US009728286B2

(12) **United States Patent**
Singh

(10) **Patent No.: US 9,728,286 B2**
(45) **Date of Patent: Aug. 8, 2017**

(54) **SYSTEM FOR LOW PROFILE TRANSLATION OF HIGH LEVEL RADIOACTIVE WASTE**

(71) Applicant: **Holtec International, Inc.**, Marlton, NJ (US)

(72) Inventor: **Krishna P. Singh**, Hobe Sound, FL (US)

(73) Assignee: **Holtec International, Inc.**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 711 days.

(21) Appl. No.: **13/731,803**

(22) Filed: **Dec. 31, 2012**

(65) **Prior Publication Data**

US 2014/0186144 A1 Jul. 3, 2014

Related U.S. Application Data

(63) Continuation of application No. 12/024,071, filed on Jan. 31, 2008, now Pat. No. 8,345,813.

(60) Provisional application No. 60/887,505, filed on Jan. 31, 2007.

(51) **Int. Cl.**
G21C 19/32 (2006.01)
G21F 5/14 (2006.01)

(52) **U.S. Cl.**
CPC ***G21C 19/32*** (2013.01); ***G21F 5/14*** (2013.01)

(58) **Field of Classification Search**
CPC G21F 5/00; G21F 5/06; G21F 5/08; G21F 5/14; B62D 61/12; B60B 33/06; B60P 3/42
USPC 376/272
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,973,372	A	9/1934	Clapp	
2,671,242	A *	3/1954	Lewis	B60B 33/06 16/26
3,732,427	A	5/1973	Trudeau et al.	
4,355,584	A *	10/1982	White, Jr.	105/72.2
4,704,539	A *	11/1987	Dequesnes et al.	250/506.1
5,839,874	A	11/1998	Johnston	
5,885,048	A	3/1999	Barth	
6,017,181	A	1/2000	Johnston	
6,328,524	B1	12/2001	Johnston	

FOREIGN PATENT DOCUMENTS

GB	1398348	6/1975

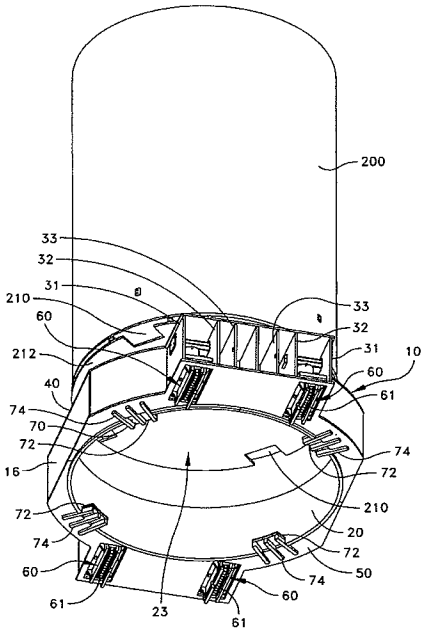
* cited by examiner

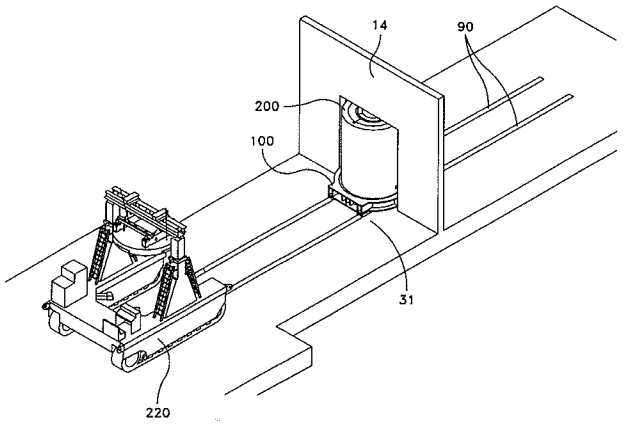
Primary Examiner — Jack W Keith
Assistant Examiner — Sharon M Davis
(74) *Attorney, Agent, or Firm* — The Belles Group, P.C.

(57) **ABSTRACT**

An apparatus, system and method for handling and translating high level radioactive waste. The apparatus comprises a body for supporting the cask close to the ground so that the cask and the apparatus can pass underneath over head doors. The apparatus further comprises rollers for translating the cask. The apparatus additionally supports the storage cask during spent nuclear fuel transfer procedures.

