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SUPERINDUSTRIA Y COMERCIO

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**PATENTE: MEJORAS A UNA EXCAVADORA FERROVIARIA PARA EL**  
**TENDIDO DE CABLES Y MÉTODOS DE USO**  
**SOLICITANTE: HENKELS & McKOY, INC**

**ASUNTO: PRESENTACION PRIORIDAD**

**DILIA RODRIGUEZ D'ALEMAN, en mi condición de apoderada de la sociedad**  
**solicitante, en esta oportunidad por el presente escrito me permito presentar:**

- 1. Copia certificada de la prioridad estadounidense reivindicada N°**  
**09/238,004 de enero 26 de 1999**
- Traducción al Español de la mencionada prioridad**

**Esta prioridad está siendo presentada dentro del término de 3 meses que**  
**exige el Convenio de París, toda vez que la solicitud fué radicada el 21 de**  
**enero de 2000.**

**Ruego a usted continuar con el presente trámite.**

**Señor Jefe,**

**DILIA RODRIGUEZ D'ALEMAN**  
**GMS/arr**  
**P- 293**

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# THE UNITED STATES OF AMERICA

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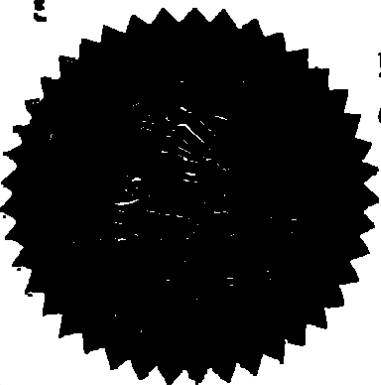
February 03, 2000

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APPLICATION NUMBER: 09/238,004

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By Authority of the  
COMMISSIONER OF PATENTS AND TRADEMARKS

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Certifying Officer

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Utility Patent

KJMS File No. 630-03

Express Mail No. EE869004370US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

J-542 U.S. PTO  
09/238004  
01/26/99

In re application of: Robert F. Lewis; Douglas W. McDonald;  
Joseph Daniel Pigott, Jr.; John Mellet  
and George A. Keesley

Serial No.: N/A

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Group Art Unit: N/A

For: RAILROAD CABLE PLOW IMPROVEMENTS AND  
METHOD OF USING THE SAME

Box Patent Application  
Assistant Commissioner for Patents  
Washington, D.C. 20231

NEW PATENT APPLICATION TRANSMITTAL LETTER

Dear Sir:

Transmitted herewith for filing is a new patent  
application, together with the following papers and documents:

- [xx] A Certificate of Express Mail (No. EE869004370US)
- [xx] Twenty seven (27) pages of the above-identified patent  
application, including the claims, abstract and list of  
reference numerals
- [xx] Four (4) sheet(s) of formal drawings
- [xx] An executed Combined Declaration or Oath and Power of  
Attorney
- [ ] An Associate Power of Attorney

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Utility Patent

KJMS File No. 630-03

Express Mail No. EE86900437008

- [xx] An Assignment of the invention to Henkels & McCoy, Inc. along with a completed and executed Recordation Cover Sheet.
- [xx] A check in the amount of \$40.00 to cover recordation of the Assignment
- [xx] Information Disclosure Statement
- [xx] Form PTO-1449 (Modified)
- [xx] References
- [ ] Preliminary Amendment
- [ ] Verified Statement establishing Small Entity status pursuant to 37 C.F.R. § 1.9 and 37 C.F.R. § 1.27

The filing fee has been calculated as shown below:

| FOR:          | NO. FILED | NO. EXTRA | RATE     | SMALL ENTITY FEE | OR | OTHER THAN SMALL ENTITY RATE | FEE            |
|---------------|-----------|-----------|----------|------------------|----|------------------------------|----------------|
| BASIC FEE     |           |           |          |                  |    |                              | \$380 OR \$760 |
| TOTAL CLAIMS  | 29 - 20 = | 9         | x 9= \$  | 0                | OR | x 18=                        | \$162          |
| INDEP. CLAIMS | 5 - 3 =   | 2         | x 39= \$ | 0                | OR | x 78=                        | \$156          |
| TOTAL         |           |           |          |                  |    |                              | \$1,078        |

- [ ] Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \$\_\_\_\_\_. A triplicate copy of this transmittal is attached.
- [xx] A check in the amount of \$1,078.00 is enclosed.
- [ ] The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. \_\_\_\_\_. A triplicate copy of this transmittal is attached.

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Utility Patent

KJMS File No. 630-03

Express Mail No. EE86900437008

- [ ] Any additional filing fees required pursuant to 37 C.F.R. § 1.16 including fees for presentation of extra claims.
- [ ] Any patent application processing fees pursuant to 37 C.F.R. § 1.17 and under 37 C.F.R. § 120(d).

Respectfully submitted,



Dated: January 26, 1999

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5                   **RAILROAD CABLE PLOW IMPROVEMENTS AND**  
                    **METHOD OF USING THE SAME**

10                   **Field of the Invention**

                    The present invention relates railroad cable plow  
or rail cable plow machines and improvements thereto. More  
particularly this invention relates to a variable ballast  
counterbalance control system and an interchangeable rail  
15 truck gauge system, both incorporated into or used with a  
rail cable plow machine. Each of these systems enhances  
the utility, versatility and plowing performance of the  
rail cable plow machine and accordingly, the efficiency of  
plowing operations.

20                   **Background of the Invention**

                    The need to provide utility cable, conduit and/or  
25 innerduct systems to meet the demands of society continues  
to increase in all countries. This is especially true  
wherever communication networks are being upgraded,  
expanded or installed. However, in certain geographic  
locations where a built-up, in-place infrastructure may not  
30 already exist, the installation of utility lines or cable  
networks is expensive and time consuming. Part of the  
expense and time is simply because of the lack of an  
existing infrastructure to use when installing the new  
lines or cables.

