United States Patent

Wynne

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[54] **ELECTRIC FURNACE SUPERSTRUCTURE SWING INTERLOCK**

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[52] **U.S. Cl.** ..... **263/33 A**, 263/46

[51] **Int. Cl.** **F27b 7/12**

[58] **Field of Search** ..... 263/33 A, 46

[56] **References Cited**

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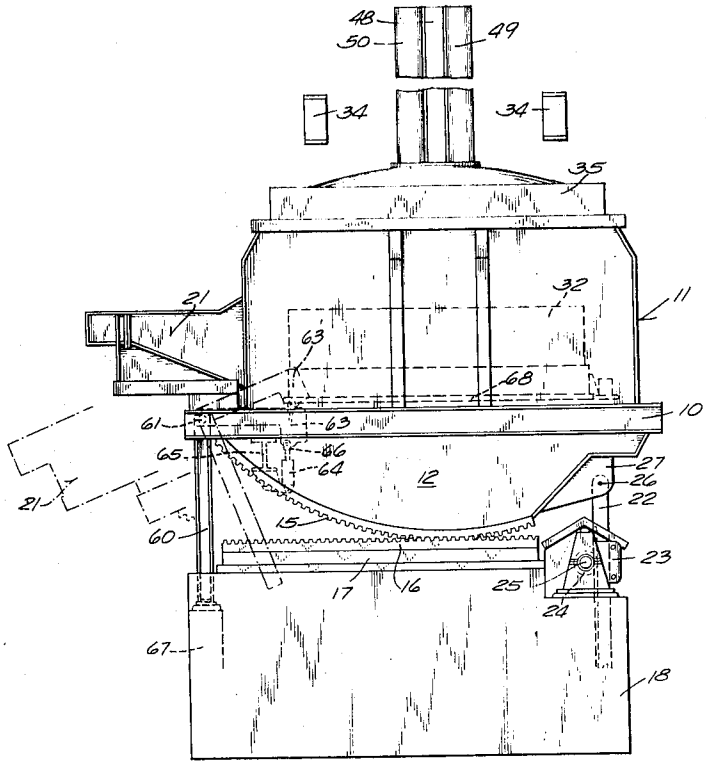
[57] **ABSTRACT**

The cover of a full-platform electric furnace is supported on a superstructure which allows the cover to be raised and lowered with respect to the furnace and to be swung away from the top of the furnace when it is lifted. An interlock means is provided for preventing the furnace from being tilted unless the superstructure is in its home position and the cover is aligned with the furnace top.

