

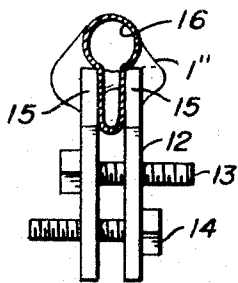
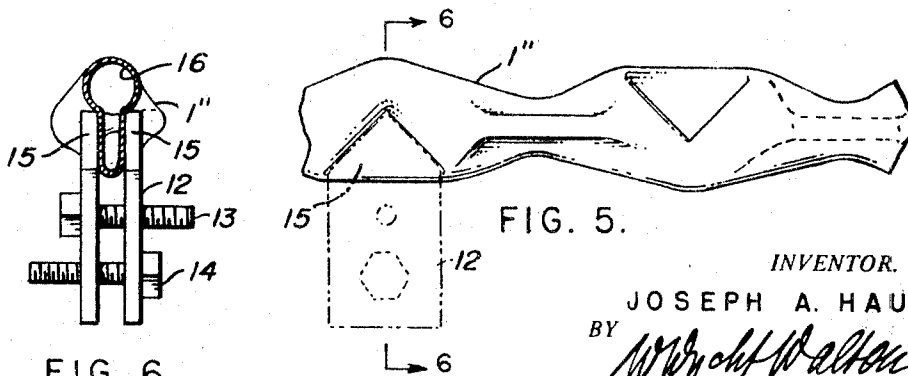
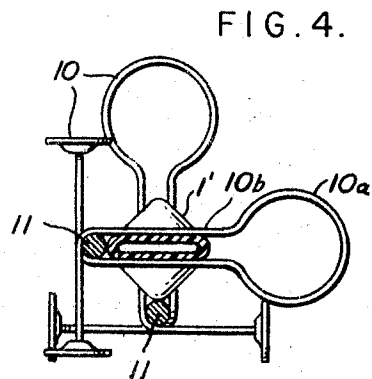
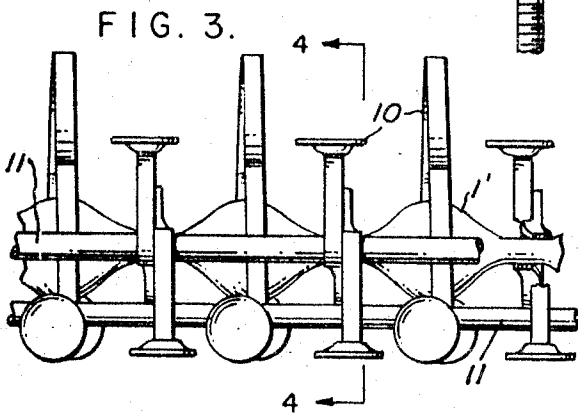
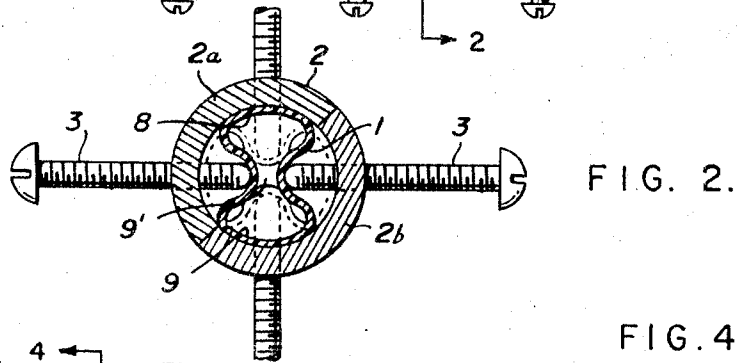
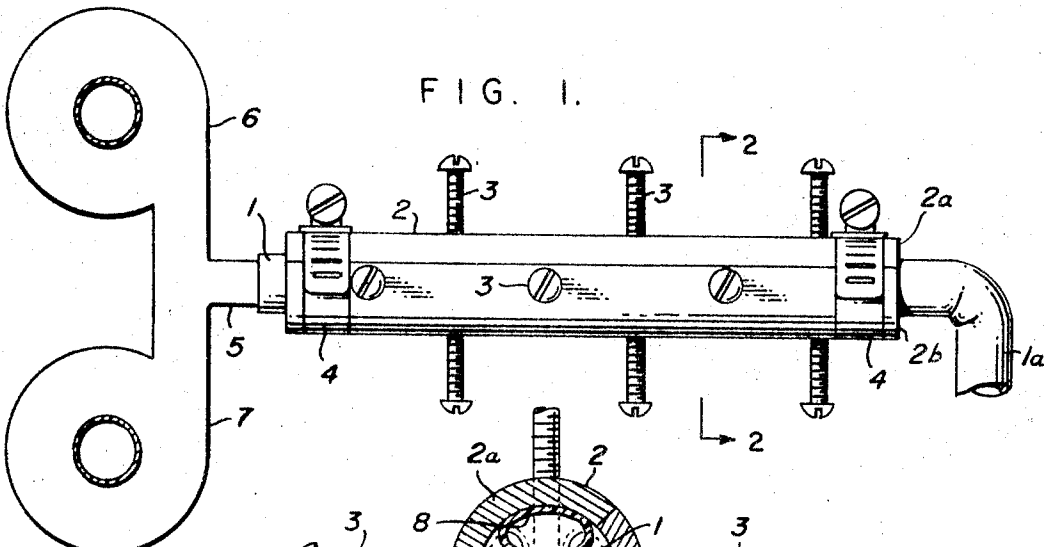
Aug. 12, 1969