35                   Even with the expense and difficulty associated  
with burying utility and cable lines in certain areas,  
there are many advantages generally supporting the use of  
underground lines. Indeed, underground lines generally are  
unaffected by wind, rain, snow or ice, thereby reducing  
40 maintenance costs of the lines and very importantly raising  
the reliability and availability of the constructed system.

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Moreover, it is often the case that time and money may be saved if the utility lines, or other necessary continuous flexible lineal material are placed underground adjacent to railroad tracks in the railroad right-of-way. This is in part because the ground surrounding and adjacent to railroad tracks has been necessarily cleared in order to place the railroad tracks. As such, the burying of cable or lines adjacent to railroad tracks generally does not require extensive clearing or excavating of the adjacent terrain.

Moreover, and equally important, the logistics and bureaucratic requirements of burying cable may be simplified because railroad tracks provide a controlled right-of-way, that is generally under the authority of a single entity. As such, approvals and agreements typically need only be negotiated and achieved with one entity instead of numerous organizations or individuals.

The primary prior art relating to rail cable plow equipment is described in U.S. Patent No. 3,546,887 issued to Helmus for a Railroad Cable Laying Apparatus. The '887 patent, issued in 1970, described the then novel combination of positionable, side mounted cable laying assemblies on a track supported mobile base. The side mounted cable laying assemblies in the '887 patent incorporated a highly maneuverable, earth cutting blade on either side of the rail car base, enabling cable to be laid at specified depths and varied distances to the side of the railroad rail.

While the utility of a rail cable plow machine is recognized, certain problems continue to lessen certain performance aspects of the plowing operations, including speed of plowing. One problem relates to the lateral, side, rolling or twisting forces imparted to the rail car by and through the plow-arm during plowing operations.

The primary forces at issue are the mass of the plow-arm cantilevered away from the rail car center of

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gravity, and the frictional forces on the plow-blade as the plow-blade cuts through the ground. More specifically, the frictional and gravitational forces tend to drag the plow-blade, as well as twist the plow-arm. These forces, and  
5 the moments resulting from the forces, are known and accommodated on current operational rail cable plows.

Where, however, a plow-arm with extended lateral reach is required, the moments transferred to the rail car chassis proportionally increase with the plow arm length.  
10 Similarly, where a rail cable plow is used on a narrower gauge rail system, the forces and moments normally generated during plow operations may need to be offset to maintain the operational stability of the narrower rail car base.

Without other methods to ensure stability of the rail cable plow and ensure the forces and moments experienced and transferred to the rail car are within operational and safety limits during plowing operations, the rail cable plow speed may need to be reduced. Where a  
20 longer plow-arm is in use and/or plow operations are adjacent to a narrower gauge track, without other methods, on-track plow operations may not be permitted at all if safety is in question. This reduction in plowing speed means longer times to install cable and lines, and may  
25 equate into decreased efficiencies and increased operational costs. Where on-track operations are disallowed, conventional off-track methods must be used that are both slower and less cost effective.

Various improvements and additions to plow mechanisms have been patented. Indeed, one such reference discloses a device to enhanced safety during transit of the rail cable plow machine. More specifically, U.S. Patent  
30 No. 4,784,524, issued to Stine for a Railroad Cable Laying Apparatus With Plow Blade Support And Dual Plow Tethering, discloses an improvement to the cable laying machine taught  
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in the '887 patent. The '524 patent comprises a pair of plow blade rests, each with a stop bar, for receiving and supporting the plow blades, and to prevent the blade from sliding off the rest. Also disclosed in the '524 patent is  
5 a tethering device connected between the two plow blades as a further check to keep the blades from sliding off the rests during transit of the rail cable plow machine.

In U.S. Patent No. 4,890,958, issued to Dancer for a Railroad Cable/Pipe Plow And Method Therefor, a novel  
10 railroad cable plow is described that includes a standard railroad flat car; a hydraulic boomed vehicle attached to the flat car; and a steerable plow attached to the hydraulic boom. The combination of otherwise standard rail and construction equipment allows a utility line installer  
15 to plow along railroad right-of-ways without owning or using a specialized railroad trenching car as disclosed in the '887 patent. However, the '958 patented plow system suffers from the same force and moment problems noted above as the "specialized" rail cable plow machines. Indeed,  
20 these force and moment problems are exacerbated by the fact that the forces, transferred through the boomed vehicle, are translated to the rail car at points considerably above the centroid of the rail car and rail-truck assembly than in the '887 patent system, which results in increased  
25 moments.

The use of ballast in rail car applications for any purpose, besides the normal ballast supporting the track rails, is very limited. For example, while not disclosing any rail plow aspects, U.S. Patent No.  
30 3,719,152, issued to Harter for a Railroad Car With Fluid Side Bearing Antisway Means, teaches using fluid dampers between the rail car truck frame and the rail car body. The purpose of the fluid dampers is to restrict or minimize lateral sway of the rail car during transportation.

35 Similarly, U.S. Patent No. 3,605,633, issued to Townsend, for a Stabilized Unit Train, discloses a passive

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stabilization system for unit trains. The passive stabilizer is a liquid storage tank allowing the free flow of liquid from one section of the tank to another section of the tank. As described in the '633 patent, because the motion of the liquid is out of phase with train resonance undulations, the train undulations are damped, thereby increasing longitudinal stability of the unit train.

As noted neither U.S. Patent No. 3,719,152 nor U.S. Patent No. 3,605,633, describe or even suggest the use of ballast of any kind to counteract or balance a railcar against lateral, side or rolling forces imparted through a plow-arm.

While each of these patented devices addresses a problem relating to plowing procedures or railcar operations, as noted, none is directed to solving the plow-blade reactive force problems described above that are encountered during rail cable plow operations. As such, these problems, as well as other deficiencies are intended to be overcome and solved by the present invention.

Accordingly, it would be desirable to have a system to enhance operational stability of a rail cable plow and thereby enable a greater lateral reach of the plow-blade and/or use of the rail cable plow on various narrower gauge track systems. Such a system could include a ballast counterbalance control system incorporated into a rail cable plow machine to overcome some of the reactive forces imparted to the rail car. Moreover, in view of the enhanced rail car stability achieved by the inventive improvements, it would be efficient and desirable to have a rail cable plow machine with truck assemblies that can be easily interchanged or replaced with different gauge truck assemblies, thereby permitting use of the rail cable plow machine on different, including narrower gauge tracks. Such improvements and results have not been seen or achieved in the relevant art.