3 Claims, 3 Drawing Figures



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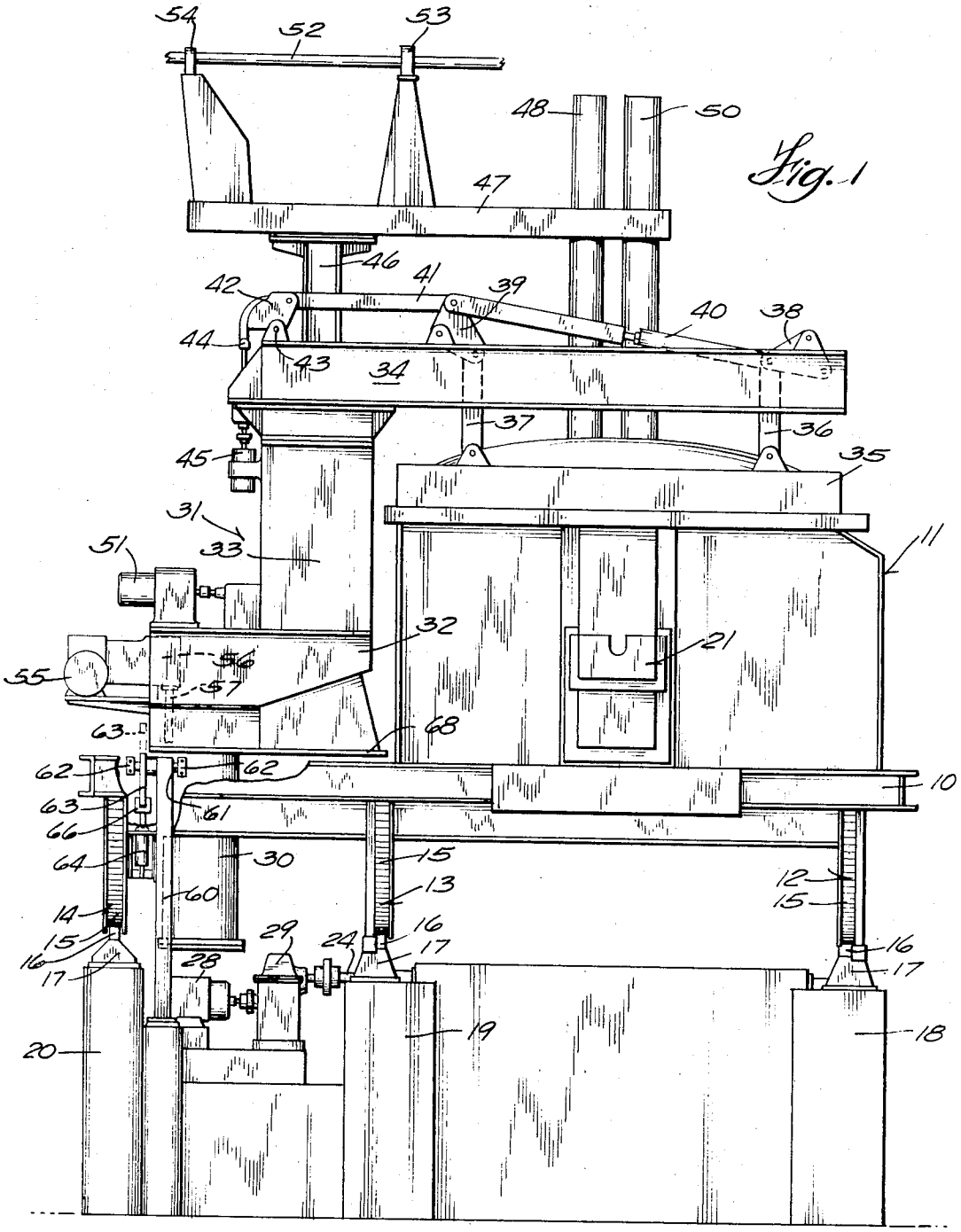