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3,460,809

MEANS FOR CONTINUOUSLY BLENDING MISCIBLE MATERIALS

Filed Feb. 13, 1968



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MEANS FOR CONTINUOUSLY BLENDING MISCIBLE MATERIALS

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Filed Feb. 13, 1968, Ser. No. 705,151

Int. Cl. B01f 13/00; F16l 11/12

U.S. Cl. 259—4

3 Claims

ABSTRACT OF THE DISCLOSURE

The invention contemplates utilization of a flexible tubular conduit and means for locally deforming it in association with means for introducing into one end of the conduit flowing supplies of a plurality of miscible materials whereby the combined streams are constrained to follow contiguous sinuous courses through the conduit until the individual ingredients become intimately blended together into a single homogeneous mixture.

BACKGROUND OF THE INVENTION

Field of the invention

Means have heretofore been proposed for continuously blending miscible liquids by passing them through chambers containing baffles of different sizes, shapes and disposition and while these may be reasonably satisfactory for blending the liquids for which they are designed they prove inadequate when liquids having different properties, especially viscosities, are presented to them while they are wholly inappropriate for blending materials other than liquids, and it is therefore an object of the present invention to provide continuous blending means in which the paths of flowing or moving materials may be shaped and intermingled appropriately for most effective blending, and for attainment with comparable effectiveness of blending of materials having different properties, especially liquids having differences in viscosity, as well as gases and, if desired, comminuted solids, the latter usually being carried in fluid streams of air or gas, or in liquids, or by gravity.

The prior art

In continuous blenders for miscible liquids it has heretofore been the practice to provide intersecting channels of more or less sinuous contour through which the liquids to be mixed have been passed by gravity or under pressure and these, while reasonably adequate for mixing liquids of predetermined viscosity, particularly when the viscosities of the several liquids are substantially the same, do not respond readily to introduction of other viscosities and hence lack the universality of utility desired for apparatus of this character and have not been widely accepted in industry. Comminuted solids, moreover, have heretofore usually been mixed in "batch" operations by mechanical mixers while I am unaware that any apparatus has heretofore been suggested for continuously homogeneously blending together streams of gaseous fluids.

SUMMARY OF THE INVENTION

The invention comprehends provision of a disposable flexible tubular conduit, means associated therewith for deforming the conduit, and hence the passage it defines, to separate the latter in effect into series of short, interconnected contiguous passages disposed about a common longitudinal axis but each rotationally offset from the corresponding passage in its adjacent series usually at about 90° of arc relatively to said axis, together with means for introducing a plurality of miscible materials into one

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end of the conduit whereby during their transit of the several subdivisional passages the ingredients are thoroughly intermingled and transformed to a true homogeneous mixture notwithstanding initial differences in viscosity, specific gravity or other properties, this mechanical mixing insuring complete blending of initial dissimilar liquids, gases or comminuted solids as the case may be, in any desired proportions.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing:

FIG. 1 is a fragmentary diagrammatic top plan view of a preferred embodiment of the invention;

FIG. 2 is a fragmentary section on line 2—2 in FIG. 1;

FIG. 3 is a fragmentary top plan view of a modified embodiment of the mixing unit constituting a component of the apparatus;

FIG. 4 is a section on line 4—4 in FIG. 3; and

FIGS. 5 and 6 are views generally corresponding to FIGS. 3 and 4 but illustrating a further modification of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus illustrated in FIG. 1 comprises a flexible tube 1 preferably disposable and made of a chemically relatively inert elastic and hence relatively deformable synthetic plastic; enclosing it through a major portion of its length is a bifurcated relatively rigid tube 2 beyond the ends of which the ends of tube 1 project in opposite directions, tube 2 carrying adjusting screws 3 hereinafter more fully described. End clamps 4 secure the parts 2a, 2b of tube 2 together in embracing to tube 1 with which they are coaxial, or other appropriate securing means may be employed therefore if desired.

Connected to tube 1 at one end is a manifold fitting 5 into which pumps 6, 7 or other convenient vessels or conduits for the ingredients to be mixed are disposed to discharge such ingredients for introduction under pressure into tube 1, the pumps diagrammatically illustrated being merely typical of such means and susceptible of being replaced by any others suitable for attaining the same results, their numbers usually corresponding to the number of ingredients to be mixed. When gases are to be mixed, for example argon and carbon dioxide to form an inert gaseous shield about weldments in the course of their formation the constituent gases are usually supplied in containers under pressure and in such cases of course no pumps or other impelling means for the ingredients are normally required.