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\$1Summary of the Invention

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The above noted problems inadequately or incompletely resolved by the prior art are addressed and resolved by the present invention.

10 A preferred aspect of the invention is a multi-compartment and variable ballast counterbalance control system for use on a railroad plow machine, said railroad plow machine having a chassis and at least one plow arm articulably attached to said chassis, said multi-compartment and variable ballast control system comprising  
15 a plurality of compartments attached to the railroad plow chassis; ballast; means to introduce the ballast into each said compartment, whereby the forces imparted to the railroad plow chassis through the plow-arm during plowing operations are counterbalanced by the ballast weighted  
20 compartments; and means to remove the ballast from each said compartment after completion of the plowing operations.

In further preferred aspects of the present invention, the multi-compartment and variable ballast  
25 control system has interconnection means and transfer pump means between the plurality of compartments to permit transfer of the ballast.

In other preferred embodiments of the present inventive device, the multi-compartment and variable  
30 ballast control system uses fluid, fluid-based, granular or solid ballast.

In other preferred aspects of the present inventive device, the multi-compartment and variable ballast control system has fluid sealed compartments to  
35 permit use of fluid, fluid-based or water ballast.

In still yet another preferred embodiment of the present invention, the multi-compartment and variable ballast control system having a railroad car chassis, to

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which the variable ballast control system is attached, is mounted upon at least two trucks, each said truck having a plurality of wheels and a specific gauge; said chassis comprising means to remove and substitute the railroad car chassis trucks with chassis trucks of a different gauge.

In a preferred method of use embodiment of the present inventive counterbalance ballast control system for use on railroad cable and conduit plow machines during plowing operations along side railroad tracks, with said ballast control system having a plurality of compartments attached to the railroad plow machine; said method comprising the steps of transporting the railroad plow machine, without ballast, to a site requiring plowing along side the railroad tracks; preparing the railroad plow machine for plowing operations; introducing ballast into at least one of the plurality of compartments on the side opposite to the side of plowing operations to counterbalance the forces imparted to the railroad plow during plowing operations; removing the ballast from the plurality of compartments after completing the plowing operations; and transporting the railroad plow machine to another site to be plowed.

The invention will be best understood by reading the following detailed description of the preferred embodiments in conjunction with the drawings briefly described below.

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85Brief Description of the Drawings

For the purpose of illustrating the invention,  
5 the attached drawings show several embodiments that are presently preferred. However, it should be understood that the invention is not limited to the precise arrangement and instrumentality shown in the accompanying drawings.

Fig. 1: is a perspective view of the cable plow  
10 car in a preferred embodiment having the inventive improvements;

Fig. 2: is a top view of a cable plow car in a preferred embodiment with the ballast tank system, and shown without the plow-arm or plow-blade for clarity;

15 Fig. 3: is a side view of a cable plow car in a preferred embodiment with the ballast tank system, and shown without the plow-arm or plow-blade for clarity;

Fig. 4: is a top view of a cable plow car in a preferred embodiment with the ballast tank system, shown  
20 with the plow-arm and plow-blade assemblies;

Fig. 5: is a side view of a cable plow car in a preferred embodiment with the ballast tank system, shown with the plow-arm and plow-blade assemblies; and

Fig. 6: is a schematic of a preferred  
25 embodiment of the ballast pump flow circuit between two ballast tanks.

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84Detailed Description of Preferred Embodiments

5 The present invention comprises improvements relating to rail cable plow machines. These improvements, among other objectives, provide a more stable rail car platform for conducting plowing operations and for burying continuous flexible lineal material. With a more stable platform, the operational capability and efficiency of the rail cable plow may be increased. For example, in addition  
10 to being able to use a plow-arm with an extended lateral reach, the more stable rail cable plow can also be used effectively on narrower gauge rails. As such, with the enhanced stability of the rail plow achieved through the incorporation of the inventive improvements, a rail plow  
15 may be used in applications that are not currently possible. Further, with enhanced stability of a rail cable plow in current applications, the speed of plow operations need not be reduced and, indeed, may be increased under certain conditions.

20 Although the disclosed stability improvements are equally applicable to and effective with rail plow machines used to bury or lay cable, conduit, pipe, innerduct or other similar continuous flexible lineal materials, for consistency and economy, all such rail plow machines will  
25 be referred herein to as "rail cable plows."

In a preferred embodiment, as shown in Fig. 1, an inventive improvement to the rail cable plow is the incorporation of a single or multiple compartment, variable ballast counterbalance control system. The variable  
30 ballast system is used to counterbalance the gravitational and frictional forces imparted to the rail car during plowing operations through the plow-arm. Those forces include the mass of the plow-arm with the plow-arm extended laterally away from the rail car chassis, and the  
35 frictional forces on the plow-blade while the plow cuts a trench in the ground adjacent to the rail track. The variable ballast counterbalance system is described in

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detail herein.

As noted, in view of the more stable rail cable plow platform, a further preferred embodiment of the inventive improvements comprises a system of interchanging  
5 rail cable car trucks of different gauge to permit time efficient access of the railroad cable plow machine to narrower gauge railroad track systems.

#### Variable Ballast Counterbalance System

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As shown in *Figs. 2 and 3*, in a preferred embodiment of the inventive improvements for rail cable plow machines, a multiple compartment ballast  
15 chassis 20. For clarity, the plow-arm and plow-blade assemblies of the rail cable plow are not shown in *Figs. 2 and 3*. The plow-arm and plow-blade assemblies are shown in greater detail in *Figs. 4 and 5*.

The plurality of compartments, as shown in *Figs. 2 and 3*, are separate tanks 50 into which ballast 60 may be  
20 individually and selectively introduced. By selective, the inventive system is designed such that the tanks 50 need not be filled with the ballast 60. Moreover, not all of the tanks 50 need be used. In other words, as a function of  
25 plowing operations and needs, any amount of ballast 60 can be introduced into any one or more of the tanks 50.

