(12) UK Patent Application (19) GB (11) 2 123 951 A

(21) Application No **8315451**
(22) Date of filing **6 Jun 1983**
(30) Priority data
(31) **398227**
(32) **14 Jul 1982**
(33) **United States of America (US)**
(43) Application published **8 Feb 1984**
(51) **INT CL³**
G01N 1/02
G21F 9/00
(52) Domestic classification
G1B CE CL
U1S 1435 G1B
(56) Documents cited
None
(58) Field of search
G1B
G6R
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(54) **Apparatus for sampling hazardous media**

(57) An apparatus for sampling a hazardous medium, such as radioactive or chemical waste, selectively collects a predetermined quantity of the medium in a recess 17 of an end-over-end rotatable valving member 16. This collected quantity is deposited in a receiving receptacle located in cavity 90 while the receiving receptacle is in a sealed relationship with recess 17 to prevent dusting of the sampled media outside the receiving receptacle. The receiving receptacle is removably fitted within a vehicle body 64 which is, in turn, slidably movable upon a track within a transport tube 88. The receiving receptacle is transported in the vehicle body from its sample receiving position within a container 10 for the hazardous medium to a sample retrieval position outside the medium container. The receiving receptacle may then be removed from the vehicle body 64, capped and taken to a laboratory for chemical analysis.

