United States Patent

Hargash

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[54] FEEDER STREAM MIXER

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[52] **U.S. Cl.** **259/4**

[51] **Int. Cl.** **B01f 15/02**

[58] **Field of Search** 259/4, 18, 36; 137/3, 9

[56] **References Cited**

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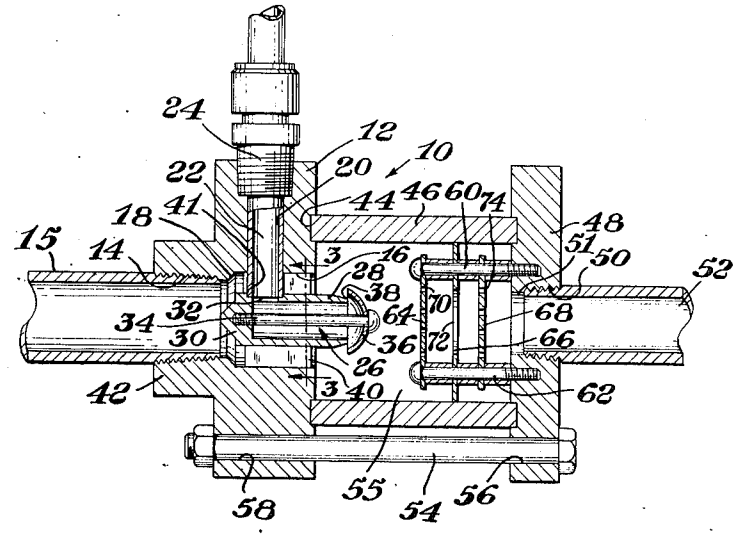
[57] **ABSTRACT**

The invention relates to a device for dispersing, dissolving and/or mixing viscous materials which uses no power driven or moving parts. The device comprises an in-line chamber having an entry and exit end. There is an axially disposed baffled viscous material nozzle near the input and whereby the viscous material entering the chamber from said nozzle is sheared by solvent flow through the chamber. Baffle plates arrayed across the exit end result in turbulent flow and further mixing before the materials leave through the exit end.

As the viscous material is pumped against an adjustable dished heat it emerges as a thin sheet which is sheared by the flow of solvents which flows through the sheet. Mixing is aided by turbulent flow in the device plus perforated baffle plates in the flow path through the device.