The ballast 60 may be introduced into each tank 50, as shown in *Fig. 2*, through fill connections 52 or  
openings located in the top of each tank 50.

The tanks or compartments 50 are configured and placed on the rail car chassis 20 such that with the  
30 selective addition of ballast 60 into the compartments 50, increased weight may be selectively applied to a certain section or sections of the rail car chassis 20. Through  
35 the selective addition of ballast to the rail car chassis 20, certain reactive forces imparted to the rail car

09238004-012699

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through the plow-arm 30, shown in Figs. 4 and 5, during plowing operations will be counterbalanced. By counterbalancing the reactive forces, the stability of the rail car during plowing operations is enhanced. In view of the variable feature of the present invention, if larger reactive forces are expected to be encountered, by simply introducing additional ballast, the larger forces can be counterbalanced.

While the Fig. 2 embodiment shows three separate compartments 50 located at the front, rear and center sections of the rail car, in another preferred embodiment, the compartments 50 may be divided, or further divided, into left and right side tanks located at or near the front and rear sections of the rail car, as illustrated in Fig. 6. In a further preferred embodiment, the center section compartment could also be divided into left hand and right hand compartments.

By way of example, use of the variable ballast counterbalance system, in the preferred embodiment having left and right side compartments could be as follows. Ballast 60 may be introduced into the left side compartments of the rail car chassis 20 when the plow-arm 30 on the right side of the rail car is extended and cutting a trench. In this configuration, the ballast on the left side of the chassis 20 will counterbalance the forces of the right side plow-arm 30 and plow-blade 40 cantilevered away from the rail car chassis 20.

While the addition of ballast 60 to the compartments 50 on the rail car side opposite the extended plow-arm tends to counterbalance the weight of the plow-arm 30, this is not the only method of using the variable ballast counterbalance control system. For example, other plowing operations may call for the addition of ballast 60 to all compartments 50 on the rail car in order to counterbalance varied reactive forces imparted to the chassis 20.

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While the preferred embodiment shown in Fig. 2 has multiple compartments, in another preferred embodiment, a single tank having a plurality of separate internal compartments, may be affixed to the rail car chassis 20.

5 Because the internal compartments of the single tank embodiment are separated, this embodiment has similar utility and features as the plurality compartment embodiment described above and shown in Fig. 2 and 3. For the single tank embodiment to have the greatest utility and  
10 range of counterbalancing, the tank should be dimensioned and configured to cover the rail car chassis 20 similar to the Fig. 2 embodiment.

As described above, during certain plowing operations, it may be desired to use or fill all of the  
15 ballast compartments 50. By filling all of the ballast compartments 50, the entire rail car is weighted to counterbalance forces imparted to the chassis 20 from any direction. While this uniform introduction of ballast to the entire rail car offers certain operational advantages,  
20 including ease of implementation, due consideration and accounting of railroad weight restrictions must be made.

Indeed, a wide range of maximum allowable weights exist between rail systems in different countries. A fully ballast laden rail car used in one country may be precluded  
25 from use in another country simply because it exceeds the track weight limitations in that country.

In North America, the United States and Canada for example, the maximum allowable weight of a four-axle rail car is 260,072 lbs. In Japan, by comparison, the rail  
30 track limit weight is only 167,504 lbs. In Latin and South America, Mexico's rail system has a weight limit of 193,952 lbs., while the narrow gauge rail system in Brazil is limited to 176,320 lbs. As such, the amount of ballast that can be used on the rail car may be limited by track  
35 weight restrictions. The following table provides an example range of allowable ballast weights for several

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countries assuming an unloaded four-axle rail cable plow car of 130,000 lbs.

| Country<br>[gauge (mm)] | Max Weight Limit<br>(lbs) | Max Ballast Weight<br>(lbs) |
|-------------------------|---------------------------|-----------------------------|
| U.S.A. (1435)           | 260,072                   | 130,072                     |
| Canada (1435)           | 260,072                   | 130,072                     |
| Japan (1435)            | 167,504                   | 37,504                      |
| Argentina (1435)        | 203,000 (est.)            | 73,000 (est.)               |
| Brazil (1600)           | 220,400                   | 90,400                      |
| Brazil (1000)           | 176,320                   | 46,320                      |
| Chile (1600)            | 220,400                   | 90,400                      |
| Columbia (914)          | 132,240                   | 2,240                       |
| India (1676)            | 201,886                   | 71,886                      |
| Mexico (1435)           | 193,952                   | 63,952                      |
| Australia (1067)        | 198,400                   | 68,400                      |
| Australia (1435)        | 212,400                   | 82,400                      |

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The inventive variable ballast counterbalance system specifically addresses this potential overweight problem. As described above, because the inventive variable ballast counterbalance system allows use of variable amounts of ballast, less ballast may be added to the compartments or ballast may be added to a limited number of compartments, where weight limitations exist. Accordingly, even though weight restrictions may exist on certain rail systems, or indeed on certain sections of a rail system, the rail cable plow can still be used effectively through selective placement, addition or removal of ballast to counterbalance the plowing reactive forces. Thus, plowing operations may continue on varied rail systems having dissimilar weight restrictions, while still ensuring the rail car operating weight complies with the current rail system weight limitations and ensuring the lateral force limitations are not broached.

09238004-012699

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The inventive variable ballast control system also enhances fuel economy during transit and non-plowing operation. During transit between plowing or trenching locations, fuel consumption and accordingly shipping costs, can be substantially reduced if the rail car weight is reduced by removal of unnecessary ballast 20. As such, in a preferred embodiment, as shown in Fig. 3, drain connections 51 are installed at the bottom of each compartment to permit removal of ballast. In other preferred embodiments, the "drains" or "access ports" may be placed at the top or side of each compartment 50.

#### Preferred Embodiments Of Ballast

A wide range of materials may be used as effective ballast in the inventive counterbalance ballast control system. For example, fluid, fluid-based or slurry materials, as well as dry materials are effective as ballast.