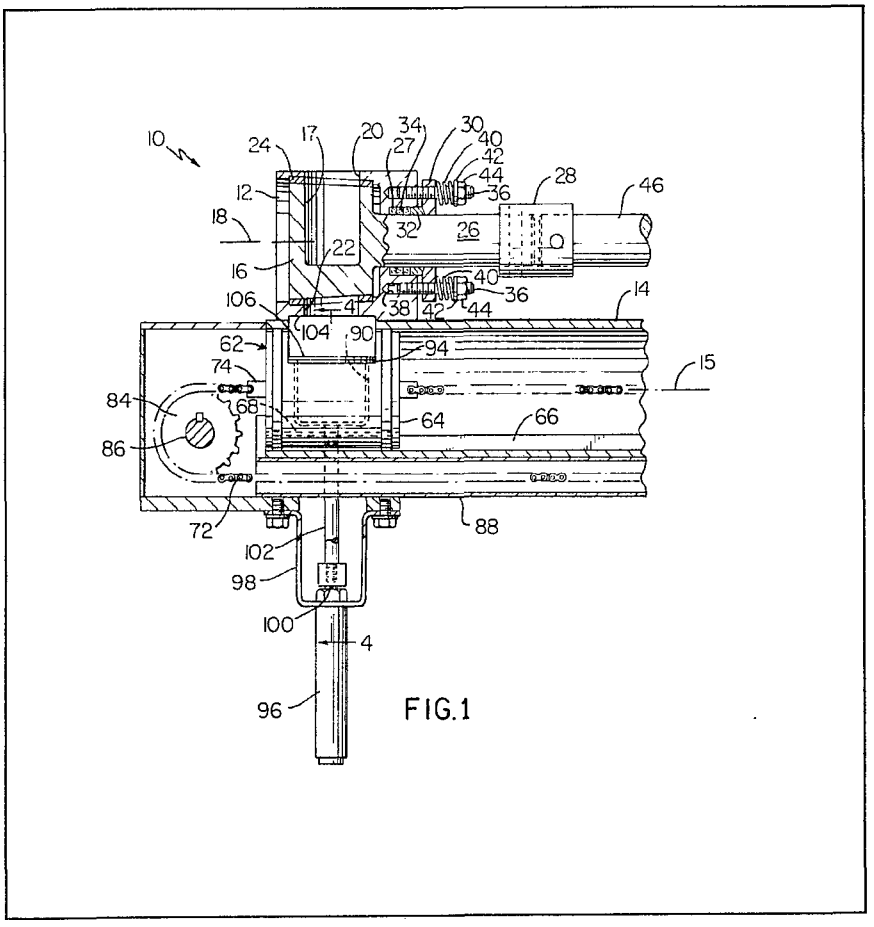

FIG.1

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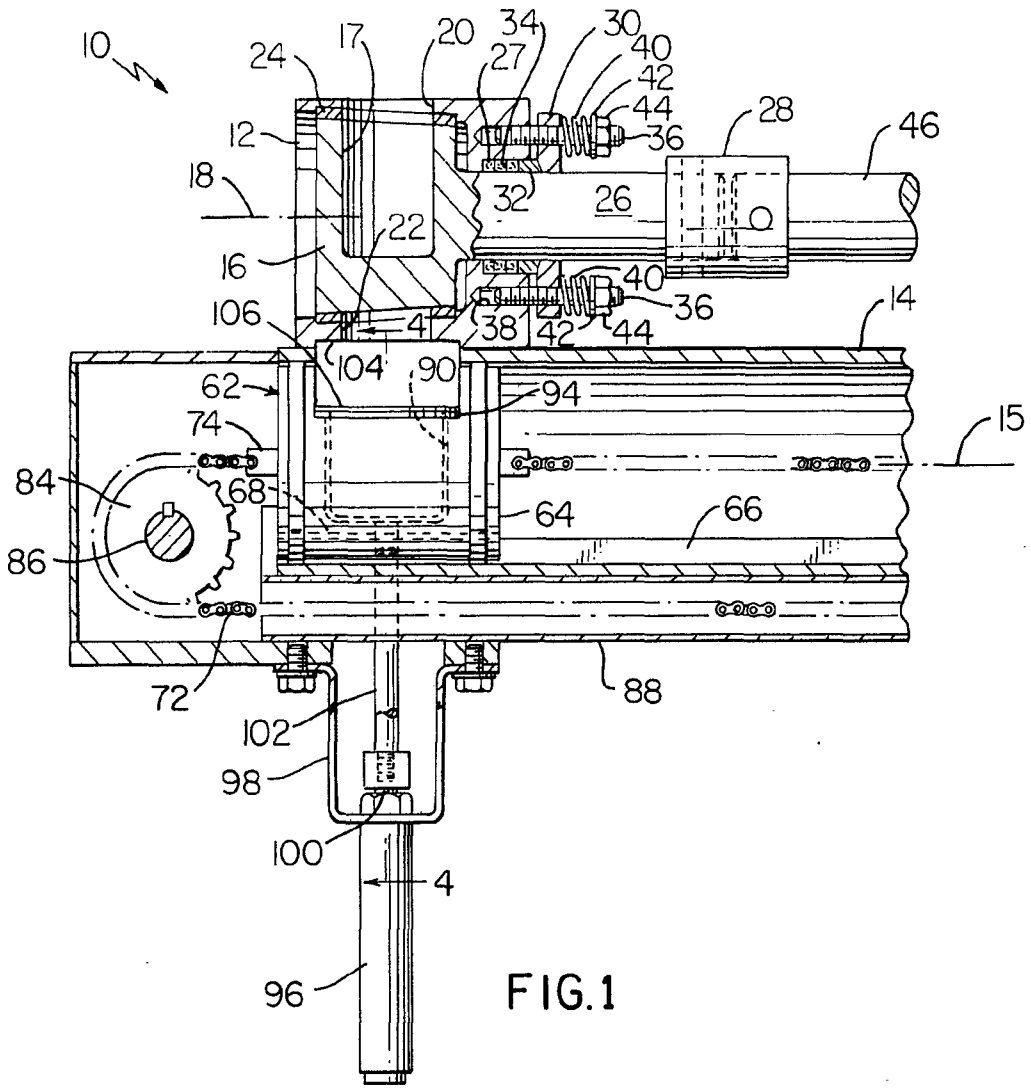

