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Murphy et al.

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[54] **APPARATUS FOR FIXING RADIOACTIVE WASTE**

[75] Inventors: **John D. Murphy**, Bedford Hills; **John Pirro, Jr.**, Rutland; **Monsey Lawrence; Stanley F. Wisla**, both of Yorktown Heights, all of N.Y.

[73] Assignee: **Atcor Inc.**, Park Mall, Peekskill, N.Y.

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[52] **U.S. Cl.** ..... **252/301.1 W**

[51] **Int. Cl.** **C09k 3/00**

[58] **Field of Search** ..... 252/301.1 R, 301.1 W

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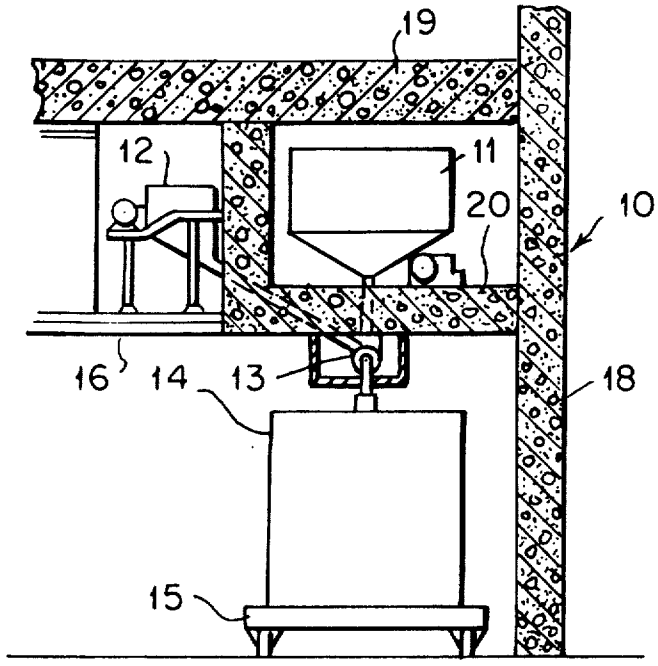
Primary Examiner—Benjamin R. Padgett

Assistant Examiner—R. L. Tate

[57] **ABSTRACT**

Fixing radioactive waste is disclosed in which the waste is collected as a slurry in aqueous media in a metering tank located within the nuclear facilities. Collection of waste is continued from time to time until a sufficient quantity of material to make up a full shipment to a burial ground has been collected. The slurry is then cast in shipping containers for shipment to a burial ground or the like by metering through a mixer into which fixing materials are simultaneously metered at a rate to yield the desired proportions of materials.