In one preferred embodiment, water is an excellent ballast material. Water is readily available at most any location, even in remote underdeveloped or undeveloped areas. Water has a relatively high weight density of 62.4 lbs/cubic feet. Moreover, after completing plowing operations, the water ballast offers the additional feature that it may simply be drained into the environment with little or no concern of environmental issues.

Where water is used as ballast, further preferred embodiments are disclosed that include features addressing the physical characteristics and effects of water as ballast. For example, one such feature in a preferred water ballast embodiment, is that the plurality of compartments 50 are each constructed to be fluid-sealed. Another aspect of using water as ballast is the potential for corrosion. Accordingly, in a preferred embodiment, the

09238004-012699

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interior of the compartments 50 should be sealed with a corrosive protective coating to prevent oxidation, rust or other corrosion.

In a further preferred embodiment for use with water ballast in either the multiple compartment embodiment or the single tank embodiment having separate internal compartments described above, the ballast counterbalance system includes at least one hydraulic transfer pump 53. As shown in Fig. 6, the transfer pumps 53 are located between the several compartments 50. The transfer pumps 53 allow controlled transfer of the ballast 60 between the several compartments 50 through interconnection piping. The transfer of ballast between the several compartments allows controllable variation of the location of the added weight to accommodate varied plowing operations. Through use of transfer pumps 53, the ballast 60 held within the compartments may be varied without removing the ballast.

As noted above, the use of water ballast also provides an environment for corrosive decay within the plurality of compartments. In a preferred embodiment, one or more cathodic protective anodes are mounted within each of the plurality of compartments. The anodes are directly connected to the compartment interior structure. To be completely effective, the protective anodes must be constructed of a different metal than the compartments metal. It is through direct connection of the different metals that an electric current is generated that polarizes the surface of the compartment, thereby protecting the compartment from active corrosion. In one preferred embodiment, an effective means for cathodic protection uses anodes of a magnesium material. Other anodic materials are alternatively used to achieve cathodic protection including zinc.

To reduce undesired or inadvertent motion of the water ballast within each of the compartments, especially during plow operations and transit, the compartments may be

09238004-012699

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equipped with one or more internal baffles or dividers. The compartment baffles dampen motion of the water while the rail car is in motion and therefore minimize the effect of any liquid ballast sloshing within the compartments.

5 Various designs of baffles are effective within the compartments. One such preferred embodiment comprises a plurality of baffles installed within the compartments, with the baffles constructed in a honey-comb design. The honey-comb design prevents the water ballast from sloshing  
10 within the compartments while still allowing the fluid to flow through the baffle at a reduced rate.

When water is used as the ballast in colder climates there is the potential that the water may freeze. Frozen ballast is not desired because, as a minimum, as a  
15 solid, the ballast is no longer variable. To prevent the water ballast from freezing, in preferred embodiments, the rail car plurality of compartments may be equipped with heating elements. The heating elements may be electrical, drawing power from the rail car electric generator. In  
20 another embodiment, heated coolant from one or more of the hydraulic main pumps and/or one or more of the diesel electric generators may be diverted to or around the plurality of compartments. In still other preferred embodiments, an antifreeze additive, such as ethyl glycol  
25 may be introduced to the plurality of compartments to prevent freezing of the water ballast.

While freezing ballast is an issue in colder climates, where the rail cable plow machine is operated in hotter regions, the pressurization of the compartments due  
30 to the heating of the water ballast may be an issue. As such, in further preferred embodiments, pressure relief valves are incorporated into the plurality of compartments to allow the compartments to release excess internal pressure. Moreover, to permit monitoring of the  
35 compartments internal pressure, pressure gauges or indicators may be installed in the several compartments.

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Similarly, vacuum relief valves may be included into the plurality of compartments to prevent the creation of undesired vacuum or low pressure conditions within the compartments.

5           While the above description relates to using water as the ballast material, other fluids or fluid-based materials may also be used as ballast. For example, a slurry, being a mixture of a fluid or fluidizer and particulate material, offers certain advantages over water  
10 as the ballast. A slurry generally will have higher density and viscosity characteristics than water. Moreover, a properly selected slurry may alleviate the concern of the ballast freezing in colder climates.

          In addition to fluid-based ballast, in other  
15 preferred embodiments, the ballast counterbalance system may use a sand, granular silica or other type of dry granular material as ballast. While sand may not be as readily available as water, it does provide increased weight density characteristics as compared to water.  
20 Moreover, like water, sand is a material that may be easily disposed, generally without raising environmental concerns.

          With the use of sand or granular ballast, the above described aspect of a transfer pump may be substituted with one or more transfer blowers. Like the  
25 transfer pump, the blower allows controlled transfer of the dry ballast between the several compartments through interconnection piping without removing the ballast from the compartments.

          Similar to granular silica, steel shot may also  
30 be used in another preferred embodiment as a ballast material. Steel shot, weighing approximately 290 lbs/cubic foot, has more than 4 times the weight density of water. As such, by using steel shot in lieu of water ballast, either higher counterbalance forces can be achieved, or less  
35 volumetric ballast would be required for a selected ballast weight. Unlike water or sand, steel shot is not as easily

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used on many rail tracks in Latin or South America, without substantial modification. Rail track gauges also vary from 1435 millimeters in many parts of Europe, Asia, Australia and Africa.

5                   Accordingly, in a preferred embodiment of an improvement to a rail cable plow machine, the rail car trucks 80 attached to the rail car chassis 20 are releasable from the chassis. Upon release and removal of the rail car trucks 80, rail car trucks of a different  
10 gauge may be installed. As such, the rail cable plow machine may be used on different gauge track systems by simply interchanging or substituting the appropriate gauge trucks for the track system being used for plowing.

