MICHAEL JACKSON'S ANTI-GRAVITY LEAN

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Concept: Equilibrium
Model: Anti-gravity shoes

Definition:
"A system of forces is said to be in equilibrium if the sums of all the forces and of all the moments at one point are equal to zero" [1].
"The sum of reaction forces on a body is always equal to the sum of action forces if the body is in a state of equilibrium, regardless of the positions and magnitudes of the action forces" [2].
"A condition in which all acting influences are canceled by others, resulting in a stable, balanced, or unchanging system" [3].

Application:
When one leans forward, their centre of gravity also moves forward. Once the vertical line from the centre of gravity goes further than the toes, toppling occurs. The anti-gravity shoes were hence used by the late Michael Jackson and his dancers as a means for creating anti-gravity illusion during his shows by allowing the wearers to be able to lean at very acute angles beyond their centres of gravity [4], as shown if figure 1.

FIGURE .1

How the shoe works:
The shoe was designed and patented by Michael Jackson and two other partners in 1993.

There is a special cut out in the shoe's heel that hitches on to rods that, when needed, come up through the stage floor and anchor the shoes (Figure 3]. The shoe is also reinforced with a sock-like covering over the ankle (Figure 2). The performers slide the shoe onto the rod and are able to lean far forward, giving them the ability to lean without needing to keep their centers of mass directly over their feet. Figure 4 shows the forces acting on the body and the shoes. The forces balance out and thus the body remains stable.

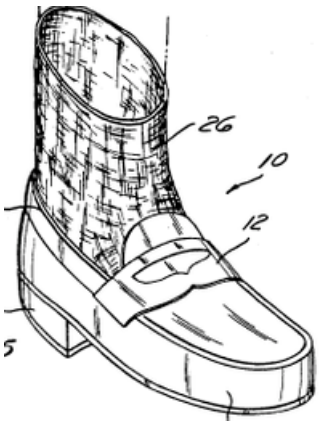

FIGURE. 2

FIGURE. 3

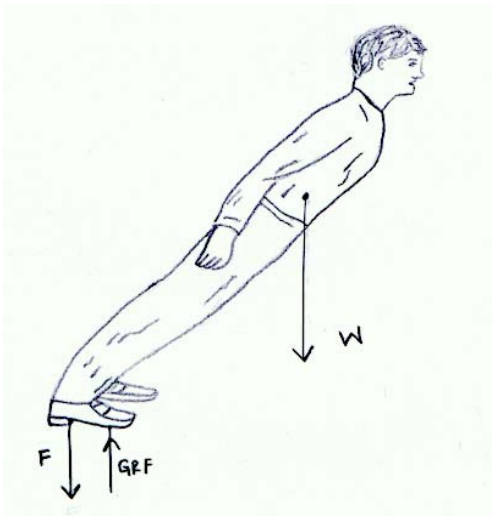

FIGURE. 4

References:

1) Williams, M.S & Todd, J.D (2000). *Structures - Theory and Analysis*. London: Macmillan Press Limited. 33.
2) http://www.mace.manchester.ac.uk/project/teaching/civil/structuralconcepts/
3) http://www.answers.com/topic/dynamic-equilibrium
4) http://www.google.com/patents?id=MAUgAAAAEBAJ&printsec=abstract&zoom=4#v=onepage&q=&f=false
5) http://www.cbsnews.com/stories/2009/07/01/eveningnews/main5128603.shtml