FIG.1

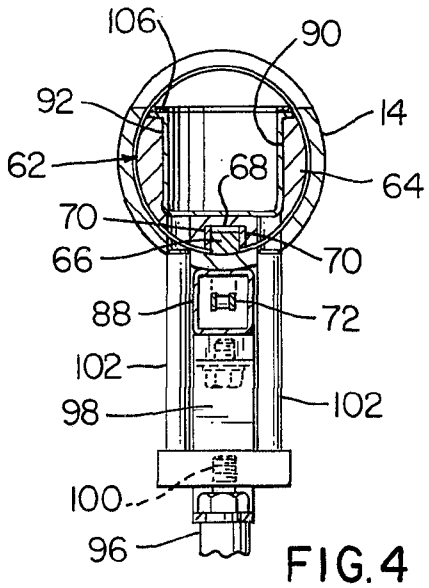

FIG.4

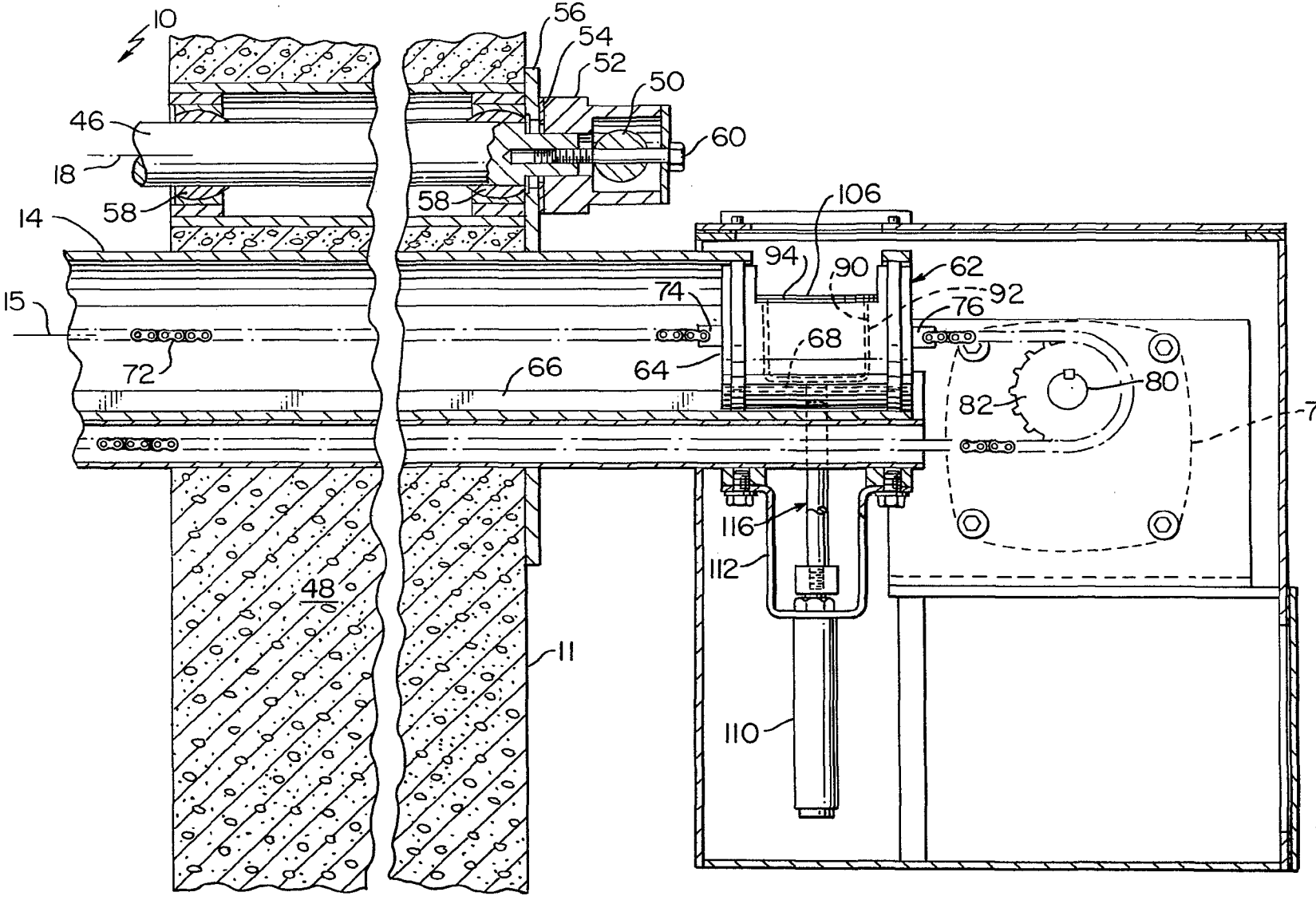

FIG.2

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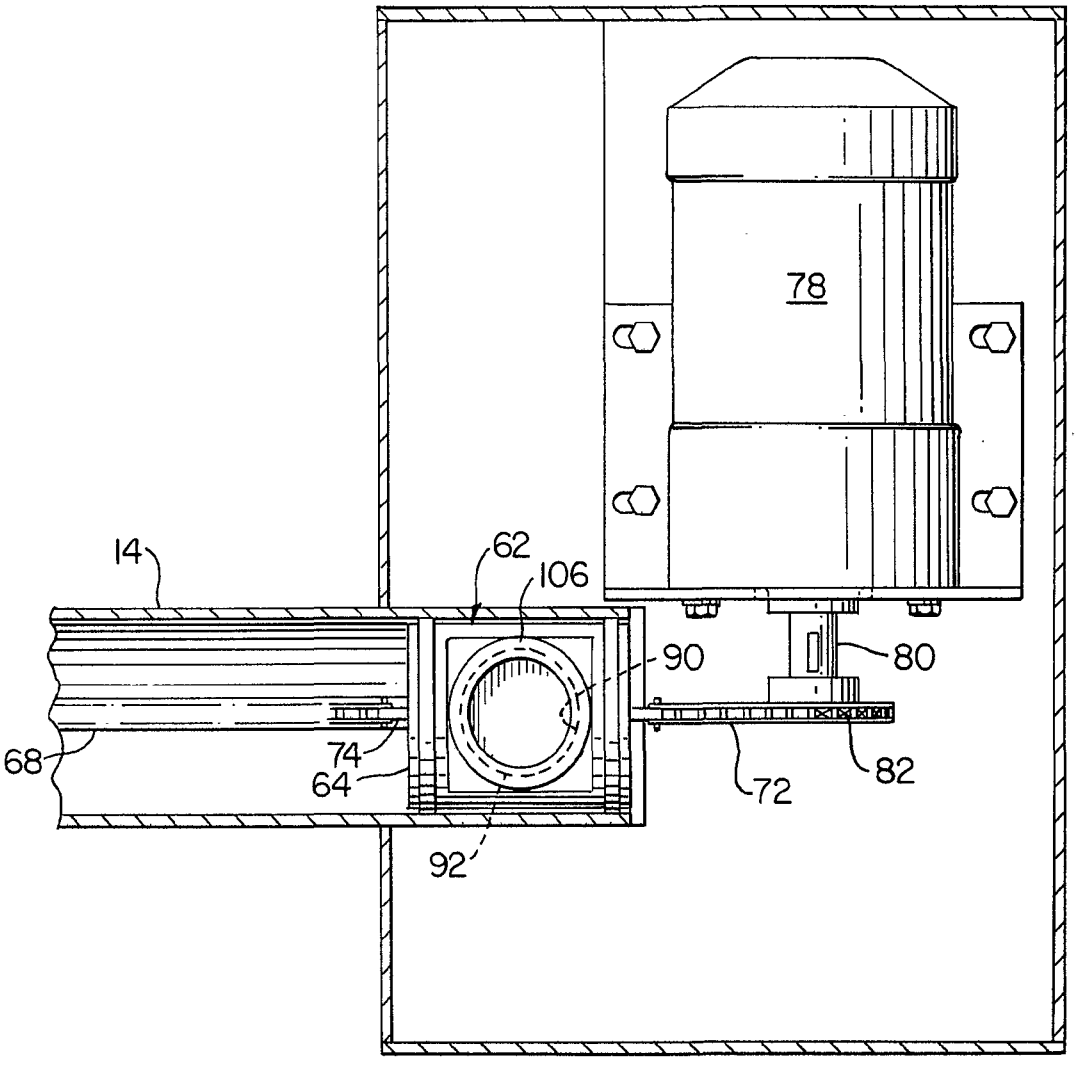

