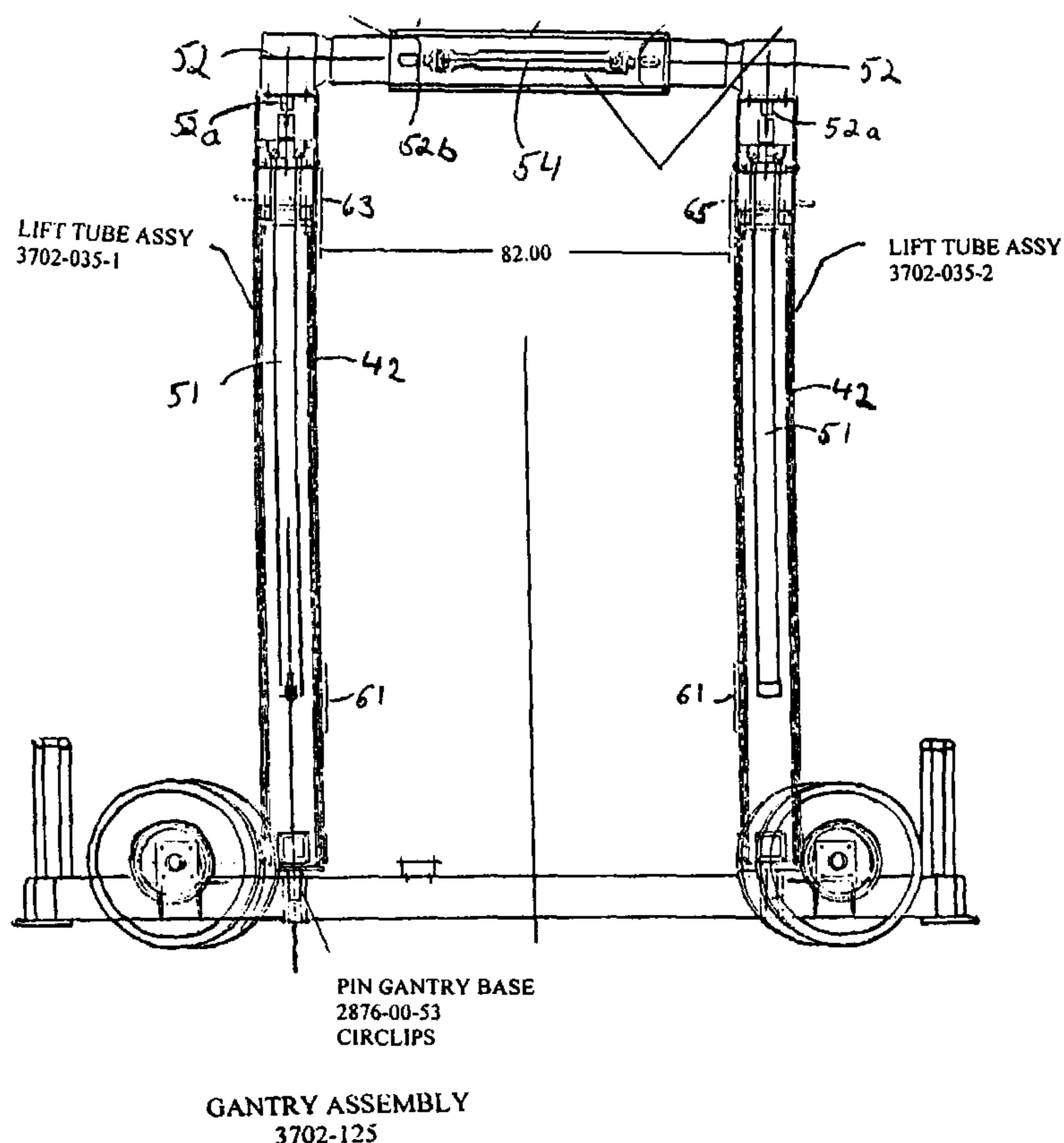


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(54) **MECANISME DE LEVAGE POUR PASSERELLE
D'EMBARQUEMENT PASSAGERS**
(54) **A LIFT MECHANISM FOR A PASSENGER LOADING BRIDGE**



(57) The present invention relates to a passenger loading bridge, in particular to an apparatus for synchronising two motors used in raising the passenger loading bridge. Synchronisation is achieved by physically coupling the drive shafts of the motors together to ensure that the shafts rotate at a same speed. Each drive shaft is then coupled to a lift mechanism for lifting and lowering a side of the passenger loading bridge such that each side is lifted and lowered in union.