Fig. 1

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Fig. 2

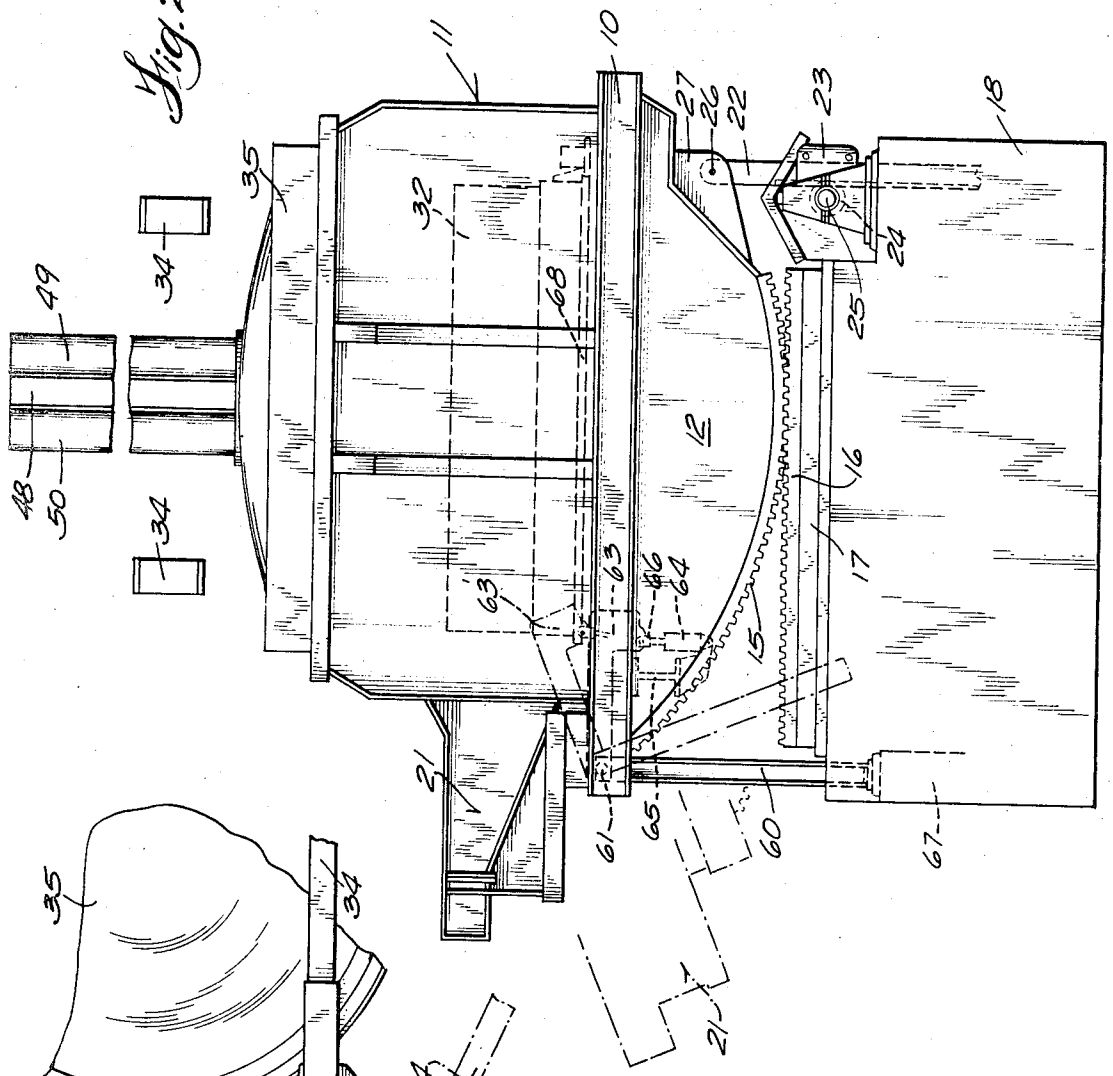
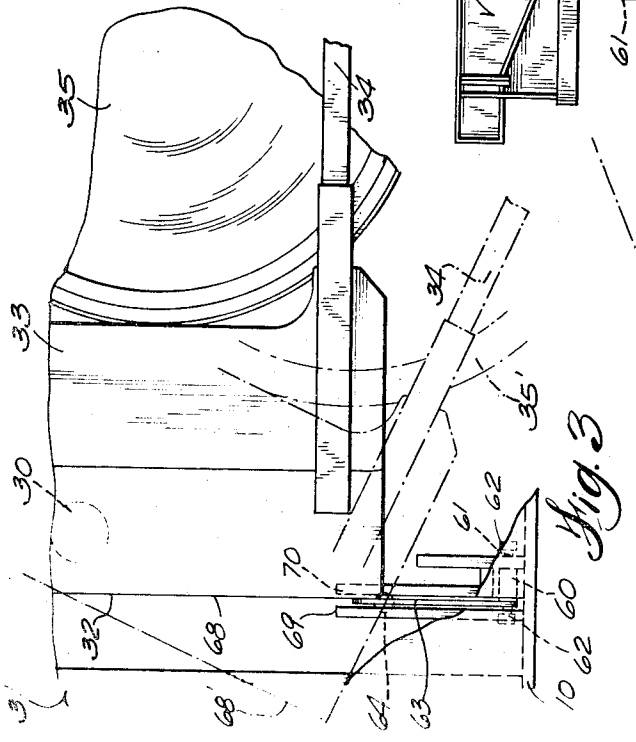


Fig. 3



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ELECTRIC FURNACE SUPERSTRUCTURE SWING INTERLOCK

BACKGROUND OF THE INVENTION

Full-platform electric furnaces have the furnace body mounted on the platform adjacent a swingable superstructure. The furnace roof is supported on a lifting mechanism which is carried by a horizontal beam that extends from the superstructure column. When the roof is lifted, it may be swung away on the superstructure so that access to the furnace is provided. In the case of an arc furnace, the superstructure also supports the mechanism for lifting and controlling the position of the furnace electrodes. The electrode drive mechanism and support swings jointly with the superstructure when the roof is lifted and swung.