FIG. 3

SPECIFICATION

Apparatus for sampling hazardous media

The present invention relates generally to material sampling and more particularly concerns the sampling of hazardous solid or a combination of solid and liquid waste material. The invention will be disclosed, by way of example, in connection with a system for handling solid radioactive waste material which minimizes the possibility of uncontrolled contamination. As will be readily apparent from the disclosure below, however, the invention has utility for the sampling of any type of hazardous material, as for example chemically hazardous material.

It is often desirable and sometimes necessary to sample and test liquid solid waste material. The need for such sampling and testing may arise under a variety of circumstances. It is desirable, for example, to test waste material to insure that it will solidify when a solidifying agent is added. When drumming up radioactive waste material, as a further example, it is also desirable to know not only the isotope, but also the exact chemical analysis of the waste material. For these and other reasons, samples of hazardous waste material are often taken for testing.

Due to the inherent dangers of handling hazardous waste materials, great care and precaution must be taken when taking samples to prevent contamination of both the humans who take the samples and making the tests and environment in which they work. The danger of contamination is particularly acute when radioactive materials are involved. Precaution must be taken not only against direct contact with the radioactive material, but also against dusting and resultant airborne contamination by the tested material. The task of sampling radioactive waste material is further complicated by the need to shield the radioactive material from humans and the need to remove the sample from behind that protective shield for testing purposes.

The present invention satisfactorily removes a predetermined quantity of hazardous material from a remote location and transports it to a retrieval position where it may be capped and taken to a chemical laboratory for analysis.

It is an object of the present invention to provide a sampling system for hazardous waste materials that will remove an accurate sample of the material from a remote location.

It is another object of the present invention to provide a sampling system for hazardous waste material that retains all dusting of the sampled media material.

It is yet another object of the present invention to provide a sampling system for hazardous waste material that minimizes the possibility of airborne contamination of the environment with the sampled media.

It is still another object of the present invention to provide a sampling system for hazardous waste material that contains the sampled material internally of the system and to a removable sampling container which may be transported to a testing location.

In accordance with the invention, an apparatus for sampling a hazardous media is provided. The apparatus includes a container for media to be sampled. A receiving receptacle is movable between a first sample receiving position inside the container and a second sample retrieval position outside the container. Means are provided within the container for selectively collecting a predetermined quantity of media and depositing the collected media into the receiving receptacle. Means are also provided which cooperate with the collecting means for selectively effectuating a sealing relationship between the receiving receptacle and the collecting means during discharge of the media to the receiving receptacle. Transport means are provided for transporting the receiving receptacle between the first and secod positions.

In accordance with a further aspect of the invention, the receiving receptacle is removably fitted within the transporting means.

In accordance with a further aspect of the invention, means are provided for lifting the receiving receptacle with respect to both the collecting means and the transporting means to effectuate a sealing relationship between the sealing receptacle and the collecting means.

In accordance with a further aspect of the invention, the lifting means includes a piston-cylinder arrangement.

A further aspect of the invention includes means outside the container for lifting the receiving receptacle with respect to the transporting means.

In accordance with still a further aspect of the invention, the collecting means includes a rotary valving element.