7 Claims, 3 Drawing Figures



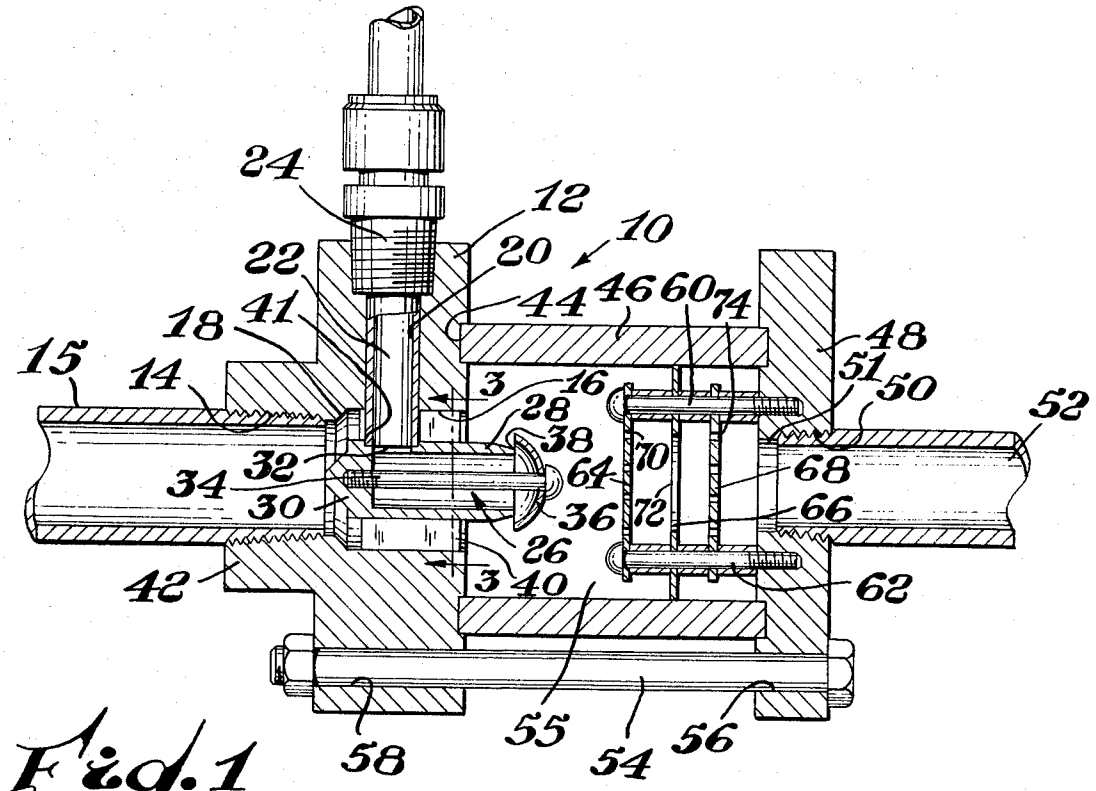


Fig. 1

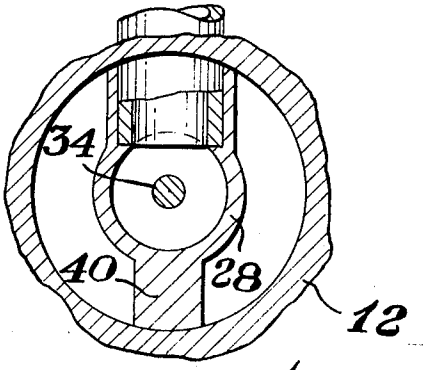


Fig. 3

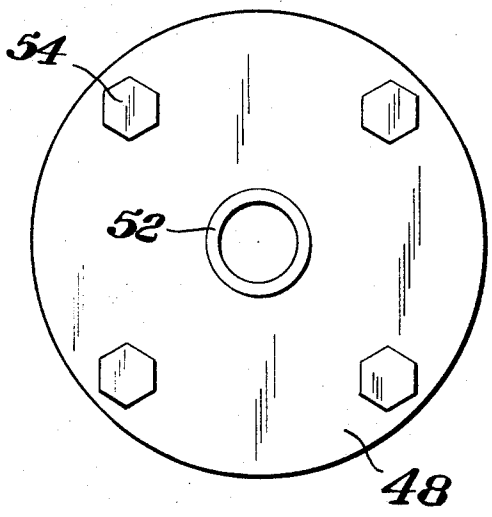


Fig. 2

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FEEDER STREAM MIXER

BACKGROUND OF THE INVENTION

This invention relates to mixing devices and particularly to devices for mixing viscous materials and a less viscous solvent.

Mixing devices which depend on motor driven stirrer vanes/or other power driven mechanisms are limited not only by the availability of power to operate them, but by the reliability of bearings which often are adversely affected by the viscous materials.

Other mixing devices are easily clogged up or are difficult ro disassemble and clean during field use.

Accordingly, a principal object of this invention is to provide an improved device for mixing viscous materials with a solvent.

Another object of this invention is to provide an improved, easy to assemble device for mixing viscous materials.

A further object of this invention is to provide an improved device having no moving parts for use in mixing viscous materials.

In accordance with this invention there is provided a mixing device wherein the solvent is flowed through the space between a generally tubular injection nozzle and a spaced apart surrounding wall. The nozzle has an adjustable dished element across its output end whereby the viscous material contacts the solvent in more or less sheetlike form and is sheared by the flow of the solvent. The materials then pass through a chamber having a series of baffle plates wherein they undergo turbulent flow and further mixing before exiting therefrom.

The invention, as well as additional objects and advantages thereof, will best be understood when the following detailed description is read with reference to the accompanying drawing, in which:

FIG. 1 is a side elevational view, in section, of apparatus in accordance with this invention;

FIG. 2 is an output end view of the apparatus of FIG. 1, and

FIG. 3 is an end view of the output end part of the apparatus shown in FIG. 1.

Referring to the drawing, there is shown mixing apparatus, generally referred to by the numeral **10**, composed of a solid cylindrical body part **12** having an axially disposed tubular input part **42** on one side thereof. A solvent input line has its threaded end **14** coupled to the inner surface of the part **42**.

A bore **16** extends axially through the body part **12** and has a tapered end part **18** communicating with the threaded end part **14** of the input line.

A viscous materials input head, indicated generally by the numeral **26**, having a rounded tapered input end **30** and an open output end having an inwardly tapered part between its inner and outer surfaces of its tubular walled part **28**. The input head is centered in the bore **16** by opposed positioning and guide elements **40** which slidably engage the inner wall of the bore **16**.

The output end of the input head extends beyond the body part **12** into a mixing chamber defined by an axially disposed tubular element **46** which is capped by an end plate **48**.

The tubular element **46** is sealed against a recess **44** in the body part **12** and against a similar recess in the end plate **48**. Bolts **54**, extending through bores **56**, **58** in the end plate **48** and body part **12**, respectively.

The end plate **48** has an axially aligned output bore **51** extending therethrough which is coupled to the threaded end **50** of an output tube **52**.