Abstract of the Disclosure

The present invention relates to a passenger loading bridge, in particular to an apparatus
5 for synchronising two motors used in raising the passenger loading bridge.

Synchronisation is achieved by physically coupling the drive shafts of the motors together to ensure that the shafts rotate at a same speed. Each drive shaft is then coupled to a lift mechanism for lifting and lowering a side of the passenger loading bridge such that each side is lifted and lowered in union.

A Lift Mechanism for a Passenger Loading Bridge

Field of the Invention

The invention relates generally to a passenger loading bridge, and in particular to lift mechanism including a motor synchronisation apparatus for use in synchronising the
5 motors used to lift and lower an end of the loading bridge for alignment with an airplane entry.

Background of the Invention

Passenger loading bridges have gained worldwide acceptance for the safety and convenience they afford passengers. Most major air terminals are provided with gates,
10 gangways or passenger loading bridges which extend from the second level of the terminal to a parked aircraft. Frequently, these bridges are relatively immobile since aircraft can park close to the terminal and be moved away by tugs or tractors.

Commonly, passenger loading bridges have been directed to standard size passenger and cargo aircraft and consequently, have been relatively large in size and
15 height. They have not generally been practicable for use with small aircraft such as, those employed in feeder lines to smaller or outlying communities. Accordingly, passengers typically have had to walk from the terminal over airport tarmac and thence up a stairway in order to enter a small aircraft. This exposes passengers to inclement weather and hazards such as propellers, cables, and fuelling hoses. It is not desirable to subject
20 passengers to inclement weather or to potentially dangerous ramp conditions. Also, aircraft operations are significantly slowed by allowing passengers onto the tarmac. For safety reasons, aircraft and equipment remain stationary while passengers are on the tarmac. Security is a concern because passengers can board incorrect aircraft or tamper with other craft. In order to increase security, it is a common practice to board only one
25 aircraft from the tarmac at any time. With passenger loading bridges in place, luggage is loaded, aircraft tests are executed, other aircraft are taxied, and so on while passengers board the aircraft. Other aircraft are capable of being boarded simultaneously when

sufficient gates exist. It is therefore desirable to provide a passenger loading bridge for use at these smaller air terminals to enhance the safety and comfort of passengers.

Commonly, smaller air terminals are only ground level structures at which aircraft park a fixed distance from the terminal building. There frequently are no tugs available.

5 This fixed distance is required to enable the aircraft to "power out" or move away from the building under its own power without damaging the building with a jet or propeller blast, or a physical collision between the aircraft and the terminal. This distance is greatest with a Boeing 727-200 aircraft, which is the largest aircraft normally serving these smaller terminals. A loading bridge must be easily adjustable to the different
10 distances during airport operation in order to service a number of different aircraft. Therefore, there has continued to be a need for a highly adjustable and enclosed passenger or cargo loading/unloading bridge that can be advantageously utilized with such small aircraft.

Large variation in the loading height of different common commuter aircraft also
15 requires a loading bridge able to be adjusted over a wide range of heights. Currently available loading gates for servicing commuter aircraft are capable of being raised and lowered to meet different aircraft heights.