A still further aspect of the invention involves the use of a valving element which includes a cylindrically tapered non-lubricated plug member with a recess for collecting sampled media, the plug member being fitted within a correspondingly tapered valve body. The rotation of this plug member is controlled from a position outside the container.

In accordance to a further aspect of the invention, the transporting means includes a transport vehicle which is horizontally movable from a position inside the container and beneath the collecting means to a position outside the container.

A still further aspect of the invention includes a track on which the transport vehicle moves horizontally.

According to a further aspect of the invention, the transport vehicle is moved horizontally along the track under the impetus of a positive mechanical drive system.

In accordance with still another aspect of the invention, the transport tube extends from a position inside the container to a position outside the container with the transport vehicle and track being disposed within the transport tube.

In accordance with a still further aspect of the invention, the positive mechanical drive system includes a chain extending between a first sprocket inside the container and a second sprocket outside the container, the chain extending in directions

which are generally both perpendicular and parallel to the track. The chain is connected to opposite sides of the transport vehicle.

In accordance with a further aspect of the invention, the receiving receptacle is a cup with a radially extending lip about its opening.

A still further aspect of the invention involves the engagement of the radially extending lip of the cup with a sealing surface of the valve body when the lifting means lifts the cup in the first sample receiving position.

A still further aspect of the invention includes a piston cylinder arrangement with a bifurcated cup lifter affixed to the piston of said arrangement.

In accordance with a still further aspect of the invention, a motor for rotating the chain about the sprockets to transport the vehicle along the track through the transport tube is provided.

In accordance with a further aspect of the invention, the track has a rectangular cross sectional configuration.

A still further aspect of the invention includes the use of bearing pads interposed between the vehicle body and the track.

In accordance to a further aspect of the invention, at least one constant force spring is provided which biases the tapered cylindrical plug member into the correspondingly tapered valve body.

In accordance with a still further aspect of the invention, the valve body has an inlet and an outlet, the outlet being vertically disposed above the outlet and the plug member being rotatable within the valve body to alternately register said recess with the inlet and outlet of the body.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

Figure 1 is a fragmentary cross sectional view of the interior end of a sampling apparatus of the present invention taken in elevation and depicting components which are disposed within a media processing system.

Figure 2 is a fragmentary cross sectional view of the exterior end of the sampling apparatus of Figure 1 taken in elevation and depicting the components which are disposed exteriorly of a media processing system.

Figure 3 is a plan view of the exterior end of the disclosed sampling apparatus depicting the motor and drive mechanism which are also illustrated in Figure 2.

Figure 4 is a cross sectional view of the transport tube of Figures 1-3 taken along line 4-4 in Figure 1.

While the embodiment will be described in connection with a preferred embodiment, it will be understood that it is not intended to limit the invention to that embodiment. On the contrary, it is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Referring now to the drawings, Figure 1 and Figure 2 show opposite ends of the preferred and illustrated embodiment of the invention. The portion of the illustrated embodiment depicted in Figure 1 is disposed within a process vessel or hopper which will be generally designated by the numeral 10. This process vessel 10 is itself completely disposed in a containment area defined by an enclosed concrete structure, a sidewall 11 of which is shown in Figure 2. Figure 1 shows a valve body 12 disposed atop a transport tube 14 having a longitudinal axis 15. A tapered cylindrical plug member 16 is rotatably fitted within the valve body for rotational movement about a horizontal axis 18 for receiving and discharging media flowing downwardly through the vessel 10. Rotational movement of the plug member 16 with respect to the body 12 about the axis 18 moves a cylindrically shaped recess 17 in the plug member 16 between a first position (illustrated in Figure 1) in which it is in registry with a valve body inlet 20 and a second material dumping position, rotated 180° from the first material receiving position, in which it is in registry with a valve body outlet 22. A sleeve 24 of Grafoil (Grafoil is a trade-mark of Union Carbide Corporation of 270 Park Avenue, New York, New York for a substantially pure graphite material) or other suitable high temperature material is interposed between the valve body 12 and the plug member 16 surrounding the plug member 16. This sleeve 24 is apertured in correspondency with the valve body inlet 20 and outlet 22 to provide a free flow path between the cylindrically shaped recess 17 and the exterior of the valve body 12 through either inlet 20 or outlet 22 when the recess 17 is in registry with one of these openings.

The plug member 16 has a stem 26 which extends horizontally out of the valve body 12 through an opening 27 to a double pin coupling 28. A gland 30 and gland follower 32 are fitted in the opening 27 about the stem 26. A pakking 34 of Grafoil or other suitable high temperature material is also disposed about the stem 26 inwardly of the gland follower 32. The gland 30 is secured to the valve body 12 through the agency of a plurality of bolts 36 which extend through the gland 30 into threaded bolt receptive openings 38 in the valve body 12. Constant load springs 40 are circumferentially disposed about the bolts 36, one end of the springs 40 bearing against the gland 30 with the other end bearing against a washer 42. The washers 42, in turn, bear against nuts 44 which are threadably fitted upon the bolts 36. The springs 40 serve to load the gland 30 and gland follower 32 to the valve body 12 with a constant force.