                  Rail car trucks of a specific gauge have bolsters  
15 positioned to contact opposing bolsters on the rail car chassis 20. The opposing bolsters prevent excessive body roll or sway of the rail car chassis during transit. Because the described preferred embodiment of the rail cable plow provides for quick interchange of different  
20 gauge trucks 80, the rail cable plow chassis 20 is manufactured with bolsters incorporated into several lateral positions to appropriately contact and therefore oppose the bolsters on various gauge rail trucks.

25                   The above detailed description teaches certain preferred embodiments for the present inventive improvements to railroad plow machines. While preferred embodiments have been described and disclosed, it will be recognized by those skilled in the art that modifications  
30 and / or substitutions are possible and such modifications and substitutions are within the true scope and spirit of the present invention. It is likewise understood that the attached claims are intended to cover all such modifications and / or substitutions.

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62CLAIMSWhat is claimed is:

1. A multi-compartment and variable ballast  
5 counterbalance control system for use on a railroad plow  
machine, said railroad plow machine having a chassis and at  
least one plow arm articulably attached to said chassis,  
said multi-compartment and variable ballast control system  
comprising:
- 10 a plurality of compartments attached to the  
railroad plow chassis;  
ballast;  
means to introduce the ballast into each  
said compartment, whereby the forces imparted to the  
15 railroad plow chassis through the plow-arm during plowing  
operations are counterbalanced by the ballast weighted  
compartments; and  
means to remove the ballast from each said  
20 compartment after completion of the plowing operations.
2. The multi-compartment and variable ballast  
control system of claim 1, further comprising internal  
interconnection means between the plurality of  
compartments.
- 25 3. The multi-compartment and variable ballast  
control system of claim 2, further comprising pump means to  
controllably transfer the ballast between the plurality of  
compartments through the internal interconnection means.
- 30 4. The multi-compartment and variable ballast  
control system of claim 2, further comprising blower means  
to controllably transfer the ballast between the plurality  
of compartments through the internal interconnection means.
5. The multi-compartment and variable ballast  
35 control system of claim 1, wherein the railroad plow  
chassis has a left side, right side, and further wherein

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the plurality of compartments are attached to the left and right sides of the railroad plow chassis.

5 6. The multi-compartment and variable ballast control system of claim 1, wherein the railroad plow chassis has a left side, right side, front section and rear section, and further wherein the plurality of compartments are respectively attached to the railroad plow chassis left side, right side, front section and rear section.

10 7. The multi-compartment and variable ballast control system of claim 1, wherein the railroad plow chassis has a front, rear and center section, and further wherein the plurality of compartments are respectively attached to the railroad plow chassis front, rear and center sections.

15 8. The multi-compartment and variable ballast control system of claim 1, wherein the means to introduce the ballast into each of the plurality of compartments is a fill connection.

20 9. The multi-compartment and variable ballast control system of claim 1, wherein the means to remove the ballast from the plurality of compartments is a drain in each said compartment.

25 10. The multi-compartment and variable ballast control system of claim 1, wherein the plurality of compartments are fluid-sealed.

11. The multi-compartment and variable ballast control system of claim 1, where the ballast is a fluid.

30 12. The multi-compartment and variable ballast control system of claim 1, where the ballast is water.

13. The multi-compartment and variable ballast control system of claim 1, where the ballast is a fluid-based composition.

35 14. The multi-compartment and variable ballast control system of claim 1, where the ballast is a granular

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material.

15. The multi-compartment and variable ballast control system of claim 1, where the ballast is a granular silica material.

5           16. The multi-compartment and variable ballast control system of claim 1, where the ballast is steel shot.

10           17. The multi-compartment and variable ballast control system of claim 10, wherein the plurality of fluid sealed compartments each further comprise at least one internal baffle to minimize fluid motion.

15           18. The multi-compartment and variable ballast control system of claim 10, wherein the plurality of fluid sealed compartments each further comprise a plurality of internal baffles to minimize fluid motion.

19. The multi-compartment and variable ballast control system of claim 18, wherein the plurality of internal baffles have a honey-comb construction.

20           20. The multi-compartment and variable ballast control system of claim 12, further comprising heating means within each said plurality of compartments to prevent freezing of the water ballast.

25           21. The multi-compartment and variable ballast control system of claim 12, further comprising additive means introduced into each said plurality of compartments containing the water ballast, to prevent freezing of the water ballast.

30           22. The multi-compartment and variable ballast control system of claim 1, wherein the plurality of compartments are internally sealed with a corrosion inhibiting coating.

35           23. The multi-compartment and variable ballast control system of claim 1, further comprising a plurality of cathodic protection anodes mounted within each said plurality of compartments.

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24. A counterbalance ballast control system for use on railroad plow machines used to plow trenches for laying cable, pipe, innerduct and conduit along side  
5 railroad tracks; said ballast control system comprising:  
a railroad car chassis having a front section, rear section and two sides;  
a plurality of containers for holding ballast, said containers being attached to the railroad car  
10 chassis front section, rear section and two sides;  
ballast; and  
means to removably introduce the ballast into the plurality of containers attached to the railroad car chassis, whereby the ballast weighted plurality of  
15 containers counterbalance forces imparted to the railroad car chassis during plowing operations.

25. A variable ballast counterbalance control system for use on a railroad plow machine, said railroad  
20 plow machine having a chassis and at least one plow arm articulably attached to said chassis, said variable ballast control system comprising:  
a compartment attached to the railroad plow chassis;  
25 ballast;  
means to introduce the ballast into the compartment, whereby the forces imparted to the railroad plow chassis through the plow-arm during plowing operations are counterbalanced by the ballast weighted compartment;  
30 and  
means to remove the ballast from the compartment after completion of the plowing operations.

26. A counterbalance ballast control system for  
35 use on railroad plow machines used to plow trenches for laying cable, pipe, innerduct and conduit along side

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railroad tracks; said ballast control system comprising:  
a railroad car chassis having a front, rear  
and center sections;

solid ballast;

5 means for receiving the solid ballast, said  
receiving means being affixed to the railroad car chassis  
front, rear and center sections; and

means for rigidly maintaining the solid  
ballast on the railroad car chassis front, rear and center  
10 sections, whereby the ballast weighted rail car chassis  
counterbalances forces imparted to the chassis during  
plowing operations.