22 Claims, 9 Drawing Sheets





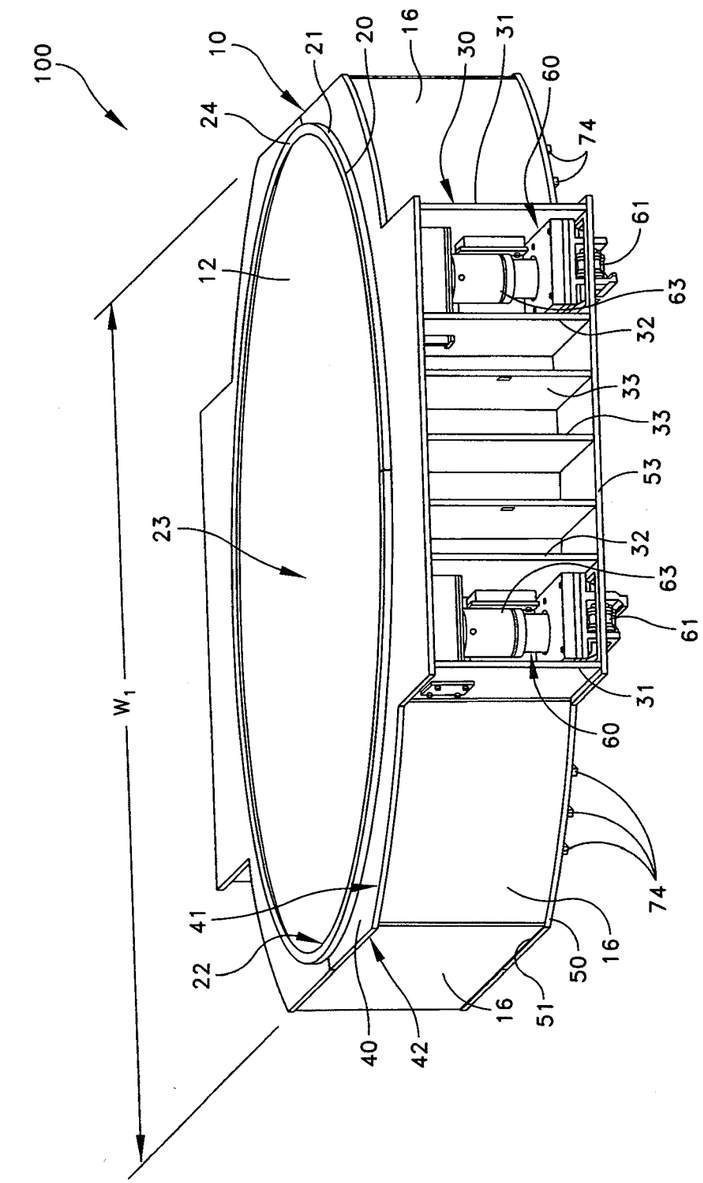

100
10
21
20
16
30
31
60
74
24
12
61
63
32
33
33
53
23
W_1
41
22
40
42
16