A typical loading bridge is disclosed in U.S. patent No. 5,761,757 to Mitchell et al. The loading bridge is comprised of a cab for interfacing with an aircraft, a bubble
20 section allowing rotation of cab about the bubble section, and a walkway connecting the airport, the bubble section and the cab. The walkway is extensible to allow the cab to move outward from the airport. As shown in Fig. 1 of the patent, the walkway is supported on two standards – one on either side – that are provided with lift mechanisms. The lift mechanisms operate in a synchronised fashion through feedback from one to the
25 other. Thus, the walkway is raised or lowered in a substantially horizontal orientation to prevent tilt within the walkway to one side or another. The standards are on a mobile base for swinging the walkway about the bubble section. These features are well known features in passenger loading bridge design.

Failure to synchronise the lifts may result in a single motor performing all the work; this is potentially hazardous. As a safety feature, a brake integral to each motor is actuated upon failure of either motor and prevents the bridge from collapsing. Unfortunately, if a brake fails, an entire side of the loading bridge is left unsupported.

5 It would be advantageous to provide a passenger loading bridge with improved safety. It would also be advantageous to provide a simple method of synchronising the operation of each of the two motors for use in raising and lowering a passenger loading bridge.

Summary of the Invention

10 It is an object of the invention to provide a simple effective apparatus for synchronising two motors, such as electric motors, for use in raising and lowering a passenger loading bridge. The motors each provide drive for raising or lowering one side of the passenger loading bridge. Therefore, in order to maintain a level loading bridge, it is necessary that the motors are substantially synchronised.

15 In accordance with the invention there is provided a lift mechanism for a passenger loading bridge. The mechanism comprises a first motor including a drive shaft having a first end and a second end; a second motor including a drive shaft having a first end and a second end; a first standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with
20 and driven by the first end of the drive shaft of the first motor; a second standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the first end of the drive shaft of the second motor; and, a mechanical link between the second end of the drive shaft of the first motor to the second end of the drive shaft of the second motor such that
25 the drive shafts of the first motor and of the second motor are substantially restricted to turning at a same speed.

In accordance with another embodiment of the invention there is provided a lift mechanism for a passenger loading bridge. The mechanism comprises a first motor

including a drive shaft having a first end and a second end; a second motor including a drive shaft having a first end and a second end; a first standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the first end of the drive shaft of the first motor; a second standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the first end of the drive shaft of the second motor; and, a coupler coupling the second end of the drive shaft of the first motor to the second end of the drive shaft of the second motor such that the drive shafts of the first motor and of the second motor are substantially restricted to turning at a same speed.

In accordance with yet another embodiment of the invention there is provided a lift mechanism for a passenger loading bridge. The mechanism comprises a first motor including a drive shaft having a first end and a second end; a second motor including the drive shaft; a first standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the first end of the drive shaft; and, a second standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the second end of the drive shaft.

According to an embodiment of the invention wherein each motor has a separate drive shaft, the drive shafts each have an axis of rotation and the axes are coaxial. For example a shaft is disposed between and coupled to each second end.

Brief Description of Figures

An exemplary embodiment of the invention will now be described in conjunction with the attached drawings, in which:

- Fig. 1 is a plan view of a preferred embodiment of the present invention illustrated in a fully extended position;
- Fig. 2 is a side view of the embodiment of Figure 1; and
- Fig. 3 is a side view of a lift mechanism according to the invention.

Detailed Description of Preferred Embodiments

The loading bridge according to the present invention is shown generally at 10 in Fig. 1. The bridge 10 is supported at a terminal end 31 by a rotunda 20. The rotunda 20 communicates with the airport terminal (not shown) through a simple passageway, or an additional walkway of desired length (not shown). The rotunda 20 is fixed and supports the terminal end 31 of the enclosed bridge walkway 30 for hinged movement about a horizontal axis for height adjustment, and also for pivotal movement about a vertical axis through the rotunda 20. The rotunda 20 may be supported on a raised platform as shown, or may be directly at the ground level. Rotation may be about a central axis or an eccentric axis. The rotunda 20 remains enclosed by flexible curtains during movement of the passenger loading bridge 10 maintaining protection from the elements. Walkway 30 includes two telescopic sections 32, 34 that provide an expansion of approximately 20 feet. If more expansion is necessary additional telescoping sections may be added.

