

United States Patent

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[54] CENTRIFUGAL MIXING AND EXTRACTION APPARATUS

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259/50

[56] References Cited

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[57]

ABSTRACT

A centrifugal mixing and extraction device, suitable particularly for mixing and extracting radioactive fluids, is designed for rapid cleaning and/or replacement of the mixing chamber and separation bowl. The entire unit, including motor, drive shaft, separator bowl, mixing chamber and impeller, is literally hung from a frame in a casing enclosing the bowl, mixing chamber and impeller. In operative position, the mixing chamber is restrained from rotation with the impeller, the bowl and the shaft by means of magnets in the lower portion of the chamber and the casing, by one or more studs fixed in one of the walls thereof and axially engageable with corresponding recesses in the other, or both. The entire unit can simply be lifted out of the casing, e.g., by disengaging the magnets, without interrupting the extraction process.

6 Claims, 2 Drawing Figures

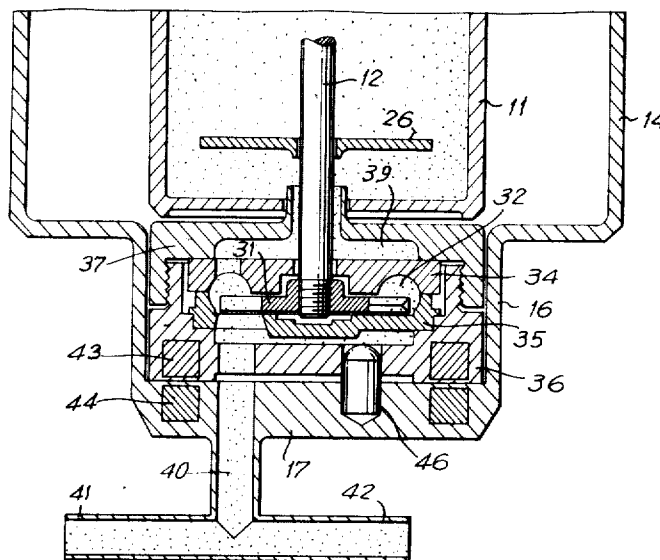


FIG. 1

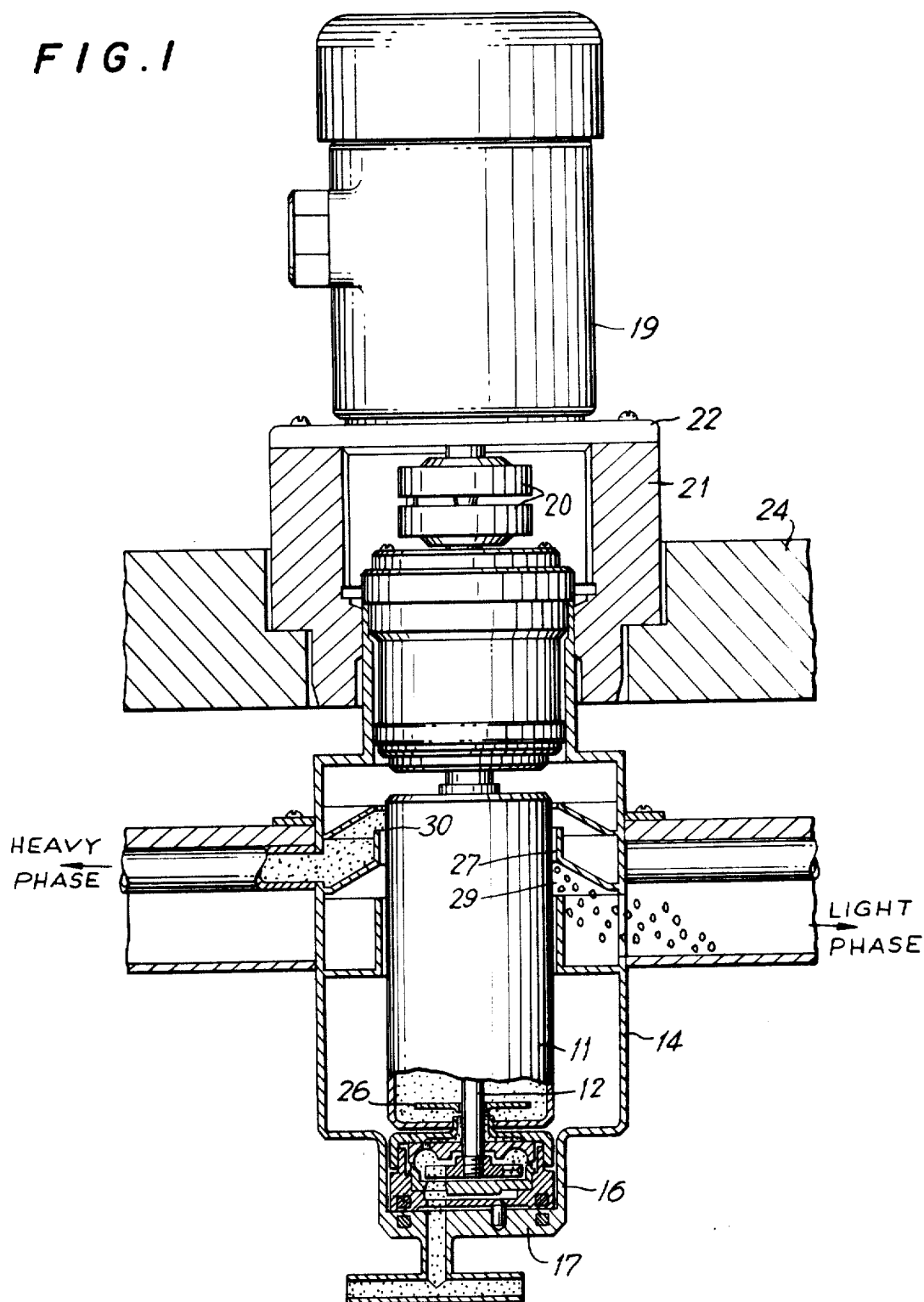
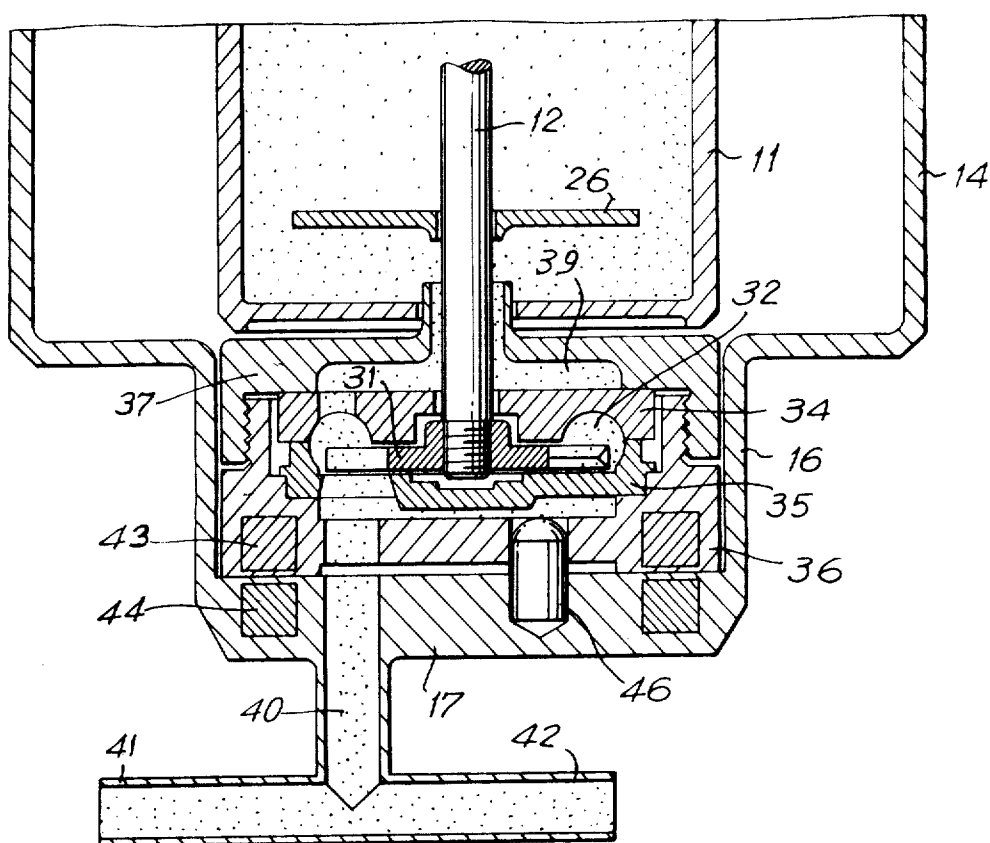