51
50
16
74

FIG. 1

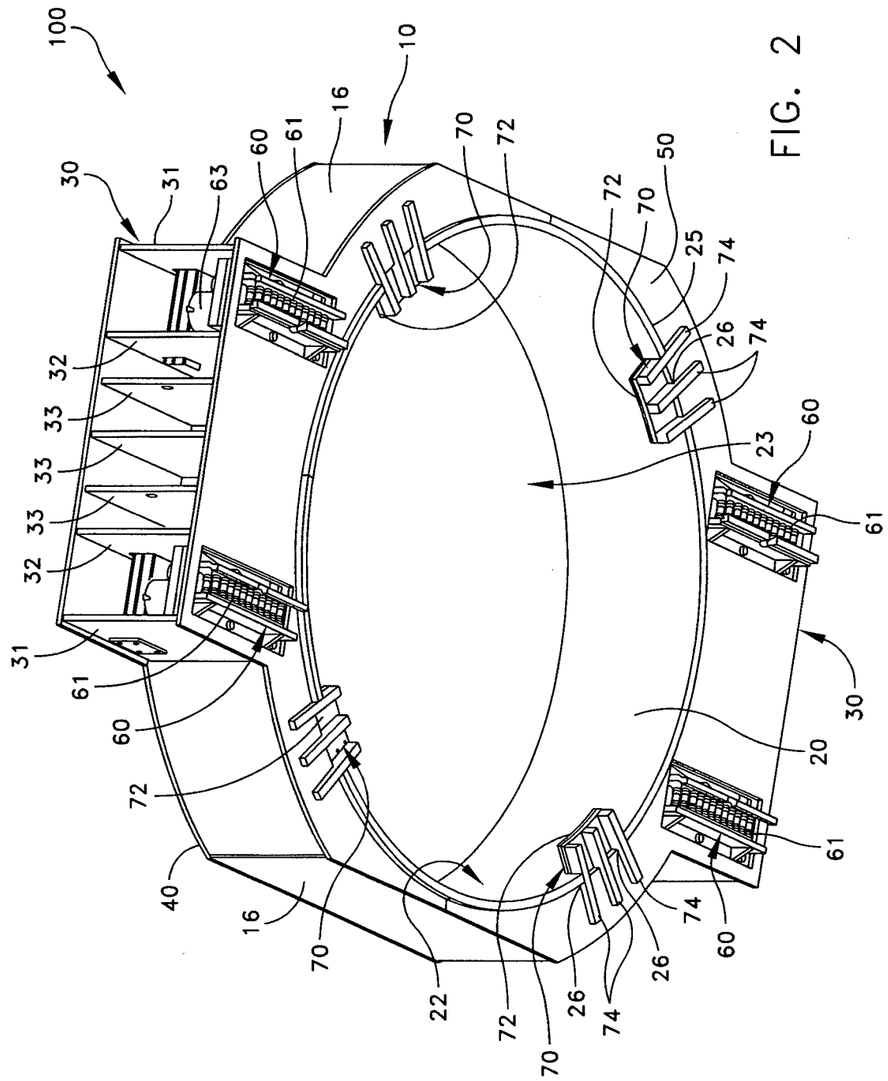


FIG. 2

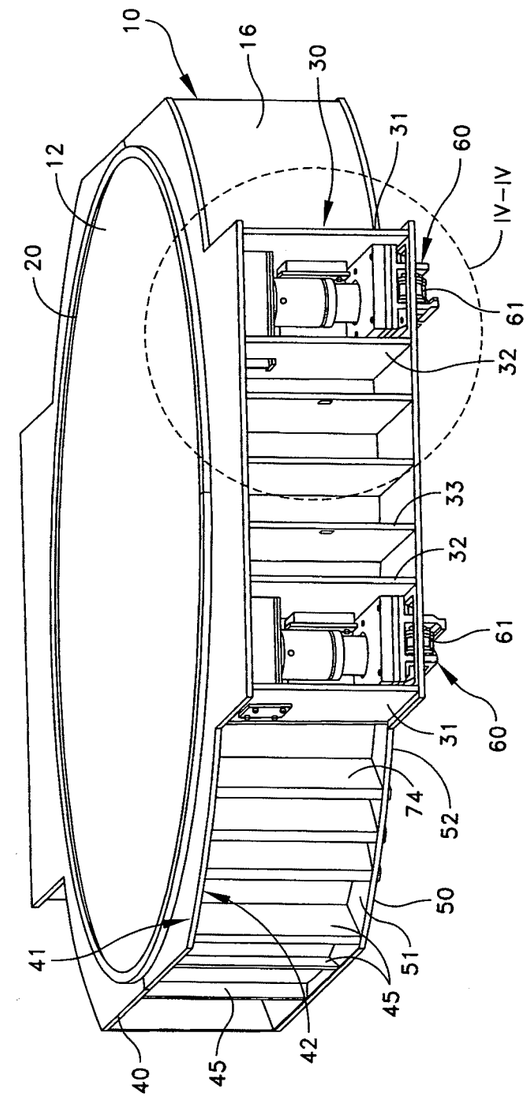

10
16
30
31
60
12
IV–IV
20
61
32