Hence, with the principal components arranged as above described, and the free end 1a of tube 1 disposed to discharge the mixture of ingredients into a suitable receptacle, conduit or other vessel provided to receive it, pumps 6, 7 or other ingredient supplying means are activated to introduce the separate ingredients preferably in continuous streams to tube 1. Adjusting screws 3 disposed in axially aligned pairs lengthwise of tube 2 and threaded into the walls of the latter project into its interior and thus into impingement against tube 1 and are adjusted to constrict tube 1 between the screws of each pair at axially spaced points and in planes 90° removed from the planes, respectively, of adjacent pairs of screws 3 whereby the interior passage defined by tube 1 is deformed, in this instance substantially into separate contiguous passages 8, 9 which may be joined at a waist 9' or be relatively completely separated when screws 3 are adjusted to constrict tube 1 even more severely than as illustrated in FIG. 2.

In any event, since each pair of screws 3 constricts the passage through tube 1 for a short distance axially of the tube and in a plane angularly offset, preferably 90°, from the plane of an adjacent pair and the ingredients passing through the tube are thus constrained to follow sinuous and relatively intertwined continuous paths, they become completely, homogeneously and thoroughly mixed together. The mixture issuing from the tube after passing through a number of the constricted zones, six in the examples shown although if preferred a larger or smaller number may be employed, thus has a uniform homogeneous composition without cells or portions predominantly composed of one or another of the original ingredients, and in the proportions delivered.

In the embodiment of the invention illustrated in FIGS. 3 and 4 spring clips 10 are employed to constrict flexible tube 1', each clip being preferably disposed as shown in angular relation to an adjacent clip. These clips are desirably capable of completely flattening tube 1 when no internal pressure is being exerted within the tube and are preferably restrained from doing so by stop rods 11 which may extend through a number of the clips to overcome the bias of springs 10a of the latter against their opposed jaws 10b to afford restricted passages for the fluid past the clips. Hence the combined ingredients are projected in contiguous flat jets through each constriction of tube 1' into a zone in which another constriction is soon encountered having its major plane normal to that of the preceding one. The components of the steam are thus in effect forced into homogeneous mixture whether six or any other number of clips 10, not less than two, be employed. Usually fewer than six of the clips results in mixtures not entirely homogeneous, although some relatively non-viscous components having closely similar densities may be adequately blended when fewer than six of the clips are employed.

As another embodiment of the invention I have illustrated in FIGS. 5 and 6 a tube 1'' similar to tube 1, 1' but having associated with it clamps 12 comprising adjusting screws 13, 14 and jaws 15, in this instance triangular in shape although their precise shape is a matter of choice. The jaws 15 are preferably adjusted to embrace tube 1'' in such a manner as to provide keyhole shaped passages 16 in the tube, one being illustrated in FIG. 6 but with adjacent ones having their major axes at right angles to those of their neighbors omitted.

It will be evident from the foregoing that the apparatus described, in the several embodiments illustrated as well as others, may be utilized for blending together or mixing substantially any materials which can be conveyed in substantially continuous streams, and that not only liquids, but gaseous fluids, slurries and finely divided solids, the latter usually entrained in streams of fluids, either gaseous or liquid, may be mixed together in the apparatus and in accordance with the principles of my invention.

While I have herein shown and described certain embodiments of the latter it will be understood I do not desire or intend to be thereby limited or confined thereto in any way as other embodiments thereof and changes in the form, structure and relationship of the parts of the apparatus and in its effect upon the materials introduced into it whatever be the quantity of each in relation to that of the others as well as in the operations to which said materials are subjected will readily occur to those skilled in the art and may be utilized if desired without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. Apparatus for blending miscible materials comprising a flexible tube, means for continuously introducing the materials into one end of the tube, and means for deforming the tube in a plurality of axially spaced zones, the deforming means causing the tube to assume at each zone a configuration symmetrical about an axis perpendicular to the longitudinal axis of the tube, the successive, corresponding, perpendicular axes in each of said zones being disposed at different angles measured about the axis of the tube, whereby the interior of the tube defines a non-rectilinear passage for contiguous streams of said materials thereby blending said streams into a single homogeneous stream.

2. Apparatus as defined in claim 1 in which said deforming means comprise a relatively rigid substantially cylindrical tube surrounding said flexible tube and a plurality of pressure exerting means threaded into the walls of said relatively rigid tube and into impingement against said flexible tube at axial intervals to deform said tube in a plurality of non-parallel zones.

3. Apparatus as defined in claim 1 in which said deforming means comprise a plurality of pairs of opposed jaws embracing the flexible tube, and yielding means biasing the jaws of each pair together, the plane of bias of the jaws of each pair being disposed angularly to the plane of bias of an adjacent pair of jaws with respect to the tube axis, each of said jaws extending transversely of the tube and cooperating with the other jaw of its pair to substantially flatten the tube.

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U.S. Cl. X.R.

138—38