a plurality of upstanding horizontally spaced support frames **12, 13** and **14.** Suitable motive means M is also supported on the base **10** near one end of the mixing or treating chamber **11,** and the motive means M is connected with suitable mixing means or powered conveying such as paddles or blades B or the like inside the chamber **11** through suitable gearing G. An inlet opening **15** is provided at one end of the chamber **11** and an outlet or discharge opening **16** is provided at the other end of the chamber **11.** Control means **17** for the adjustable restrictor means **18** inside the chamber **11** is provided at a desired position on the chamber means **11.** A more detailed description of the structure and operation of the processor P is in U.S. Pat. No. 3,618,902, and for a more complete understanding of the processor, reference may be had to that patent inasmuch as, except for the adjustable restrictor means **17, 18,** the remainder of the structure is identical to that disclosed in the aforementioned patent.

Referring in particular to FIGS. 4 through 7, the mixing or treating chamber 11 has a substantially figure-eight cross-sectional configuration and comprises a pair of tubular sections 19 and 20 disposed in side-by-side parallel relationship with adjacent sides thereof intersecting and defining a through opening into the respective tubular sections 19 and 20. The paddles or blades B are suitably secured on a pair of elongate parallel, rectangular shafts 21 and 22 in the chambers 19 and 20, respectively. The shafts 21 and 22 are connected through the gearing G with the motive means M for driving the paddles or blades B in a conventional and well-known manner.

The adjustable restrictor means 18 comprises a pair of cylindrical bushings 23 and 24 fitted over the shafts 21 and 22 to permit free rotation of the shafts relative to the restrictor means 18. A generally figure-eight shaped restrictor plate 25 comprising a weir or gate is positioned over the bushings 23 and 24 and the shafts 21 and 22 adjacent a first paddle or blade means B. The restrictor plate 25 has a plurality of openings 26 therethrough spaced around the center of each section of the plate. The openings 26 are shown as having a trapezoidal configuration, but any suitable shaped opening may be used. The plate 25 is shaped to conform to the interior configuration of the chamber 11, and the plate is immovably fixed within the chamber.

A pair of separate, adjustable, interengaged gates or star wheels 27 and 28 are rotatably positioned on the bushings 23 and 24 immediately adjacent plate 25, and each gate 27 and 28 has a plurality of radially extending circumferentially spaced blades or vanes 27*a* and 28*a*, respectively, spaced and configured to correspond to the openings 26 through the plate 25 so that depending upon the angular adjustment of the gates 27 and 28, the blades or vanes 27a and 28a expose or cover more or less of the openings 26. The gate 28 has a plurality of teeth 29 formed on a segment of the periphery thereof between a pair of spaced blades 28*a* and the gate 27 has a similar and corresponding plurality of teeth or gears 30 thereon in mating registry with the gears 29 on gate 28. A link 31 is connected with the gate 28 adjacent the gears 29 and extends through the wall of chamber 11 and is pivotally connected to a screw slide 32 comprising a cylindrical slide member 33 and an elongate threaded adjusting rod 34 projecting axially through a boss or port 35 on the side of section 20 of chamber 11 and thence through an operating nut 36 held on the end of boss 35 by means of a retaining sleeve 37.

As seen in FIG. 5, the operating nut 36 has a radially outwardly extending flange 38 thereon received behind a radially inwardly directed flange 39 on the retaining sleeve 37 to prevent axial movement of the adjusting nut 36 when the adjusting rod 34 is threaded in and out through the boss 35 to adjust the star wheels or gates 27 and 28.

As seen in FIGS. 4, 5 and 7, the star wheel 28 includes a recessed or countersunk portion 40 within which the link 31 is received in order to reduce the amount of space occupied by the restrictor means 18. Any other suitable means may be used for adjusting the star wheels 27 and 28 such as, for example, hydraulic, pneumatic or solenoid means.

In FIG. 5, the star wheels or gates 27 and 28 are shown in their fully opened positions completely uncovering the openings 26 through the restrictor plate 25 in full lines, and the star wheels or gates 27 and 28 are shown in partially covering relationship to the openings 26 in phantom lines.

In operation, when the adjusting screw or bolt 34 is turned in or out, the link 31 moves, thus causing the star wheel 28 to rotate a predetermined amount around the shaft 22 and the interengagement of gears 29 and 30 results in a corresponding amount of rotational movement of star wheel or gate 27, thus effecting equal amounts of control of the openings 26 in each half of the plate 25.