3 Claims, 4 Drawing Figures



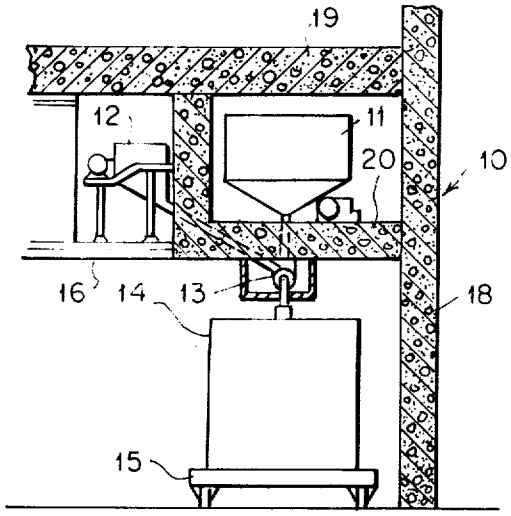


Fig. 1

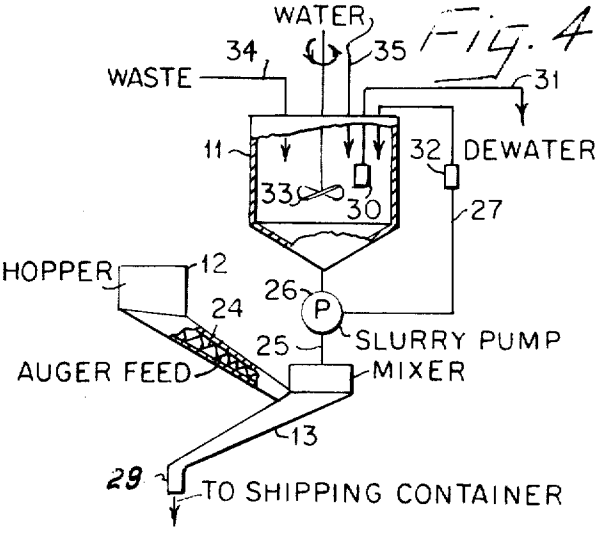


Fig. 4

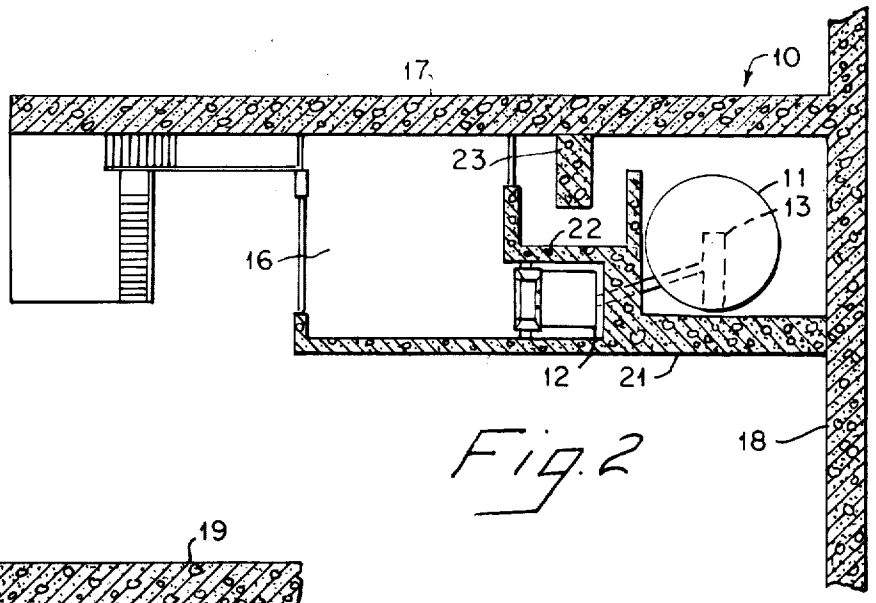
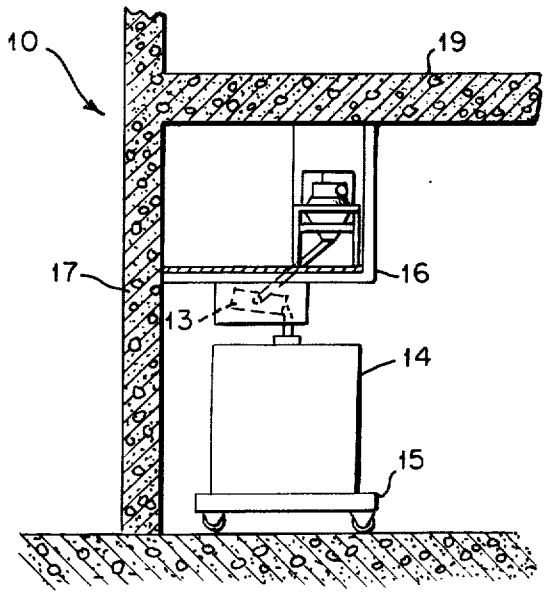


Fig. 2

Fig. 3



JOHN D. MURPHY
JOHN PIRRO, JR.
LAWRENCE RUTLAND
STANLEY F. WISLA
INVENTORS

BY
McLean, Morton and Boustea
ATTORNEYS

APPARATUS FOR FIXING RADIOACTIVE WASTE

This invention relates to disposal of radioactive waste and, in particular, to such disposal by fixing the waste for shipment to a burial ground or the like.

BACKGROUND OF THE INVENTION

Radioactive wastes accumulate in nuclear power generating stations and are, for example, contaminated bead ion exchange resin, powdered resin, filter aid, filter precoat and evaporator bottoms which are contaminated typically with corrosion and fission products.