An array of baffle plates **61**, **66**, **68** are disposed in the mixing chamber perpendicularly to the longitudinal axis of the chamber and surrounding the output bore **51** and are held in position by spacer sleeves along the screws **60**, **62** which engage the end cap **48**. The baffle plates **61**, **68** each have an array of small bores **70**, **74**, respectively, therein, while the plate **66**, which generally extends to the inner wall of the tubular element **46**, has an axially disposed larger bore **72** therein.

Returning to the input head **26**, a screw **34**, supporting a dished plate **36** having a concave surface facing the tapered end part **18**, is coupled to the tapered end part **28** such that the rim **38** of the dished part is held in (usually adjustable) symmetrical spaced apart relationship with respect to the tapered end **28**.

The body part **12** has a bore **20** extending from its side surface to the axial bore **16**.

A bore **41**, extending through the upper one of the guide elements **40**, is aligned with the bore **20**. A viscous materials inlet tube **22** in the bore **20** is coupled at its lower part to the input head **26** through the bore **41** and at its upper end part to the coupling **24** of a viscous materials inlet line.

In operation, a solvent, such as water, for example, is pumped through the inlet line **15** and passes around the outer surface of the input head **26** (except where it encounters spacers **40**). Viscous material, such as liquid polyacrylamide, for example, enters the input head **26** under pressure through the line **22** and is exuded in more or less sheet form from the dished output end of the head **28** where the viscous material is sheared into fragments which undergo turbulent mixing with the solvent in the mixing chamber **55**.

Additional and more thorough mixing takes place as the viscous material and solvent take tortuous paths through the baffle plates **61**, **66**, **68** to reach the output line **52**.

The spacing between the dished element **36** and the tapered end **28** of the head **26** is usually critical for a particular viscous material.

The head **26** may be withdrawn from the body part **12** by removing the tube **24** from the bore **41**. While two longitudinally extending sleeves are shown, more sleeves or other spacer support means which accommodate the tube **28** may be used.

It is understood that the flow rate of solvent and viscous material are adjusted to provide the best mixing through the unit.

The apparatus may be made of any suitable material which can withstand the temperatures, pressures and materials involved.

This apparatus, using no moving parts, provides excellent mixing of a variety of types of viscous materials with a less viscous solvent and is easily assembled and disassembled for cleaning or adjustment purposes.

In the case where the mixer device is to be used with only one viscous material under constant use conditions, the spacing between the dished element **36** and the tapered end **28** of the head **26** may be non-adjustable by means of a sleeve around the screw **34** or by the screw seating against the ends of its threaded bore in the input end **30**.

What is claimed:

1. Mixing apparatus comprising a blocklike cylindrical body part having a central bore extending axially therethrough and a viscous materials feed bore extending transversely from an outer surface of said body part to said central bore, a hollow tubular element substantially larger in diameter than the diameter of said central bore, an end cap having an axial bore, said tubular element being axially aligned with said central bore with said end cap sealing one end thereof and the other end of said tubular element being sealed against an end of said body member to thereby define a chamber within said tubular element, said end cap having mixed materials outlet bore therein, a viscous materials introduction member, said introduction member being disposed in said central bore, said introduction member having a hollow tubular body, a closed end having a tapered outer surface, an open end, centralizing spacer elements extending from said tubular body and slidably engaging the wall of said central bore, a viscous materials inlet bore extending transversely through said tubular body, and a dished element fixedly coupled to said body and presenting a concave surface adjacent to said open end, means coupling said viscous materials feed bore to said viscous materials inlet bore, means for coupling a solvent inlet line to said central bore on the end thereof remote from said chamber, means for

coupling a mixed materials outlet line to said axial bore in said end cap, and an array of baffle plates disposed in the flow path of materials which are being mixed in said chamber.

2. Apparatus in accordance with claim 1, wherein said means coupling said viscous materials feed bore to said viscous materials inlet bore comprises an inlet tube extending through said bores and coupled to said introduction member.

3. Apparatus in accordance with claim 1, wherein said array of baffle plates is coupled to and supported from said end cap.

4. Apparatus in accordance with claim 1, wherein the open end of said introduction member has its outer wall surface tapered inwardly towards said end.

5. Apparatus in accordance with claim 1, wherein said viscous materials feed bore and said viscous materials inlet bore are aligned and are perpendicular to the longitudinal axis of said body part.

6. Apparatus in accordance with claim 1, wherein said array of baffle plates includes at least three plates including at least one intermediate plate which fits closely but slidably with respect to the inner wall of said tubular element.

7. Apparatus in accordance with claim 1, wherein bolts extending from said body part to said end cap are used to seal said tubular element to said body part and said end cap.

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