More than one restrictor means 18 may be provided in the chamber 11, if desired; and various sizes and configurations of the openings and gates may be provided as necessary. Further, the material from which the restrictor means 18 is constructed is selected to be compatible with the material being treated in the processor.

Although the adjustable restrictor means 18 has been described herein as applied to a double shaft mixer having a particular blade construction B therein, the invention is equally applicable to any single or double shaft continuous processor and can readily be provided on existing processors or can be easily included in the construction of new processors.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present invention is therefore illustrative and not restrictive, since the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents, are therefore intended to be embraced by those claims.

What is claimed is:

1. A continuous processor for treating material, comprising an elongate, closed tubular chamber means having inlet means at one end thereof for introducing a material into the tubular chamber means and outlet means at the other end of the tubular chamber means for discharging material from the chamber means, powered conveying means in said chamber means for treating material therein and for causing the material to flow from the inlet to the outlet, and adjustable restrictor means in said tubular chamber means between the inlet and outlet thereof for regulating the flow of material through said chamber means, said restrictor means comprising an apertured restrictor plate fixed transversely in said tubular chamber and adjustable gate means adjacent said apertured restrictor plate and movable relative thereto to control the flow of material through said apertured restrictor plate to control the time required for flow of the material through the tubular chamber to thus regulate the extent of the treatment of the material during its movement from the inlet to the outlet.

2. A continuous processor as in claim 1, wherein said powered conveying means includes a plurality of mixing blades mounted on rotatable shaft means in said chamber means for rotation in said chamber means.

3. A continuous processor as in claim 2, wherein said restrictor means is mounted in said chamber means between adjacent mixing blades.

4. A continuous processor as in claim 3, wherein adjustment means is connected to said adjustable gate means and extends externally of said chamber means

for adjustment of said gate means from outside said chamber means.

5. A continuous processor as in claim **4,** wherein said restrictor plate conforms in size and shape to the cross sectional size and shape of the chamber means.

6. A continuous processor as in claim **5,** wherein a plurality of apertures extend through said restrictor plate; and said gate means includes means adjacent each aperture for adjusting the size of each aperture.

7. A continuous processor as in claim **6,** wherein said chamber means has a substantially figure-eight cross-sectional configuration, said restrictor plate has a corresponding figure-eight configuration, and said gate means includes a pair of adjacent gates connected together for simultaneous movement.

8. A continuous processor as in claim **7,** wherein a pair of shafts extend through the chamber means in parallel side-by-side relationship, a gate rotatably mounted on each shaft, said adjustment means connected to one of said gates for rotating said one gate, and interengaged means on said gates for effecting adjustment of the other gate upon adjustment of said one gate.

9. A continuous processor as in claim **8,** wherein said interengaged means comprises a plurality of gears on a peripheral portion of each gate, rotation of one gate in one direction causing like but opposite rotation of the other gate.

10. A continuous processor as in claim **9,** wherein each gate has a plurality of radially extending vanes thereon in cooperative association with a respective aperture so that rotary movement of said gates causes said vanes to move relative the apertures to control the size of the apertures.

11. A continuous processor as in claim **10,** wherein said adjustment means includes a link pivotally connected at one end to a peripheral portion of said one gate and pivotally connected at the other end thereof to a reciprocable adjustment rod extending externally of said chamber.

12. A continuous processor as in claim **11,** wherein said adjustment rod is threaded and is threadably received through a stationary nut so that rotation of said rod effects axial movement thereof.

13. A continuous processor as in claim **12,** wherein the apertures are trapezoidal in shape and the vanes on the gates are similarly shaped.

14. A continuous processor for treating material comprising elongate tubular chamber means, inlet means at one end of said chamber means for introducing a material into the chamber means, outlet means at the other end of the chamber means for discharging material from the chamber means, means in said chamber means for treating material therein and for causing the material to flow from the inlet to the outlet, and adjustable restrictor means in said chamber means between the ends thereof for regulating the flow of material through said chamber means, said restrictor means comprising a restrictor plate fixed transversely in said chamber and having a plurality of apertures therethrough, and adjustable gate means adjacent said restrictor plate, said gate means including means adjacent each aperture for adjusting the size thereof.

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