33
32
61
60
31
74
52
50
51
45
41
40
45
42

FIG. 3

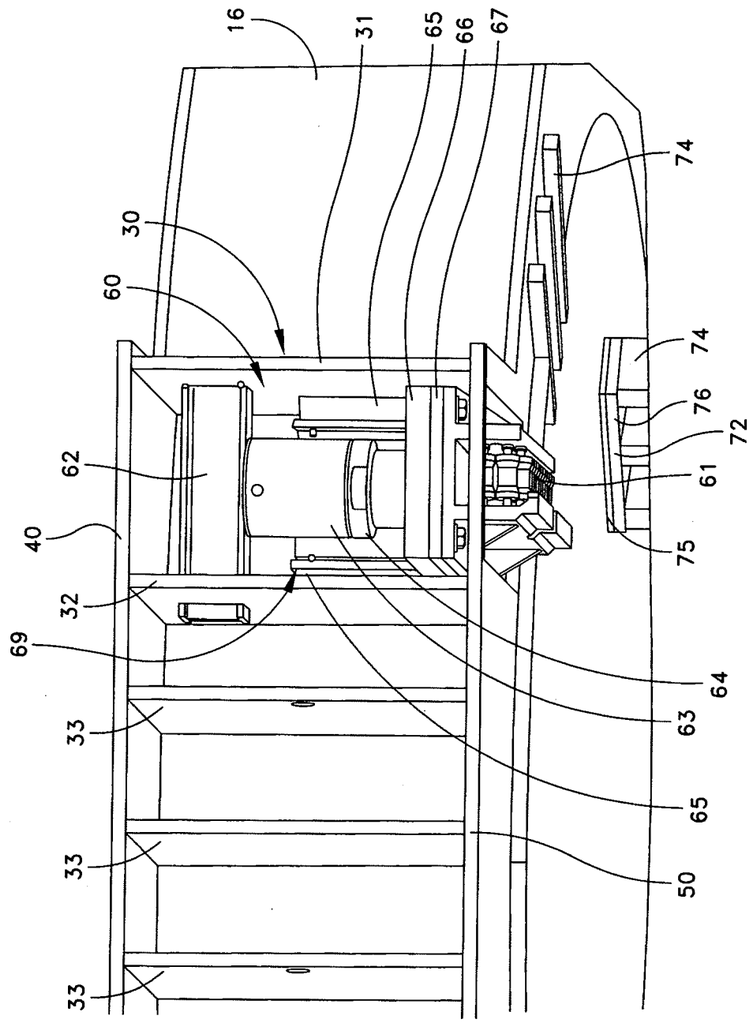


FIG. 4

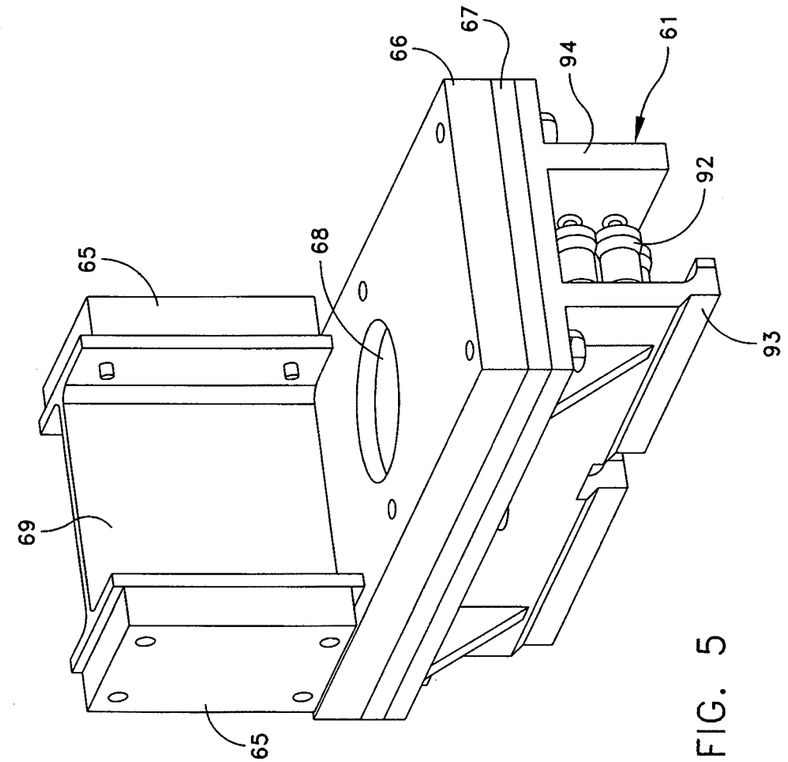