The present practice in disposal of radioactive wastes is to mix the wastes with cement and water, if required, and to cast these in drums for shipment to a burial ground. Fixing is required by most burial grounds in order that the radioactive waste not be available to the environment and is also desirable, as it prevents spread of radioactive material which might occur incidental to an accident in shipment. The present practice of fixing radioactive wastes at a nuclear facility is cumbersome and presents potential contamination problems.

GENERAL SUMMARY OF THE INVENTION

This invention is generally applicable to the disposal of any radioactive wastes which can be slurried in an aqueous medium and has for its general purpose fixing of such wastes on a production line basis avoiding the difficulties of atmospheric contamination and non-uniform mixture characterizing prior fixing methods.

In accordance with this invention radioactive wastes are collected from time to time, and slurried in an aqueous medium in a metering tank which is contained in a shielded enclosure. The metering tank is adapted to meter the collected slurry, when required, through a mixer which is also connected simultaneously to receive cement or other fixing materials in metered quantities proportionate to the metering rate of the slurry. The mixer is shielded and arranged continuously to discharge metered and mixed fixing material and slurry into a shipping container for shipment to a burial ground when the mixture has set.

Ordinarily in accordance with this invention the fixing process is carried out only when a sufficient quantity of radioactive waste has been collected to constitute a suitable quantity for shipment to a burial ground. This quantity may involve one or several shipping casks or other containers and the fixing process is carried out continuously until the desired number of casks have been charged. Thus expensive shipping casks are tied up at the particular plant only for that time necessary for the fixing operation and need not be kept on hand as storage vessels until an adequate quantity for shipment has been made up.

Another advantage of this invention is that it is flexible in terms of achieving the proper ratio of water to fixing material in the mixture. Thus if the radioactive wastes are in slurry form containing excess water they can readily be dewatered by decanting or filtering from the metering tank prior to fixing. If they are solid wastes additional water can be added as required. The proportions of fixing material, water and waste materials are a function of density, shielding requirements, moisture content and ultimate disposition of the fixed waste.

For a more complete understanding of the practical application of this invention reference is made to the accompanying drawings in which:

FIG. 1 is a fragmentary elevation partly in section of the waste processing facility of a nuclear power plant;

FIG. 2 is a plan view partly in section of the facility shown in FIG. 1;

FIG. 3 is an end view partly in section of the same facility; and

FIG. 4 is a schematic diagram of certain apparatus shown in FIGS. 1, 2 and 3.

Referring to the drawings the reference numeral 10 designates a building, housing a waste processing facility at a nuclear power plant. The waste processing facility itself includes a metering tank 11, hopper 12 and a mixer 13. Both metering tank 11 and its associated equipment and hopper 12 and its associated equipment are located on a platform 16 in the processing area of the power plant such that a portable shipping container, such as a movable shipping cask 14 or ICC approved drum mounted, for example, on a dolly 15 can be positioned beneath platform 16 to receive the contents of metering tank 11 and hopper 12 through mixer 13 which is mounted on the underside of platform 16.

Exemplary of the portable containers used in this invention are a shielded nuclear cask licensed in accordance with AEC regulations, Title 10, Chapter 71, Code of Federal Regulations for "large quantities" of radioactive materials or Department of Transportation regulations for Group B shipments or Group A or low specific activity. In addition ICC approved single trip containers for radioactive materials, e.g., ICC-17H, 55 gallon steel, open head, typify the drums used herein.

The processing area in building 10 is entirely enclosed in concrete, including an outside wall 17, a rear wall 18 and a ceiling 19 which are shown in the drawings. Platform 16 is mounted beneath ceiling 19 in the corner where rear wall 18 and outside wall 17 join, and metering tank 11 is positioned in such corner with hopper 12 mounted further out on the platform. Walls 17 and 18 and ceiling 19 are of thick concrete and thus serve partially to shield tank 11. Metering tank 11 is shielded further by providing a thick concrete floor 20 on platform 16 beneath tank 11 and by providing an outside wall 21 of thick concrete on platform 16 rising to ceiling 19 and extending from outer wall 17 in front of metering tank 11. The shielded enclosure for metering tank 11 is completed by a U-shaped partition 22 and baffle 23 formed of concrete and extending across platform 16 from floor 20 to ceiling 19 and from front wall 21 to rear wall 18 defining a U-shaped access to service metering tank 11 when required. Arrangements not shown are provided for charging metering tank 11 with slurried radioactive waste and water, as required, through ceiling 19.