Adjacent an aircraft engaging end 33 the walkway 30 is supported by a wheeled gantry support means 40. The wheeled gantry 40 is powered to drive the aircraft engaging end 33 through the arc shown, while the terminal end 31 pivots about the rotunda 20. The wheeled gantry 40 also includes standards 42 to either side of the walkway 30 each comprising a mechanical screw jack lift for raising and lowering the height of the aircraft engaging end 33 of the bridge 10. Other lifting mechanisms may also be employed to raise the bridge 10. The screw jack lifts are preferred as they provide low braking requirements in the event of motor failure and slow decent of the passenger loading bridge in case of brake failure. Standards 42 are shown angled with their uppermost ends inclined toward the aircraft engaging end 33. This angle reduces lateral drag on the tires to prevent excessive wear as the bridge 10 is raised. Of course, though this angle has benefit, it is not necessary for carrying out the present invention.

As is evident to those of skill in the art from a review of Figs. 1 and 2, the lift mechanisms within the standards 42 operate synchronously. In order to achieve this, prior art loading bridges use electronic synchronisation to slow movement of one side of the passenger loading bridge or another in order to synchronise movement of both sides. This

is done using sensors and feedback to control one of braking and motor drive shaft speed. Though electronic motor synchronisation is well known and widely used, it would be preferred to use a simpler more cost effective and reliable method of motor synchronisation.

5 Referring to Fig. 3, a detailed view of standards 42 according to the invention is shown. A screw 51 extends a length within each standard. The loading bridge is provided with brackets (not shown) for mating with the screws 51 to cause the passenger loading bridge to rise as the screws 51 are rotated in one direction and to decline as the screws 51 are rotated in an opposite direction. Bearings interfacing between the screws 51 and
10 brackets reduce wear and enhance smooth motion of the passenger loading bridge 10. The screws 51 are each driven by an electric motor 52. The electric motors 52 include a drive shaft having a first end 52a and a second end 52b. The electric motors are selected to have sufficient power to raise half the weight of the bridge or more. Preferably, the electric motors have integral braking systems for preventing turning of the driven shaft
15 when the electric motor 52 fails. This in turns prevents the screw 51 from turning and locks the loading bridge in place.

According to the invention, the two motors 52 are mechanically synchronised by coupling the second end of the drive shafts 52b of each motor 52 together. This coupling ensures that each driven shaft turns at a same speed thus guaranteeing that each side of
20 the passenger loading bridge travels at a same speed. In Fig. 3, the coupling is shown as a mechanical bar 54 coupled to each second end 52b. Such a configuration requires, when a non-flexible bar is used, that the driven shafts have a same axis of rotation. Of course, using two motors having a same single driven shaft results in the same benefits as those achieved by coupling the second ends 52b together.

25 Advantageously when the motors 52 each comprise an integral braking system as is commonly found in motors of the type used in loading bridges, the method of synchronisation according to the present invention also guarantees that should one motor 52 or the other motor 52 fail, the integral braking system of the failed motor prevents raising or lowering of both sides of the passenger loading bridge. Also, should either

braking system fail, there exists in the other motor a duplicate breaking system for enhanced safety of passengers using the bridge and safety of personnel operating the bridge.

As shown in Fig. 3, the first end 52a of the driven shaft is at 90 degrees to the
5 second end 52b. This is useful when a screw lift mechanism is employed. Other lift mechanisms may require a first end 52a coaxial to the second end 52b. This will not adversely affect operation of the invention. Thus, as used herein, the driven shaft may comprise several non-contiguous shafts that are each driven by the motor either directly or indirectly. The invention relies on mechanical coupling of driven shafts of each motor
10 to ensure that the driven shafts rotate at a substantially same speed.