FIG. 5

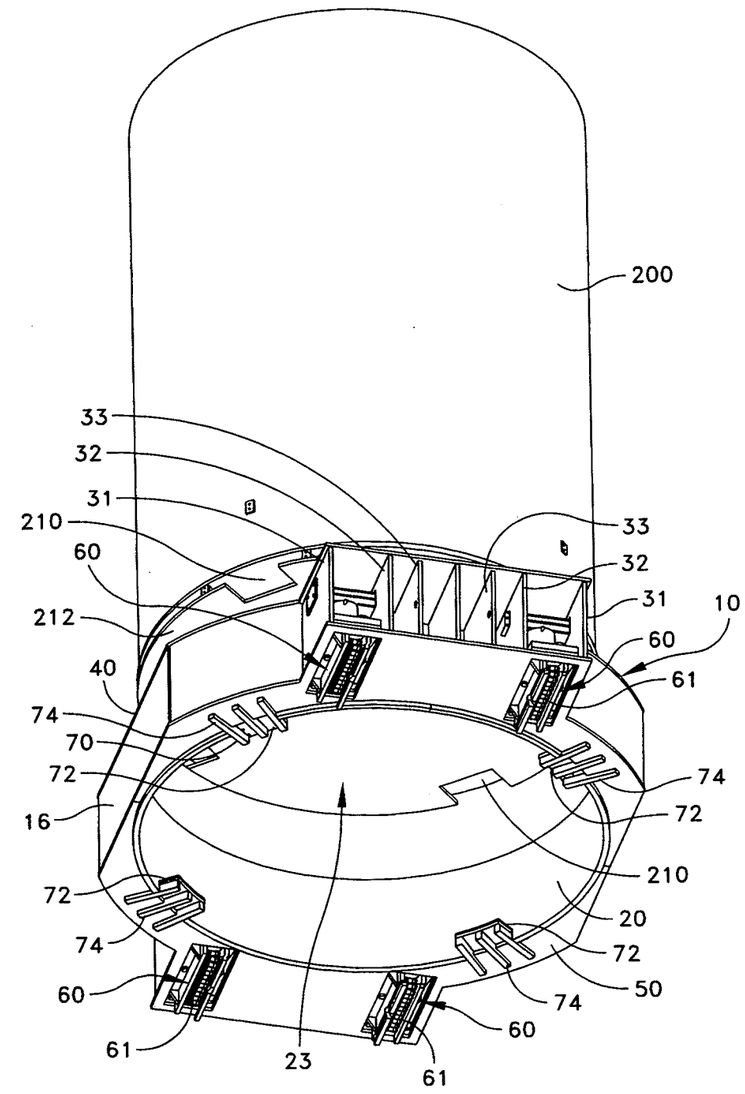

200
33
32
31
210
60
212
40
74
70
72
16
72
74
60
61
23
61
60
74
72
50
20
210
72
74
60
31
32
33
10
61