Hopper 12 is located on platform 16 outside of the enclosure in which metering tank 11 is mounted and is provided with a downward, gravity feed into an auger 24 leading to mixer 13 mounted on the underside of platform 16 beneath floor 20. Mixer 13 is also provided with a connection 25 through a slurry pump 26 from the underside of metering tank 11. Pump 26 is located in the shielded enclosure in which tank 11 is housed and is provided with suitable valving to discharge directly into mixer 13 or to discharge into a line 27 recirculating the discharge of slurry pump 26 to the upper end of tank 11. Mixer 13 itself, while located on the un-

derside of platform **16**, is housed in a steel shielded compartment **28** and is provided internally with a power driven agitator such that fixing material and waste discharged from hopper **12** and tank **11** into the upper end of mixer **13** feed by gravity to the lower end of mixer **13** while being thoroughly mixed, such that they are discharged through outlet **29** in a suitably mixed condition for casting.

Finally, it will be noted, referring particularly to FIG. **4** that water can be withdrawn through a filter **30** and line **31** from tank **11** when it is desired to dewater the contents. Also a radiation detector **32** is located in line **27** to measure the radioactivity of the contents during recirculation. An agitator **33** is also provided in metering tank **11** to provide thoroughly mixed slurry of uniform consistency.

In operation radioactive waste is collected from time to time and slurried and delivered to metering tank **11**, for example, through a line **34**. Spent resin in a demineralizer, for example, can be backflushed and fed as a slurry through line **34** to metering tank **11**. The operation of agitator **33** assures that the mixture is uniform without hot spots. Recirculation through line **27** enables radiation measurements to be made to verify that the Curie capacity of the shipping cask or casks to be used is not exceeded. Radiation measurements could be made on the surface of the metering tank alternatively.

As wastes are accumulated in tank **11**, the radiation level rises to the maximum of the desired shipment. A shipping cask **14** fitted with a tank liner or ICC approved drums is then transferred and positioned, for example, by dolly **15** under platform **16** beneath mixer **13**. At this point, with a knowledge of the volume of liquid contents in metering tank **11** and of the volume of shipping cask or casks **14** and with the knowledge of the proportion of water to fixing materials required, excess water present in the slurry in tank **11** is removed through filter **30** and line **31**. On the other hand, if additional water is required, it is supplied through line **35** followed by sufficient agitation utilizing agitator **33** to insure a uniform mixture. Slurry pump **26** is then operated to discharge the contents of tank **11** into mixer **13** at a regulated rate. At the same time auger **24** is operated to supply fixing materials from hopper **12** into mixer **13** in the proper proportion for the slurry introduced from tank **11**. Mixer **13** is also operated to agitate the mix so that, as it is discharged from outlet **29** into the shipping cask, the mix is properly uniform. After cask **14** is filled it is sealed and the top secured, and the cask is shipped to the burial site typically on a flat bed trailer. Depending on the means of transportation, one or more shipping casks **14** may be filled during the course of the operation.

We claim:

1. A waste processing facility for preparing radioactive wastes for disposal which includes means defining a shielded enclosure, a metering tank positioned in said enclosure, said metering tank including metering means for removing liquid contents therefrom at a metered rate and measuring means for measuring the radioactivity of liquid contents thereof, mixing means for continuously receiving, mixing and discharging fixing materials and liquids said mixing means being connected to said metering means to receive the contents of said tank through said metering means, fixing materials feed means connected to said mixing means to deliver fixing materials thereto at a regulated rate, means defining a space in which to position a container relative to said mixing means to receive the discharged contents therefrom.

2. A waste processing facility according to claim **1** which further includes means for storing fixing materials adjacent said enclosure defining means.

3. A waste processing facility according to claim **1** in which said means defining an enclosure is located on a platform in which said mixing means is positioned on the underside of said platform, the space beneath said platform thereby constituting said space in which to position a container.

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