A full-platform furnace is adapted to tilt as a single unit with the superstructure when it is desired to pour molten metal from the furnace. It is necessary for the furnace roof to be down on or aligned with the furnace when the platform is tilted. If the roof is swung away from the furnace in the direction of the tilting and the furnace is tilted, the mass of the cover will impose a strong rotational force on the superstructure which may overstrain the superstructure swing mechanism. If the roof swings too far, the combined center of mass of the roof and furnace will be so located that the furnace tilting drive will be overburdened when trying to restore the furnace to its upright position.

SUMMARY OF THE INVENTION

An object of the present invention is to overcome the foregoing problems by providing an interlock which prevents the furnace from being tilted unless the superstructure and roof are in a predetermined safe and proper position.

Briefly stated, an embodiment of the invention comprises a lock element on the platform with a lock control means on the superstructure. If the furnace roof and superstructure are in their desired home position, the lock element becomes subject to being actuated in which case the furnace platform is released for being tilted.

How the foregoing and other more specific objects of this invention are achieved will appear from time to time throughout the course of the ensuing description of an illustrative embodiment of the invention taken in conjunction with the drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevation view of a full-platform electric arc furnace which embodies the invention;

FIG. 2 is a side elevation view of the furnace in the preceding figure with some parts being omitted;

FIG. 3 is a fragmentary top view of that part of the furnace which embodies components of the invention, the superstructure base being shown in phantom lines as it would be positioned when the furnace roof is not in its home position.

DESCRIPTION OF A PREFERRED EMBODIMENT

Refer to FIGS. 1 and 2 which show front and side elevations of the furnace. The furnace comprises a main platform 10 which is essentially a channel iron frame. The furnace 11 is supported on the top of platform 10. The platform is mounted on three curved support members 12, 13, and 14. The periphery of each support member has a gear segment such as 15 fastened to its periphery. The gear segment is adapted to rock on a gear rack 16 which is mounted on a metal base such as 17. There are three spaced-apart parallel pedestals 18, 19, and 20 supporting the gear racks.

At the rear of the furnace is a mechanism for tilting the platform when it is desired to pour molten metal from furnace 11 by means of a spout 21. The tilting mechanism comprises a toothed arm 22 which is captured in a pair of spaced-apart guide plates 23. The arm 22 is adapted to translate through the guide plates under the influence of a pinion 24 which is fastened on a shaft 25 that may be turned by a reversible motor 28 which operates through a speed reducer 29 as can be seen in FIG. 1. Toothed arm 22 makes a pivoting connection at 26 with a web 27 which extends from curved support member 12. It is easy to see that when pinion 24 is driven counterclockwise under power, toothed arm 22 will be advanced upwardly and will cause the furnace platform to tilt on gear segment 15 and to incline the pouring spout 21 as shown in dashed-dot lines provided the furnace platform is conditioned for tilting in a manner which will be described hereafter. Of course, when pinion 24 is driven clockwise, the furnace will be restored to its horizontal position or tilted slightly backwardly if desired. It is preferable to have two tilting mechanisms such as that shown in FIG. 2. One mechanism may be associated with curved support member 12 and the other with support member 13.

Supported on suitable structural members associated with platform 10 is a turret bearing structure 30. The turret bearing structure is adapted to sustain thrust and radial loads on its internal bearings, not shown. The internal construction of the turret 30 will not be described since it is conventional and can be devised by one versed in the mechanical arts. It is sufficient for present purposes to be aware that a shaft, not shown, extends down into the turret and supports a swingable furnace superstructure which is generally designated by the numeral 31.

The superstructure comprises a base 32 to which is welded a vertical column 33. Fastened to the top of column 33 are a pair of horizontally extending spaced-apart coplanar beams such as the one which is marked 34. The roof 35 of the furnace is supported on beams 34 by means of links 36 and 37. There are at least four such links, only two of which are visible in FIG. 1. Roof support links 36 and 37 are respectively connected to bell cranks 38 and 39 which are journaled for pivoting on beam 34. The bell cranks are interconnected with an adjustable link 40 and they are also connected by means of a link 41 to a cable segment 42. Segment 42 is pivotally mounted at 43 on beam 34 so that when the segment is rocked counterclockwise, the furnace roof 35 will be lifted from furnace body 11. Segment 42 is rocked and roof 35 is thereby lifted by application of a tensile force to a cable 44 by a motor-driven drum system, the motor of which is marked 45.