FIG. 6

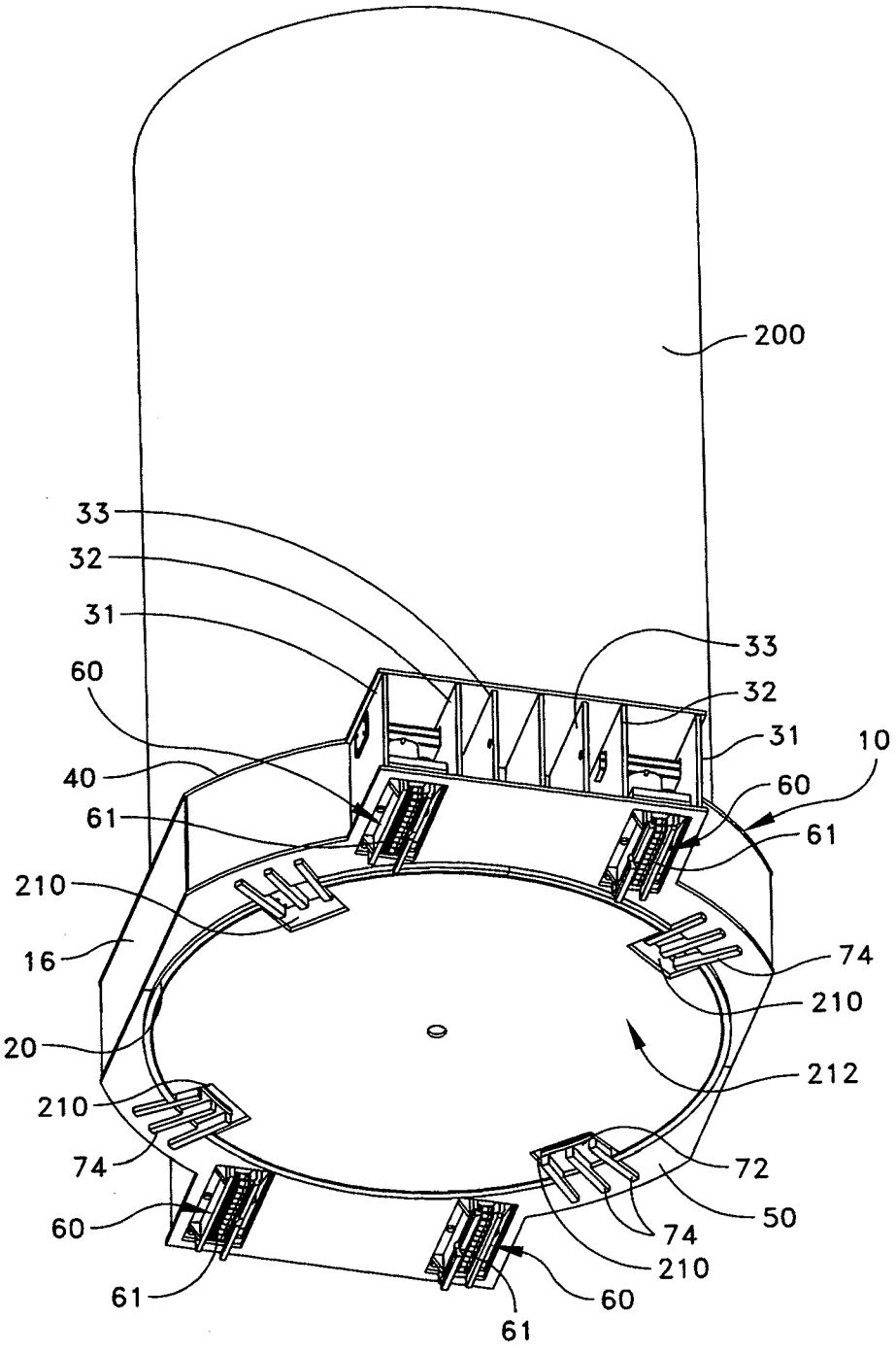

200
33
32
31
60
40
61
210
16
20
210
74
60
61
33
32
31
10
60
61
74
210
212
72
50
74
210
60
61