Because the present invention is implemented in the embodiment described herein with a statically coupled shaft for synchronising the two motors 52, it is rugged, reliable, inexpensive, and maintenance free. These are highly advantageous for a product used outdoors and installed in diverse locations. As such, the inventive synchronising apparatus
15 is advantageous for use in loading bridges.

Numerous other embodiment of the invention will be apparent to persons skilled in the art without departing from the spirit and scope of the invention as defined in the appended claims.

Claims

What is claimed is:

- 5 1. A lift mechanism for a passenger loading bridge comprising:
a first motor including a drive shaft having a first end and a second end;
a second motor including a drive shaft having a first end and a second end, the second
end mechanically linked to the second end of the drive shaft of the first motor for
substantially restricting the drive shafts to turning at a same speed;
10 a first standard including a lift for engaging the passenger loading bridge and for raising
and lowering the passenger loading bridge, the lift coupled with and driven by the first
end of the drive shaft of the first motor; and,
a second standard including a lift for engaging the passenger loading bridge and for
raising and lowering the passenger loading bridge, the lift coupled with and driven by the
15 first end of the drive shaft of the second motor.
2. A lift mechanism for a passenger loading bridge as defined in claim 1 wherein the
second ends of the drive shaft are mechanical linked by a shaft disposed between the
second ends and coupled thereto.
- 20 3. A lift mechanism for a passenger loading bridge as defined in claim 2 wherein the
shaft is a sleeve.
4. A lift mechanism for a passenger loading bridge as defined in claim 1 wherein the
25 second ends of the drive shaft are permanently linked.
5. A lift mechanism for a passenger loading bridge as defined in claim 1 wherein the
second end of the drive shaft of the first motor is for mating with the second end of the
drive shaft of the second motor.

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6. A lift mechanism for a passenger loading bridge as defined in claim 2 wherein the drive shafts have a substantially same axis of rotation.

7. A lift mechanism for a passenger loading bridge comprising:

- 5 a first motor including a drive shaft having a first end and a second end;
a second motor including a drive shaft having a first end and a second end;
a first standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the first end of the drive shaft of the first motor;
10 a second standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the first end of the drive shaft of the second motor; and,
a coupler coupling the second end of the drive shaft of the first motor to the second end of the drive shaft of the second motor such that the drive shafts of the first motor and of
15 the second motor are substantially restricted to turning at a same speed.

8. A lift mechanism for a passenger loading bridge as defined in claim 7 wherein the coupler comprises a shaft disposed between the second ends and coupled thereto.

- 20 9. A lift mechanism for a passenger loading bridge as defined in claim 8 wherein the drive shafts have a substantially same axis of rotation.

10. A lift mechanism for a passenger loading bridge as defined in claim 9 wherein the shaft is a rigid shaft.

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11. A lift mechanism for a passenger loading bridge as defined in claim 7 wherein the first end of the drive shaft of the first motor is at 90 degrees to the second end of the drive shaft of the first motor.

12. A lift mechanism for a passenger loading bridge as defined in claim 7 wherein the first end of the drive shaft of the first motor and the second end of the drive shaft of the first motor are of two different physical shafts forming the drive shaft of the first motor.

5 13. A lift mechanism for a passenger loading bridge as defined in claim 7 wherein the first end of the drive shaft of the first motor and the second end of the drive shaft of the first motor are of a same physical shaft.

14. A lift mechanism for a passenger loading bridge comprising:

10 a drive shaft having a first end and a second end;