Extending vertically through column 33 of superstructure 31 and swingable with the latter are three aligned posts 46 which support crossarms such as 47. At their ends the crossarms support carbon or graphite electrodes 48, 49, and 50. These electrodes are triangu-

larly arranged as viewed from the top and extend down into the furnace through roof 35. A winch mechanism, not shown, is driven by a motor 51 and this causes the electrode posts 46 to be moved up and down as required to maintain an electric arc between the electrodes in the furnace. Motor 51 may also be used to elevate electrode posts 46 sufficiently for the lower ends of the electrodes 48, 49, and 50 to withdraw into roof 35 so that the latter may be swung on superstructure 31 without having the electrodes collide with furnace body 11. One of the cables for supplying electric power to the electrodes is marked 52 and is shown supported on posts 53 and 54 which extend from crossarm 47. It will be understood that suitable connectors are provided, but not shown, for connecting cables such as 52 to the electrodes.

As indicated earlier, in a full-platform electric furnace such as is now being described, the superstructure 31 and furnace body 11 are mounted on a common platform 10 and, therefore, tilt as a unit during the process of pouring metal from spout 21. Superstructure 31 can also be swung about the axis of turret 30 which is normal to the plane of platform 10. A motor 55 is carried on base 32 of the superstructure. The motor drives a speed reducer 56 whose output shaft 57 is suitable mechanically connected to drive the shaft, not shown, which occupies turret bearing structure 30 and on which the superstructure 31 is supported. Thus, one may see that when roof 35 is lifted, the motor 55 may be operated to cause superstructure 31 to swing and thereby displace roof 35 from its position over furnace 11 to a position on the foreground side of it as viewed in FIG. 1. Swinging roof 35 forwardly, of course, shifts the center of gravity of the whole mass which is supported from platform 10. If the furnace platform were tilted under these circumstances, the weight of roof 35 and its associated support structure would contribute toward tilting the furnace. As the furnace tilted, the weight of the roof and its associated support members would exert a greater and greater rotational force on superstructure 31. This rotational force may be greater than the counterforce which can be provided by the roof swing drive including speed reducer 56 in which case the roof 35 might tend to swing freely toward the front side of the furnace. With the roof off balance, a much greater torque must be developed by motor 55 to restore column 31 to an angular position where roof 35 would be lined up with the top of furnace 11.

In accordance with the present invention, the furnace platform 10 is not tiltable unless superstructure 31 is in its home position which means that roof 35 is either resting on furnace 11 or the roof is in a position where it is lifted above the furnace but in alignment with it. The means for interlocking the platform 10 and superstructure 31 for prohibiting furnace tilting unless the superstructure is in a predetermined position will now be described by first referring to FIG. 2. One may see in this figure that platform 10 has a tilt prohibiting stop element such as leg 60 pivotally attached to the front end of the platform. The pivot shaft for leg 60 is marked 61 and it is journaled in bearings 62, see FIG. 1, which are fastened to platform 10. Rigidly joined with leg 60 is a lock element such as locking bar 63 which is shown in dashed lines in FIG. 2. Leg 60 and locking bar 63 constitute a double-armed lever which pivots about the axis of shaft 61. A fluid pressure operated cylinder and piston assembly 64 is anchored to a support beam 65 which is in turn fastened to platform 10. The piston of the cylinder 64 is connected by a pivot pin 66 to locking bar 63. If the locking bar 63 is free of any interference, it may be rocked upwardly to the position shown in dashed-dot lines in FIG. 2 by pressurizing cylinder 64. Upon this event, leg 60 is free to swing clear of the stationary element such as supporting pedestal 67 on which it rests as is evidenced by the legs assuming the dashed-dot line position of FIG. 2. When the furnace platform is rocked back to the nominally horizontal position in which it appears in FIG. 2, cylinder 64 is operated reversely to restore leg 60 to the position in which it is shown in solid lines whereupon the leg again rests on pedestal 67.