FIG. 7

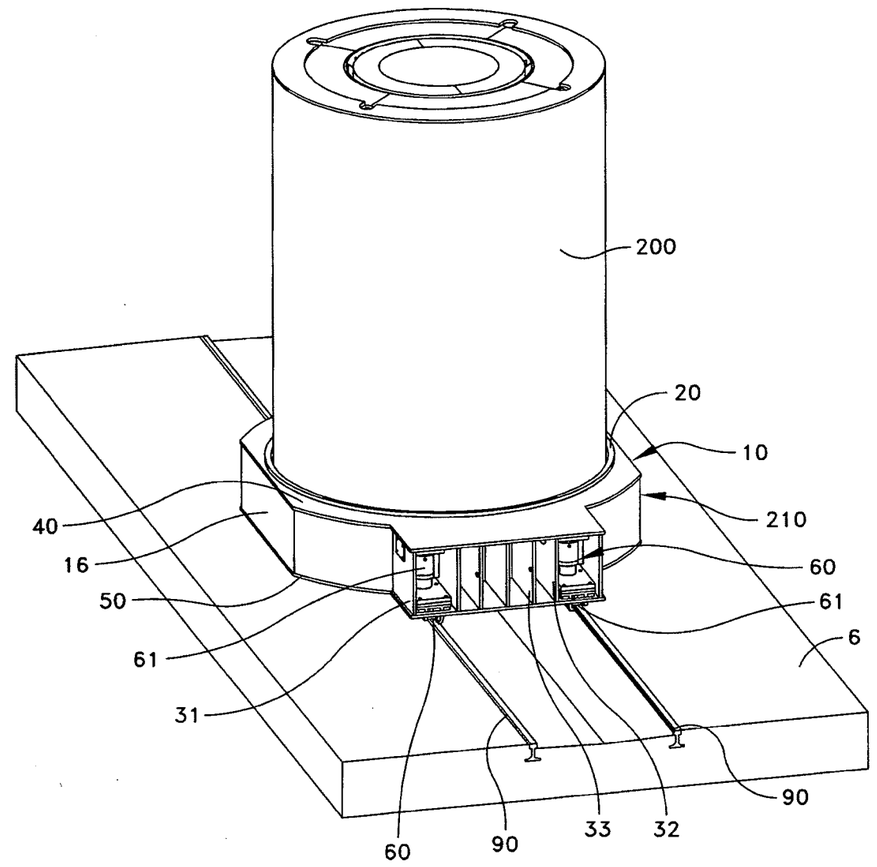


FIG. 8

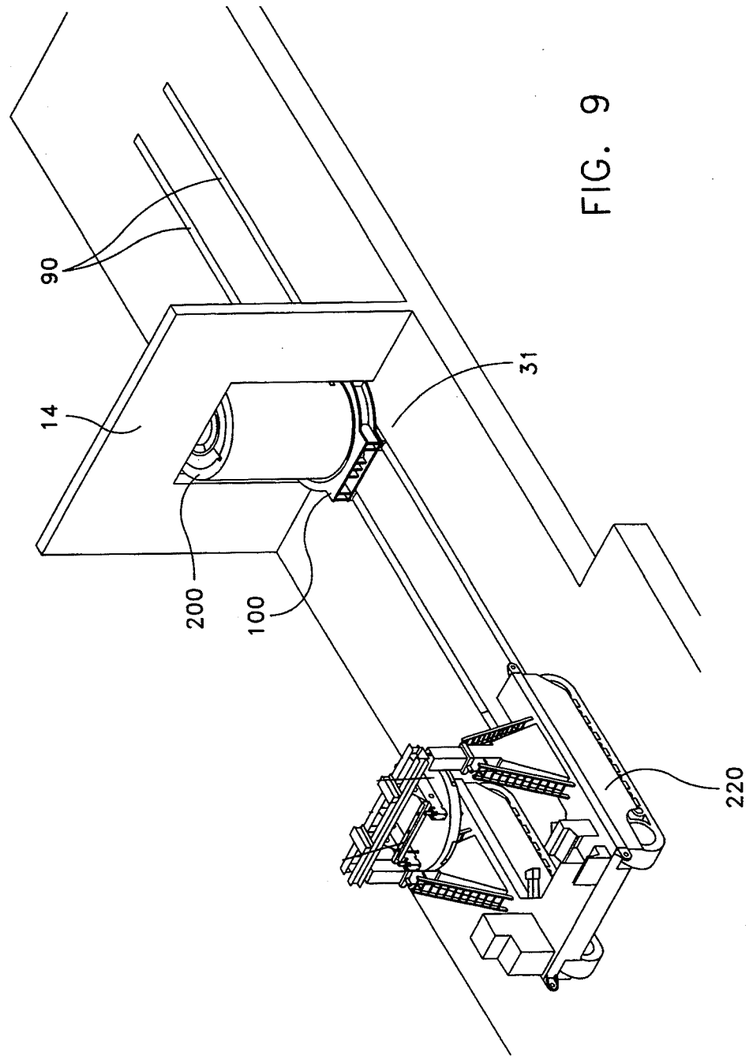


FIG. 9

SYSTEM FOR LOW PROFILE TRANSLATION OF HIGH LEVEL RADIOACTIVE WASTE

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a continuation of U.S. patent application Ser. No. 12/024,071, filed Jan. 31, 2008, now U.S. Pat. No. 8,345,813, which in turn claims the benefit of U.S. Provisional Patent Application Ser. No. 60/887,505, filed Jan. 31, 2007, the entireties of which are incorporated herein by reference.

FIELD OF THE INVENTION

The present invention relates generally to apparatus, systems and methods for transporting high level waste "HLW"), such as spent nuclear fuel rods, and specifically to low profile translation of high level waste containment casks.