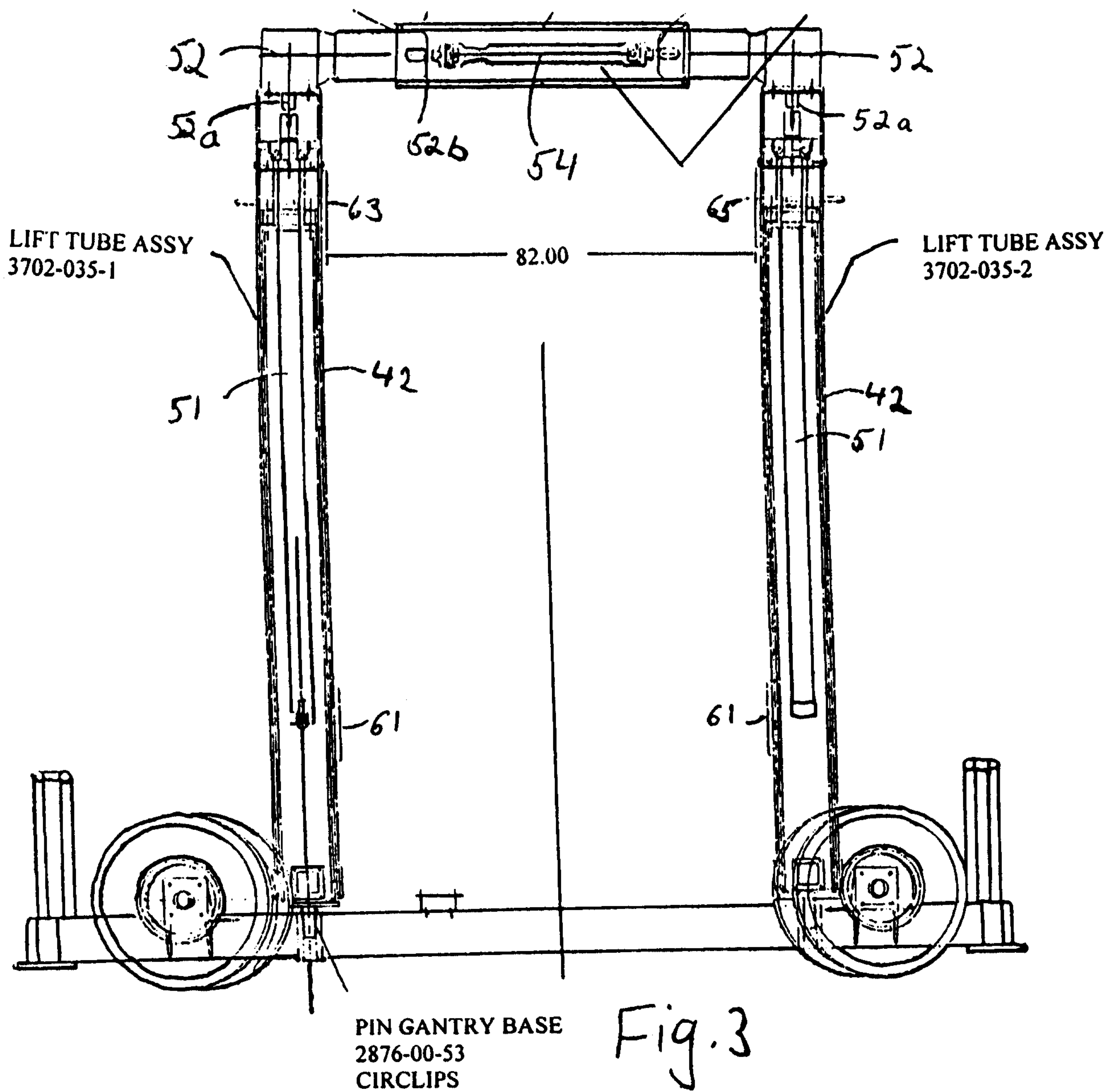
a first motor drivingly engaging the drive shaft;

a second motor drivingly engaging the drive shaft;