27. The counterbalance ballast control system of  
claim 26, wherein the solid ballast is steel plate.

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28. A method of using a counterbalance ballast  
control system on railroad cable and conduit plow machines  
during plowing operations along side railroad tracks, said  
ballast control system having a plurality of compartments  
20 attached to the railroad plow machine; said method  
comprising the steps of:

transporting the railroad plow machine,  
without ballast, to a site requiring plowing along side the  
railroad tracks;

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preparing the railroad plow machine for  
plowing operations;

introducing ballast into at least one of the  
plurality of compartments on the side opposite to the side  
of plowing operations to counterbalance the forces imparted  
30 to the railroad plow during plowing operations;

removing the ballast from the plurality of  
compartments after completing the plowing operations; and

transporting the railroad plow machine to  
another site to be plowed.

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29. The multi-compartment and variable ballast control system of claim 1, wherein the railroad car chassis, to which the variable ballast control system is attached, is mounted upon at least two trucks, each said  
5 truck having a plurality of wheels and a specific gauge; said chassis comprising means to remove and substitute the railroad car chassis trucks with chassis trucks of a different gauge.

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60**ABSTRACT**

Improvements to railroad plow machines are disclosed. The improvements each enhance stability of the rail cable plow machine thereby permitting increased operational capability and efficiency. One preferred embodiment of the invention is a multiple compartment, variable weight ballast system used to counterbalance the forces imparted to the railroad car chassis by the plow blade during plowing operations. A further preferred embodiment is a system of interchanging different railroad gauge truck systems to permit use of the railroad plow on tracks of varying gauges.

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List of Figure Reference Numerals

- 10 Rail cable plow
- 20 Rail car chassis
- 30 Rail car plow-arm
- 40 Rail car plow-blade
- 50 Ballast compartment
- 51 Ballast compartment drain
- 52 Ballast compartment fill
- 53 Ballast compartment transfer pump
- 60 Ballast
- 80 Rail car trucks

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## COMBINED DECLARATION AND POWER OF ATTORNEY

As a below-named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name; and

I verily believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled: **RAILROAD CABLE PLOW IMPROVEMENTS AND METHOD OF USING THE SAME**, the specification of which:

[xx] is attached hereto.

[ ] was filed on \_\_\_\_\_ as  
Application Serial No. \_\_\_\_\_  
and was amended on \_\_\_\_\_  
(If applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any Amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 C.F.R. § 1.56(a).

I hereby claim foreign priority benefits under 35 U.S.C. § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of any application on which priority is claimed:

| Country | Number | Date Filed | Priority Claimed |
|---------|--------|------------|------------------|
| _____   | _____  | _____      | <u>none</u>      |
| _____   | _____  | _____      | _____            |
| _____   | _____  | _____      | _____            |

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s) listed below and, insofar as the

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Utility Patent

KJMS File No. 630-03

subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose material information as defined in 37 C.F.R. § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

| Application Serial No. | Filing Date | Status (patented,<br>pending) |
|------------------------|-------------|-------------------------------|
|                        |             | none                          |
|                        |             |                               |
|                        |             |                               |

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I hereby appoint Kevin W. Goldstein, Registration No. 34,608, of the law firm of KELLEY JASONS McGUIRE & SPINELLI, L.L.P., One Penn Center, 1617 JFK Boulevard, Suite 1400, Philadelphia, Pennsylvania 19103, to prosecute this application and to transact all business in the United States Patent and Trademark Office connected therewith, and

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I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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|   |                                                                                   |                                                                 |                        |
|---|-----------------------------------------------------------------------------------|-----------------------------------------------------------------|------------------------|
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|   | Post Office Address                                                   |                                |                                                  |

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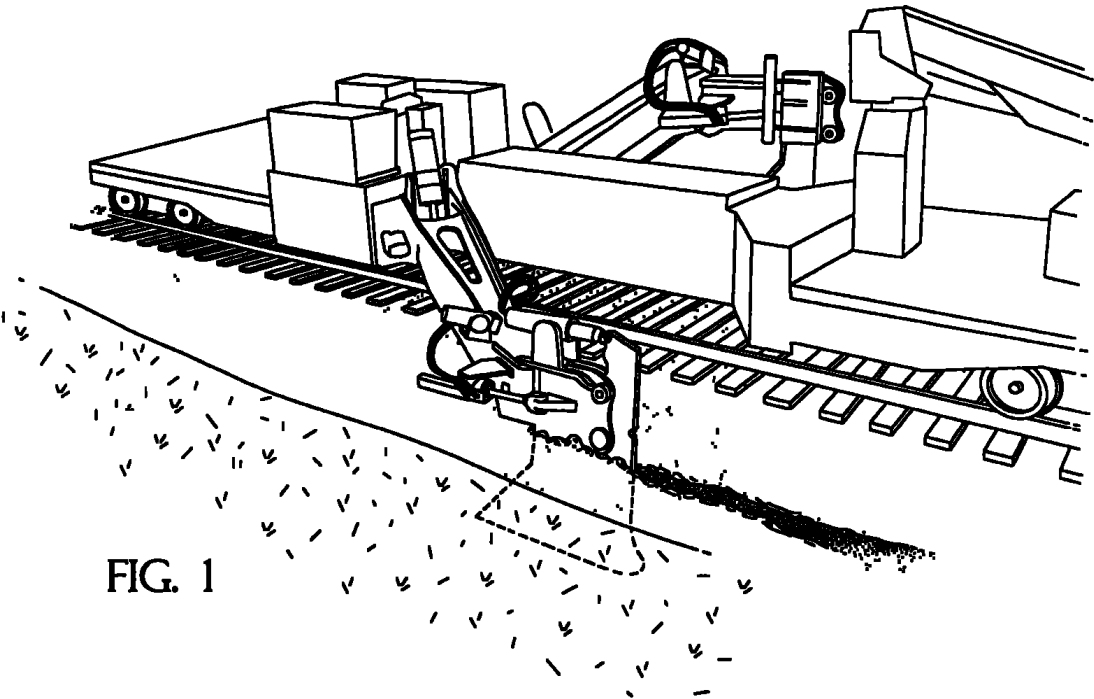