Coupling 28 connects the stem 26 with a wrench shaft 46. This wrench shaft 46 extends out of the containment area and through the surrounding concrete shield wall 11. The concrete shield wall 11 serves to attenuate the passage of any radioactivity from within the containment area 10 to the exterior environment, making the external environment safe for human activity.

As shown in Figure 2, the wrench shaft 46 of the illustrated embodiment is manually rotated by rotation of a wrench handle 50. This handle 50 acts through a wrench hub 52 to rotate the wrench shaft 46. The hub 52 acts through a thrust bearing 54 to bear against a face plate 56 mounted on the exterior

shield wall 48. Two bearings 58 are located interiorly adjacent to the face plate 56 with the wrench shaft 46 being rotatably journaled within the bearing 58. A take-up bolt 60 is threadably received in the outside end of the wrench shaft 46 and extends out of the hub 52 to allow lateral movement of the wrench shaft, pulling the tapered cylindrical plug member 16 deeper into the correspondingly tapered opening of the body 12. The movement of the plug member 16 increases the sealing pressure between the plug member 16 and the valve body 12. As will be apparent to those skilled in the art, rotation of the wrench handle 50 effectuates rotation of the tapered cylindrical plug member 16 with respect to the valve body 12.

Referring once again to Figure 1, outlet 22 of the valve body 12 is in open communication with the interior of the transport tube 14. This transport tube 14 contains a movable transport vehicle generally designated by the numeral 62. This transport vehicle 62 includes a vehicle body 64 which is longitudinally movable within the tube from the sample receiving position of Figure 1 to the sample retrieval position of Figure 2. The vehicle body 64 is guided in its movement through the transport tube 14 by a track 66 which, in the illustrated embodiment, takes the form of a small bar having a rectangular cross section which is secured to the interior bottom of the transport tube 14. A matching groove 68 is provided in the bottom of the transport vehicle body 64 which permits the vehicle body to ride on the track 66 on guide bearing pads 70 interposed between the groove 68 and the track 66. The track 66 keeps the vehicle body 64 from rotating about the tubes longitudinal axis 15 as it is traversed through the transport tube 14.

The vehicle body 64 is driven through the transport tube 14 under the power of a chain drive system which includes a chain 72 which is fastened to the vehicle body 64 on opposite sides thereof, the chain 72 being fastened to the interior side of the body 64 at location 74 and to the exterior side of the vehicle body 64 at location 76. The chain 72 is powered by a gear motor 78 positioned exteriorly of the containment area. Power is transmitted from the gear motor 78 to the chain 72 by way of an output shaft 80 extending out of the motor 78 and a drive sprocket 82 fixedly mounted to the output shaft 80. The chain 72 is in meshing relationship with the drive sprocket 82 as well as an idler sprocket 84 disposed within the vessel 10 interiorly of the vehicle body 64. The idler sprocket 84 is fixedly mounted for rotational movement about an idler shaft 86. The chain 72 extends through a chain tube 88 disposed beneath the transport tube 14, about the drive and idler sprockets 82 and 84 respectively, and back through opposite sides of the transport tube 14 where it connects to opposite sides of the vehicle body 64 at locations 74 and 76. In the preferred embodiment, the motor 78 is a fractional horse power direct drive electrical motor and this motor 78, along with the remaining components of the drive system, provide a positive mechanical drive mechanism for the vehicle 62.

Referring once again to Figure 1 as well as Figure 4, it may be seen that the vehicle 64 has a cup receptive cavity 90 into which a cylindrically shaped sampling cup 92 is fitted. This sampling cup 92 has a radially outward extending lip 94 about its upper periphery, which lip 94 serves as a seat for the cup 92 when the cup is in an inactive or transport position. A sealing gasket 106 is affixed to the lip 94.

A piston 96 is secured to a piston bracket 98 beneath the illustrated sample receiving position of the vehicle body 64 in Figure 1 and subjacent to the chain tube 88. The piston 96 has a reciprocally moving and extending rod 100 which directs a bifurcated cup pusher 102 into selective lifting contact with the underside of the sampling cup 92. Lifting of the sampling cup 92 effectuates a sealing contact between the radially extending lip 94 and a surface 104 of the valve body 12. The sealing relationship between the lip 94 and the surface 104 is augmented by the interposition of the gasket 106 which rests atop the lip 94. The utilization of a seal between the sampling cup 92 and the valve body 12 serves to contain all dusting of the sampled media material, preventing any contamination of all parts external to the sampling cup 92.