FIG. 2



CENTRIFUGAL MIXING AND EXTRACTION APPARATUS

This invention relates to an improvement in centrifugal mixing and extraction devices that enables the entire mixing and extraction unit to be quickly and bodily removed and replaced for servicing with a minimum of handling, and is therefore particularly suitable for mixing and extracting radioactive fluids.

It is known that fast contact devices or compact centrifugal mixing and extraction apparatus have previously been developed whereby radioactive materials in fluid form or suspended in a fluid are mixed with and extracted by another liquid due to intense mixing and subsequent centrifugal separation into heavy and light phases. In order to obtain as complete an extraction as possible, it is frequently necessary and desirable to utilize a battery of units as successive stages of mixing and separation which work continuously and in countercurrent.

When radioactive fluids are involved, e.g., when fission products or fissile materials are to be extracted, the fluid should be subject to as short a residence time as possible in order to avoid radiation damage or contamination.

One advantage of the apparatus of this invention is that it does not require extensive mechanical disconnection and consequent danger of exposure of personnel to high radiation doses. Another advantage is that it provides an apparatus in which the impeller pump and the mixing chamber can be cleaned and/or replaced readily and without subjecting personnel to unnecessary radiation. Whether radioactive materials are processed or are not, the apparatus of the present invention has the further advantage of reducing to an absolute minimum the downtime for cleaning and replacing the moving parts of a centrifugal mixing and extraction apparatus.

In accordance with the invention, a mixing and extraction unit is literally suspended on a framework so that the separation bowl or rotor and mixing chamber are seated within a suitable casing. The materials to be mixed and separated are fed to the apparatus from below into a mixing chamber wherein they are mixed and impelled upwardly into the centrifugal bowl for separation into light and heavy phases in the usual manner. Means are provided to keep the mixing chamber from rotating in the casing when the device is in operative position. However, the entire unit, including mixing chamber, impeller and bowl, can be literally lifted out of the casing without interrupting the mixing and extraction procedure in the remainder of a battery of such centrifugal mixing and extraction devices.

The structure of the apparatus of the invention and the advantages thereof will become further apparent from the accompanying drawings wherein:

FIG. 1 is a schematic view, partly in section, of a complete unit; and

FIG. 2 is a sectional view in elevation showing the lower portion of the apparatus in greater detail.

Referring to FIG. 1, a rotor or centrifugal bowl 11 is supported on a drive shaft 12 within a casing 14 having a depending portion 16 with a lower wall 17. The drive shaft 12 is connected to a motor 19 by way of a coupling 20 in a yoke 21 having a bearing plate 22, the yoke 21 being supported in a frame 24, which is constructed as a radioactive shield in the event the apparatus is used for mixing and extracting radioactive material.

The centrifugal bowl 11 is provided with a deflector plate 26, baffle means 27, and outlets 29 and 30 for the light and heavy phases, respectively, these elements being known and not forming part of this invention.