Locking bar 63 is prohibited from being rocked upwardly and leg 60 is prohibited from being moved off of its pedestal 67 unless the superstructure 31 is in a predetermined position as indicated. Accordingly, a lock control element such as locking plate 68 is fastened to the bottom of the base of the superstructure to interfere with movement of locking bar 63 at all times except when the superstructure is in its home position. From inspection of FIGS. 1 and 2 one may see that locking bar 63 will strike the bottom of locking plate 68 unless the superstructure is angularly positioned as in FIG. 1 in which case the locking bar may move upwardly as indicated by dashed-dot lines in that figure and marked 63'. Under this condition, leg 60 may be rocked back and platform 10 is free to tilt.

Usually electrical interlocks, not shown, are also provided for preventing energization of platform tilting motor 28 unless superstructure 31 is in a predetermined angular position. The new mechanical interlock for preventing the furnace platform from being tilted is, however, superior from the viewpoint of safety since it is not subject to failure of the interlock switches nor to their being misconnected or overridden by installation or maintenance personnel. Platform 10 cannot be tilted even though leg 60 is accidentally impacted because locking bar 63 will prevent the leg from rocking in almost any imaginable case.

FIG. 3 shows how the platform is provided with a pair of spaced-apart guide bars 69 and 70 which provide a slot through which the back end of locking bar 63 may emerge to engage the corner of locking plate 68 and prevent clockwise turning of the platform about the axis of turret 30. Of course, when the superstructure 31 and its attached locking plate 68 are rotated, the locking plate assumes an angular position, suggested by the dashed-dot lines 68'. Under the latter circumstance, the rear end of locking bar 63 cannot rise since it is interfered with by locking plate 68.

Now that the foregoing description has illustrated one method for preventing tilting of the furnace unless the superstructure is in a predetermined position, various means for accomplishing the same result will occur to those skilled in the art. Such other skilled artisans will understand that the particular design and location of the platform tilting and superstructure swinging mechanisms interlock will depend on the arrangement of the other components of the furnace. Those familiar with the design of furnaces will readily appreciate that the principles of the interlocking mechanism herein

disclosed may be applied to hydraulically operated furnaces as well as the mechanical furnace in connection with which the invention has been described. Hence, although a preferred embodiment has been shown and described in detail, such description is merely illustrative rather than limiting, for the invention may be variously embodied and is to be limited only by interpretation of the claims which follow.

I claim:

1. A furnace assembly comprising:
a. a tiltable platform means,
b. a furnace having a removable roof, said furnace being supported on the platform means,
c. a swingable structure that is journaled for swinging on the platform means about an axis that is nominally vertical when the platform means is nominally horizontal,
d. furnace roof lifting means supported from said swingable structure and engaged with said roof means for selectively raising the roof means to enable swinging it away from said furnace,
e. a selectively releasable lock means normally preventing said platform means from being tilted.
f. said lock means includes:
i. a stationary element,
ii. a stop means pivotally connected with said platform means and interposed between it and the stationary element to selectively permit or prohibit tilting of said platform means,
g. said lock control means comprising means constraining said stop means to remain in a position which prevents tilting of the platform means when said swingable structure is in certain positions and to release said stop means when said structure is in a predetermined position.

2. The invention set forth in claim 1 wherein:
a. said releasable lock means includes a leg means pivotally mounted on said platform means, said leg means normally preventing said platform means from being tilted,
b. a locking bar means connected with said leg means to pivot therewith,
c. a locking bar control means carried by said swingable structure and adapted to interfere with pivotal movement of said locking bar means when said swingable structure is in certain angular positions and to free said locking bar means for joint pivotal movement with said leg means when said structure is in a predetermined position whereby to enable tilting of said platform means.

3. The invention set forth in claim 2 including:
a. a fluid pressure operated actuator mounted on said platform means and connected to said locking bar means,
b. said actuator being opposed by said control means against letting said locking bar means move to release said leg means when said swingable structure is in any position except said predetermined position.

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