As mentioned above, the plug member 16 is movable between a first sampling position in which the recess 17 is in registry with the inlet 20 and exposed to the downwardly moving media in the vessel 10 and a second sample dumping position in which the recess 17 is rotated 180° about axis 18 to register the recess 17 with the valve body outlet 22. The first sample receiving position is that depicted in Figure 1. In order to reduce the amount of material that will be trapped and to insure the reliability of the tested sample, the plug member 16 is rotated to a third rest position intermediate the first and second positions. This third position is preferably midway between the first and second positions, approximately 90° from the illustrated position of Figure 1.

Prior to rotating the plug member 16 from its rest position, the piston 96 is activated to lift the sampling cup 92 into its sealed position with the valve body 12. Once the sampling cup is sealed with respect to the valve body 12, the plug member 16 is rotated to its first sampling position and media flowing through the vessel 10 fills the recess 17. Once the recess 17 is filled, the plug member 16 is rotated 180° to its second or dumping position wherein the contents of the recess 17 are deposited into the sampling cup 92. It is then desirable to move the plug member 16 back to its intermediate rest position and to thereafter retract the piston 96 to rest the sampling cup 92 in the vehicle body 64. Rotating the plug member 16 out of registry with the outlet 22 prior to breaking the seal between the lip 94 and the location 104 minimizes the area to pressure balance. Pressure balancing between the interior and exterior of the sampling cup 92 prior to breaking the seal with the valve body is important to minimize dusting of the contaminated media used in the preferred embodiment.

After the sampling cup 92 has been reseated in the vehicle body 64 with the media sample to be tested, the motor 78 is actuated to slide the vehicle 62 along track 66 to the sample retrieval position depicted in Figure 2. A further piston 110 is secured in a bracket

112 beneath the sample retrieval position and subjacent to the chain tube 88. This piston 110 has a cup pusher 116 substantially identical to that of cup pusher 102 and which serves the same purpose of lifting the sampling cup 92 with respect to the vehicle body 64.

The sample retrieval position is outside the shield wall 48 and preferably enclosed in a gloove box (not shown). When the sampling cup 92 is lifted by the cup pusher 116, the cup 92 is preferably physically capped and then taken to an analytical laboratory for analysis. The radially extending rim 94 on the sampling cup 92 provides a sealing surface for a cap. The system is designed so that the sampling cup 92 may be removed and replaced with another cup during the time the media sample is being tested. Consequently, once the sampling cup 92 is removed, another cup may be inserted in its place and the vehicle body 64 thereafter returned immediately to the sample retrieving position to collect another sample.

The illustrated embodiment is designed as a permanent part of a final vessel through which radioactive waste would pass immediately prior to druming. The described invention allows for a continuous process in which samples are taken at intermittent intervals for chemical analysis. Analysis of the samples provides knowledge of the content of the waste which is being drumed for transport to a disposal site. The illustrated system also minimizes the amount of airbone contamination released into the environment when taking a sample.

Thus it is apparent that there has been provided, in accordance with the invention, an apparatus that fully satisfies the objects, aims, and advantages set forth above. While the invention has been described in conjunction with a specific embodiment thereof, it is evident that many alternatives, modifications, and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications, and variations as fall within the spirit and broad scope of the appended claims.

CLAIMS

1. An apparatus for sampling a hazardous media, comprising:

a) a container for media to be sampled;

b) a receiving receptacle movable between a first sample receiving position inside said container and a second sample retrieval position outside said container;

c) means within said container for selectively collecting a predetermined quantity of media and depositing the collected media into the receiving receptacle;

d) means cooperating with said collecting means for selectively effectuating a sealing relationship between said receiving receptacle and said collecting means during discharge of media into said receiving receptacle; and

e) means for transporting said receiving receptacle between said first and second positions.

2. An apparatus as recited in claim 1 wherein said receiving receptacle is removably fitted in said transporting means.

3. An apparatus as recited in claim 2 further including means for lifting said receiving receptacle with respect to both said collecting means and said transporting means to effectuate the sealing relationship between said receiving receptacle and said collecting means.

4. An apparatus as recited in claim 3 wherein said lifting means includes a piston-cylinder arrangement.

5. An apparatus as recited in claim 3 further including means outside said container for lifting said receiving receptacle with respect to said transporting means.

6. An apparatus as recited in claim 5 wherein said collecting means includes a rotary valving element.

7. An apparatus as recited in claim 6 wherein said valving element includes a cylindrically tapered plug member with a recess for collecting sampled media, said plug member being fitted within a correspondingly tapered valve body, the rotation of said plug member being controlled from a position outside the container.

8. An apparatus as recited in claim 3 wherein said transporting means includes a transport vehicle which is horizontally movable from a position inside said container and beneath said collecting means to a position outside said container.

9. An apparatus as recited in claim 8 further including a track upon which said transport vehicle moves horizontally.

10. An apparatus as recited in claim 9 wherein the transport vehicle is moved horizontally along said track under the impetus of a positive mechanical drive system.

11. An apparatus as recited in claim 10 further including a transport tube extending from a position inside said container to a position outside said container, said transport vehicle and said track being disposed within said transport tube.