Referring now to FIG. 2, the lower end of the drive shaft 12 is provided with an impeller 31 rotatable within an encapsulated mixing chamber 32 formed by upper and lower plates 34 and 35, respectively. The lower plate 35 is seated in a guide plate 36 which in turn is secured to a yoke 37 forming a collecting chamber 39 for passing mixed material from the mixing chamber 32 to the interior of the bowl 11. The lower plate

35, the guide plate 36 and the lower wall 17 of the casing 14 are provided with a conduit 40 for receiving the materials to be mixed and extracted from conduits 41 and 42. Pairs of magnets 43 and 44 are mounted in the guide plate 36 and in the lower wall 17 respectively in order to firmly seat the guide plate 36 against said lower wall 17 and one or more studs 46 are mounted in lower guide plate 36 to engage with a mating recess in the lower wall 17, or vice versa, to secure the lower guide plate 36 against rotation within the lower portion 16 of the casing 14.

In operation, material to be mixed and extracted is introduced into the apparatus by way of conduits 41 and 42 to enter the encapsulated mixing chamber 32 by way of line 40. The impeller 31 mixes the materials and impells them from the mixing chamber through the collecting chamber 39 into the centrifugal bowl 11 for separation into light and heavy phases.

When it is desired to service and/or replace the unit, the motor 19 is disengaged from the drive shaft 12 by uncoupling the coupling 20 and removing the cover plate 22, whereupon the entire unit can be lifted out by means of shaft 12, the bowl 11 and the mixing chamber 32 as well as the lower guide plate 36 all being drawn upwardly against the force of the magnets through the casing 14 and the yoke 21 and frame 24. When it is desired to replace the unit, the reverse procedure is followed, care being taken to insert the studs 46 into the mating recesses in the lower wall 17 of the casing 14 and attraction of the magnets 43 and 44 to insure a tight seal.

It is apparent that a greater portion of the unit can also be removed by lifting the yoke 21 from the frame 24, whereupon the entire casing 14 enclosing the rotor or bowl 11 and the mixing chamber 32 are removed as a single unit.

It will be apparent from the foregoing that it is possible quickly to replace a centrifugal mixing and extraction unit without interrupting the operation of other units in a bank of such mixers and extractors. Furthermore, it is to be noted that the units can be removed quickly without mechanical disengagement and without unduly exposing personnel to radiation in the event the unit is utilized with radioactive materials and the frame 24 is constructed of a radioactive shielding material.

What is claimed is:

1. Centrifugal mixing and extraction apparatus comprising a casing, an encapsulated mixing chamber seated in a lower portion thereof, an impeller rotatable within the mixing chamber, a rotatable bowl above and in communication with said mixing chamber, a drive shaft for rotating said impeller and said bowl within the casing, a motor for driving the shaft, means for removably supporting said motor and drive shaft in a frame, and means selectively restraining the mixing chamber against rotation within the casing, said means further allowing the release of the mixing chamber from said casing for withdrawal of the mixing chamber, impeller, bowl, drive shaft, and motor together from said frame.

2. Apparatus defined in claim 1 wherein the releasing and restraining means are magnetic.

3. Apparatus as defined in claim 1 wherein the releasing and restraining means comprise a vertical stud fixed to a lower wall of the mixing chamber for mating engagement with the casing.

4. Apparatus defined in claim 1 wherein the releasing and restraining means comprise oppositely disposed magnets in a lower wall of the mixing chamber and the casing and a vertical stud fixed to said lower wall and axially engageable with the casing.

5. Apparatus defined in claim 1 wherein the releasing and restraining means comprise a vertical stud fixed to the casing for mating engagement with a lower wall of the mixing chamber.

6. Apparatus defined in claim 1 wherein the releasing and restraining means comprise oppositely disposed magnets in a lower wall of the mixing chamber and the casing and a vertical stud fixed to the casing and axially engageable with said lower wall.

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