BACKGROUND OF THE INVENTION

In the operation of nuclear reactors, the nuclear energy source is in the form of hollow zircaloy tubes filled with enriched uranium, typically referred to as fuel assemblies. When the energy in the fuel assembly has been depleted to a certain level, the assembly is removed from the nuclear reactor. At this time, fuel assemblies emit both considerable heat and extremely dangerous neutron and gamma photons (i.e., neutron and gamma radiation). Thus, great caution must be taken when the fuel assemblies are handled, transported, packaged and stored. To protect the environment from radiation exposure, spent nuclear fuel is both transported and stored in large cylindrical containers called casks. A transfer cask is used to transport spent nuclear fuel between locations while a storage cask is used to store spent nuclear fuel for a determined period of time.

Casks are typically designed to shield the environment from the dangerous radiation in two ways. First, shielding of gamma radiation requires large amounts of mass. Gamma rays are best absorbed by materials with a high atomic number and a high density, such as concrete, lead, and steel. The greater the density and thickness of the blocking material, the better the absorption/shielding of the gamma radiation. Second, shielding of neutron radiation requires a large mass of hydrogen-rich material. One such material is water, which can be further combined with boron for a more efficient absorption of neutron radiation.

The transfer cask must perform the vital function of providing adequate radiation shielding for both neutron and gamma radiation emitted by the enclosed spent nuclear fuel. The transfer cask must also be designed to provide adequate heat transfer. Guided by the shielding principles discussed above, transfer casks are made of lead or a gamma absorbing material and contain a neutron absorbing material as well. As stated previously, greater radiation shielding is provided by increased thickness and density of the gamma and neutron absorbing materials. The weight of a fully loaded transfer cask is typically in the range of 100-125 tons.

Similarly, storage casks are designed to be large, heavy structures made of steel, lead, concrete and an environmentally suitable hydrogenous material. However, because storage casks are not handled as much as transfer casks, the primary focus in designing a storage cask is to provide adequate radiation shielding for the long-term storage of spent nuclear fuel. Size and weight are at best secondary

considerations. As a result of maximizing the thickness of radiation absorbing materials, the weight and size of storage casks often cause problems associated with lifting and handling. Typically, storage casks weigh approximately 150 tons and have a height greater than 15 ft. A common problem is that storage casks cannot be lifted by nuclear power plant cranes because their weight exceed the rated capacity of the crane.

A common problem arises when the fully loaded transfer cask must be transported to the storage cask for the canister transfer procedure. Generally, the storage cask is located in a truck bay, or other location outside of the staging area. To get to the transfer cask, the storage cask may have to pass through a door of a nuclear planes truck bay. The doors are typically 17-24 feet tall. The transfer casks are typically about 16 feet and 3 inches tall. The need to move casks into and out of enclosed facilities limits the size and shape of machines that can be used to move the casks. For example, a low ceiling in such a facility makes it impractical to use a boom or overhead crane to lift and transport casks. Similarly, a doorway not much larger than the cask itself limits the extent to which a lifting device can extend beyond the sides, top or bottom of the cask. Thus, a need exists for a low profile transporter that can withstand the weight of the storage cask.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an apparatus for translating casks having a low profile.

It is another object of the present invention to provide an apparatus for translating casks that can withstand high moment forces.

A further object of the present invention is to provide an apparatus for translating casks that can be raised and lowered.

A still further object of the present invention is to provide an apparatus for translating casks that can fit through an overhead, door.

Another object of the present invention is to provide an apparatus that supports a cask during spent nuclear fuel transfer procedures.

A still further object of the present invention is to provide an apparatus that can translate a cask close to the surface of the ground while avoiding interference with irregularities on the floor surface.

A yet further aspect of the present invention is to provide an apparatus for translating casks that has a variable height.

These and other objects are met by the present invention which in one aspect can be an apparatus for translating a nuclear waste storage cask comprising: a body for supporting a cask; and at least two rollers adapted to move between a retracted position and an extended position, wherein when the rollers are in the retracted position, the rollers do not contact a ground surface.

In another aspect the invention can be an apparatus for translating a cask comprising: a body comprising a top surface, an open top end and a cavity for receiving a cask, at least one support member for supporting a cask close to a ground surface; and rollers for translating the apparatus.

In a yet further aspect the invention can be A system for translating spent nuclear fuel comprising: an apparatus for supporting and translating a cask comprising: a body having an open top end and a cavity for receiving a cask; and at least two rollers adapted to move between a retracted position and an extended position; a cask positioned in the cavity, wherein the cask is supported close to a ground surface.