12. An apparatus as recited in claim 11 wherein the positive mechanical drive system includes a chain extending between a first sprocket inside said container and a second sprocket outside said container in directions which are generally both perpendicular and parallel to said track, said chain being connected to opposite sides of said transport vehicle.

13. An apparatus as recited in claim 12 wherein said receiving receptacle is a cup with a radially extending lip about its opening.

14. An apparatus as recited in claim 13 wherein said radially extending lip engages a sealing surface on the valve body when said lifting means lifst said cup when the cup is in the first sample receiving position.

15. An apparatus as recited in claim 14 wherein the lifting means includes a piston-cylinder arrangement and a bifurcated cup lifter affixed to the piston of said piston-cylinder arrangement.

16. An apparatus as recited in claim 15 further including a motor for rotating said chain about said sprockets to transport said vehicle body along said

track and through said transport tube.

17. An apparatus as recited in claim 16 wherein said track has a rectangular cross sectional configuration.

18. An apparatus as recited in claim 17 further including bearing pads interposed between said vehicle body and said track.

19. An apparatus as recited in claim 7 further including at least one constant force spring biasing said tapered cylindrical plug member into the correspondingly tapered valve body.

20. An apparatus as recited in claim 7 wherein said valve body has an inlet and an outlet, said inlet being vertically disposed above said outlet and said plug member being rotatable within said valve body to alternately register said recess with said inlet and said outlet.

21. In a system for processing a hazardous media, a sampling apparatus, comprising:

a) a flow control member;

b) a vehicle body movable between a first media receiving position within the processing system and a second position exterior to the processing system;

c) a receiving receptacle removably fitted within said vehicle body, said flow control means being operative to selectively permit media flow into the receiving receptacle; and

d) means for lifting said receiving receptacle with respect to said vehicle body in sealing relationship with said flow control member when said vehicle body is in the first media receiving position.

22. An apparatus as recited in claim 21 further including means for lifting said receiving receptacle with respect to both said flow control member and said vehicle body to effectuate the sealing relationship between said receiving receptacle and said flow control member.

23. An apparatus as recited in claim 22 wherein said lifting means includes a piston-cylinder arrangement.

24. An apparatus as recited in claim 23 further including means for lifting said receiving receptacle with respect to said vehicle body when said vehicle body is in the second position exterior to said processing system.

25. An apparatus as recited in claim 24 wherein said flow control member includes a rotary valving element.

26. An apparatus as recited in claim 25 wherein said rotary valving element includes a cylindrically tapered plug member with a recess for collecting sampled media, said plug member being fitted within a correspondingly tapered valve body, the rotation of said plug member being controlled from a position outside the processing system.

27. An apparatus as recited in claim 21 wherein said transport vehicle is horizontally movable from a position inside said processing system and beneath said flow control member to a position outside said processing system.

28. An apparatus as recited in claim 27 further including a track upon which said transport vehicle moves horizontally.

29. An apparatus as recited in claim 28 wherein the transport vehicle is moved horizontally along said track under the impetus of a positive mechanical drive system.

30. An apparatus as recited in claim 29 further including a transport tube extending from a position inside said processing system to a position outside said processing system, said transport vehicle and said track being disposed within said transport tube.

31. An apparatus as recited in claim 20 wherein the positive mechanical drive system includes a chain extending between a first sprocket inside said processing system and a second sprocket outside said processing system in a direction generally perpendicular to said track, said chain being connected to opposite sides of said transport vehicle.

32. An apparatus as recited in claim 31 wherein said receiving receptacle is a cup with a radially extending lip about its opening.

33. An apparatus as recited in claim 32 wherein said radially extending lip engages a sealing surface on the valve body when said lifting means lifts said cup when the cup is in the first media receiving position.

34. An apparatus as recited in claim 33 wherein the lifting means includes a piston-cylinder arrangement and a bifurcated cup lifter affixed to the piston of said piston-cylinder arrangement.

35. An apparatus as recited in claim 34 further including a motor for rotating said chain about said sprockets to transport said vehicle body along said track and through said transport tube.

36. An apparatus as recited in claim 35 wherein said track has a rectangular cross sectional configuration.

37. An apparatus as recited in claim 36 further including bearing pads interposed between said vehicle body and said track.

38. An apparatus as recited in claim 37 further including at least one constant force spring biasing said tapered cylindrical plug member into the correspondingly tapered valve body.

39. An apparatus as recited in claim 38 wherein said valve body has an inlet and an outlet, said inlet being vertically disposed above said outlet and said plug member being rotatable within said valve body to alternately register said recess with said inlet and said outlet.

40. An apparatus as recited in claim 32 further including a seal affixed to the radially extending lip.

41. An apparatus as recited in claim 9 wherein said track includes means for preventing rotation of said transport vehicle as it is moved horizontally.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company Limited, Croydon, Surrey, 1984.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.