FIG. 1

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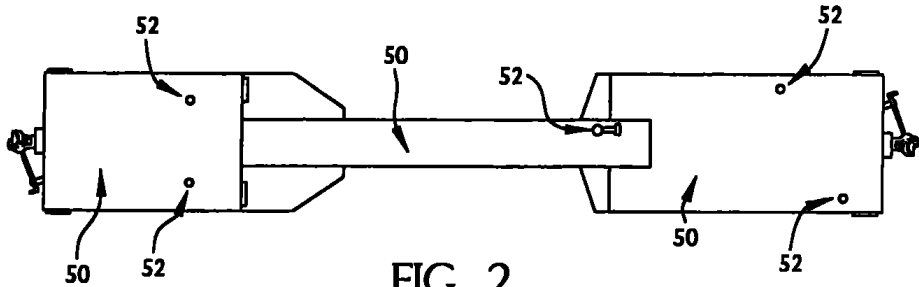


FIG. 2

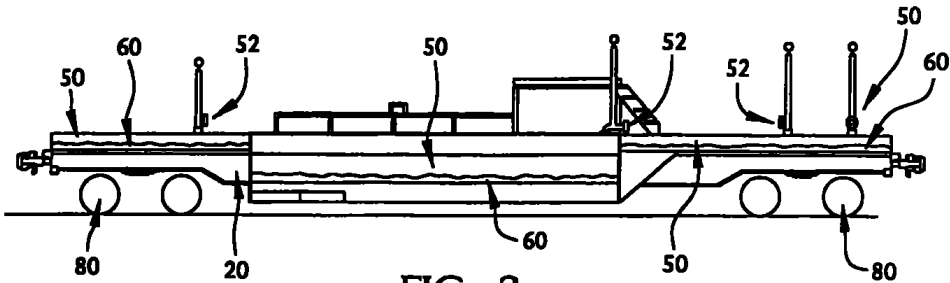
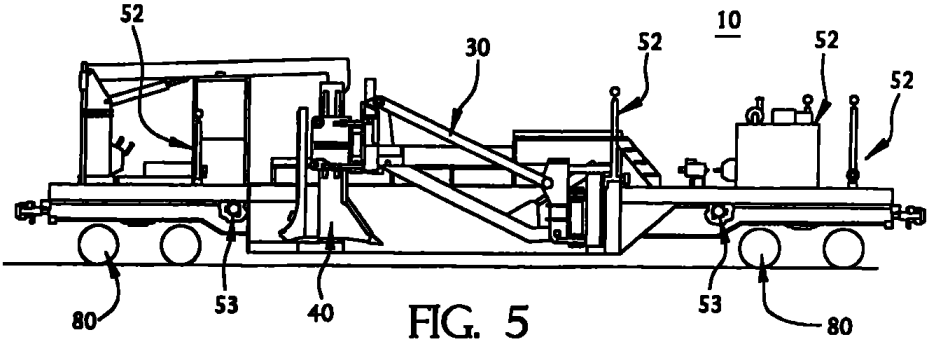
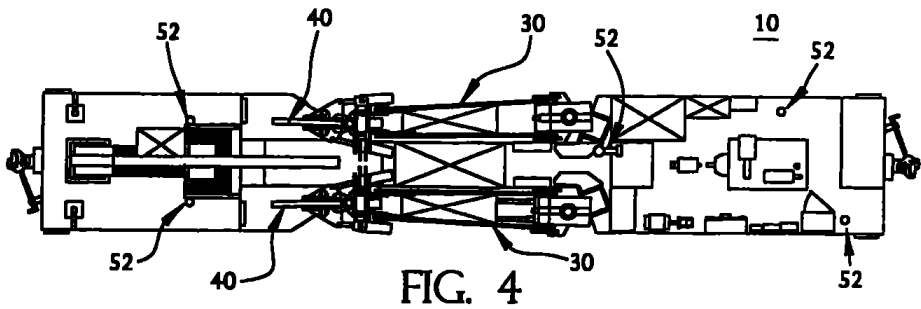


FIG. 3

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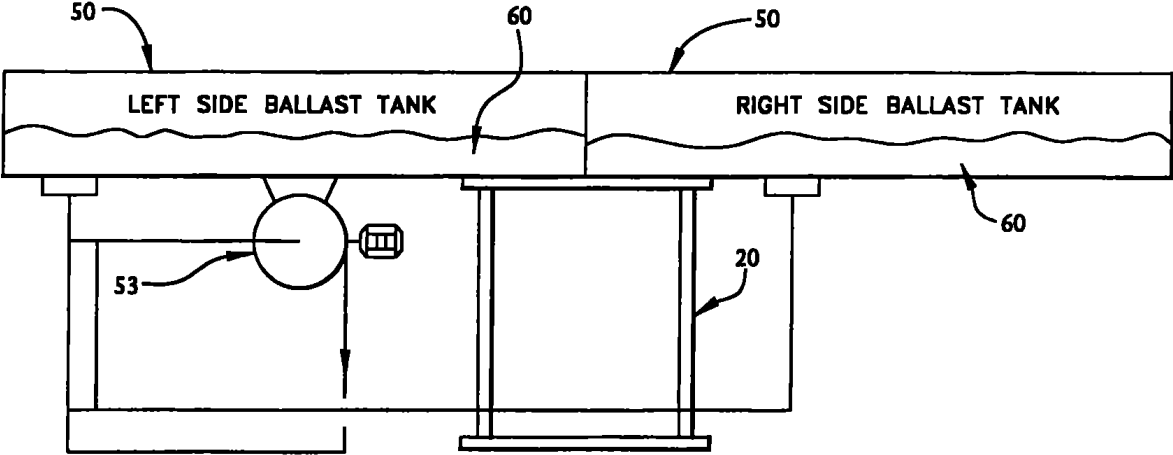


FIG. 6

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**Febrero 3 del 2000**

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