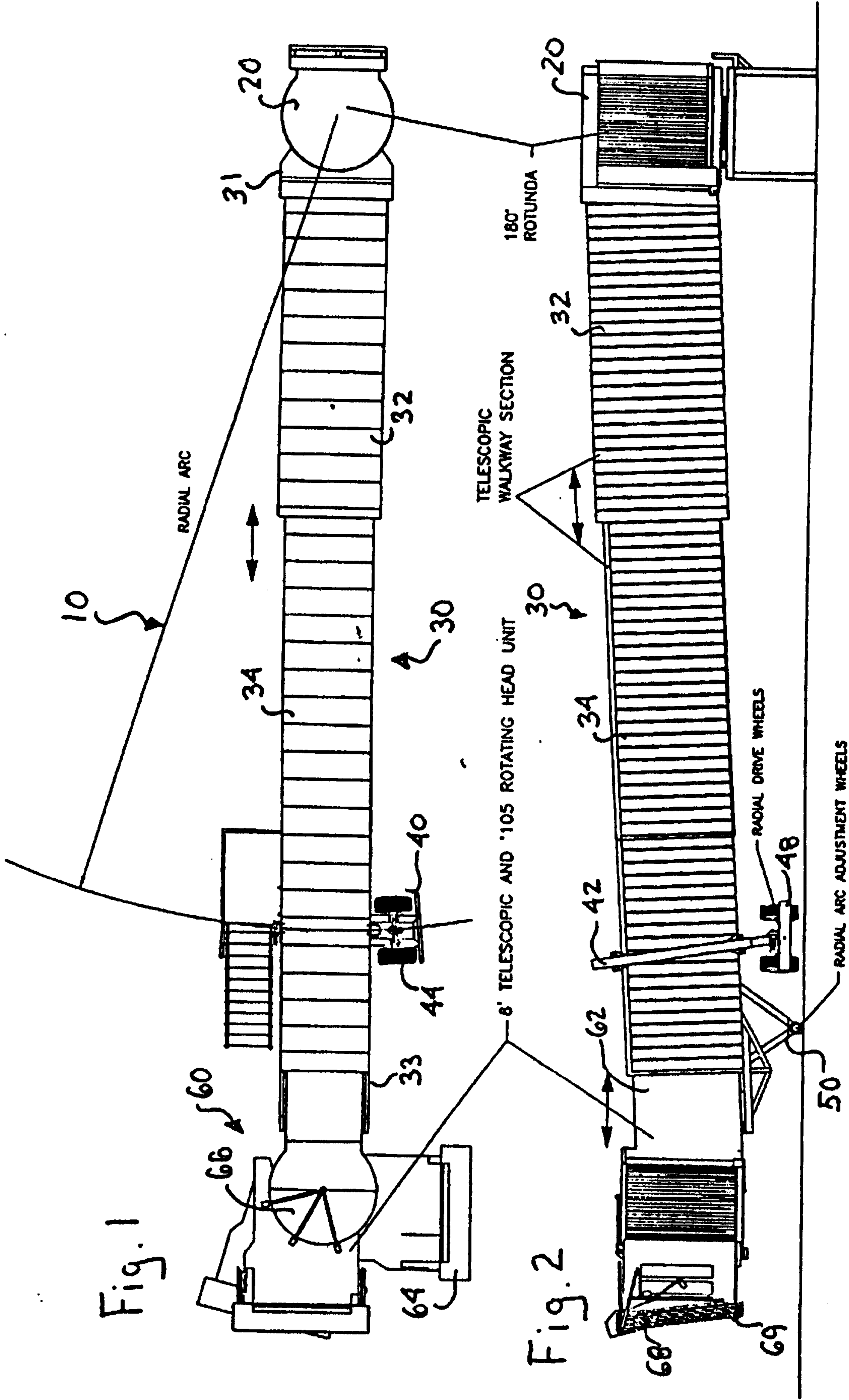
a first standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the first

15 end of the drive shaft; and,

a second standard including a lift for engaging the passenger loading bridge and for raising and lowering the passenger loading bridge, the lift coupled with and driven by the second end of the drive shaft.



GANTRY ASSEMBLY
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WITH THE ADDITION OF RADIAL ARC ADJUSTMENT WHEELS
THE RADIAL DRIVE WHEELS CAN BE LIFTED AND THE RADIAL ARC
CAN BE EXPANDED OR RETRACTED BY TELESCOPIC MOVEMENT OF WALKWAY SECTION