TECHNICAL SOURCE GUIDE

A LEVER-ACTUATED ELEVATOR TRAP

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For a recent production of “Fiddler on the Roof”, the director asked that the character of Fruma-Sarah, played by a woman riding on the shoulders of a fellow actor; be raised through the floor (and disappear the same way) on an elevator trap. We determined that the effect could be accomplished using an available elevator carriage with T-track guides, but the actuating mechanism would be difficult due to the total height of the Fruma-Sarah character; about 8 feet, and the combined weight of the two actors, nearly 400 lbs. There was insufficient head space in the 12-foot trap room for a double-purchase counterweight system (Fruma-Sarah wouldn't fit between the carriage and the stage overhead), and a single-purchase system was impractical because the necessary 400-pound counterweight would have to be muscled up and down when the carriage was not loaded.

On a tour of the Krannert Center at the University of Illinois, I observed a lever-actuated elevator used to raise an actor through an 8-foot platform. A counter-weighted lever pivoting from a point halfway up the guide track pulled wire ropes that raised the carriage as the lever was swung down in an arc. When the trap reached stage level, the lever ended up inverted from its initial position. (Figure 1) I realized that with such a system, the counterweights provide little assistance when the lever is up and the load is down, but as the angle between the lever and the vertical track increases, so does the contribution of the counterweights. I also noted that with such a system, the lower and longer the lever; the more leverage one could have over the load.

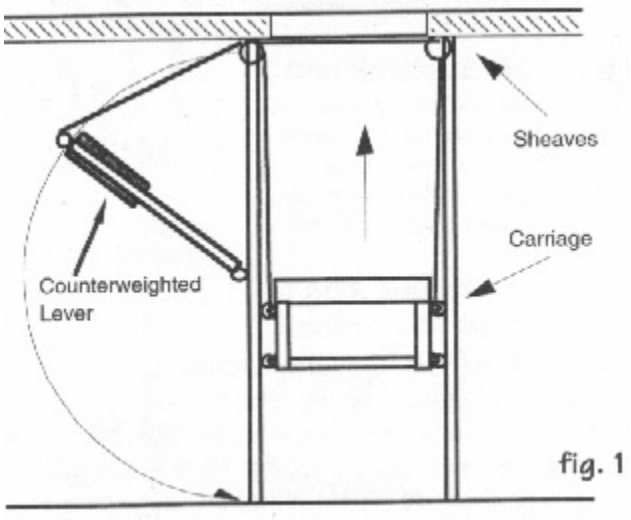

fig. 1

Based on these assumptions, I designed a pipe frame lever whose fulcrum was at the floor to give it maximum length-about 10 feet The lever consisted of a rectangular frame of 1 - 1/2" pipe assembled with Rota-Locks. Quarter-inch aircraft cable was used to connect the lever through steel blocks to the elevator carriage. The pipe frame lever was then loaded with sandbags and steel stage weights to counter-weight the empty carriage-about 150 pounds. (Figure 2) As we expected, the leverage was almost nil when the lever was straight up, but improved quickly as the frame swung through its arc. We therefore added a secondary single pipe about 16 feet long, attached with a doubled length of 1/2" polyester rope to the frame lever. When the pipe frame was vertical, this secondary lever rested at about 45 degrees. (Figure 3) The angle and length gave us the purchase to pull the frame lever down to where its leverage became effective, just about the point where the secondary pipe hit the floor The frame lever hit the floor just as the carriage reached stage level, where it was secured in place by flippers hinged to guide tracks. (Figure 4)

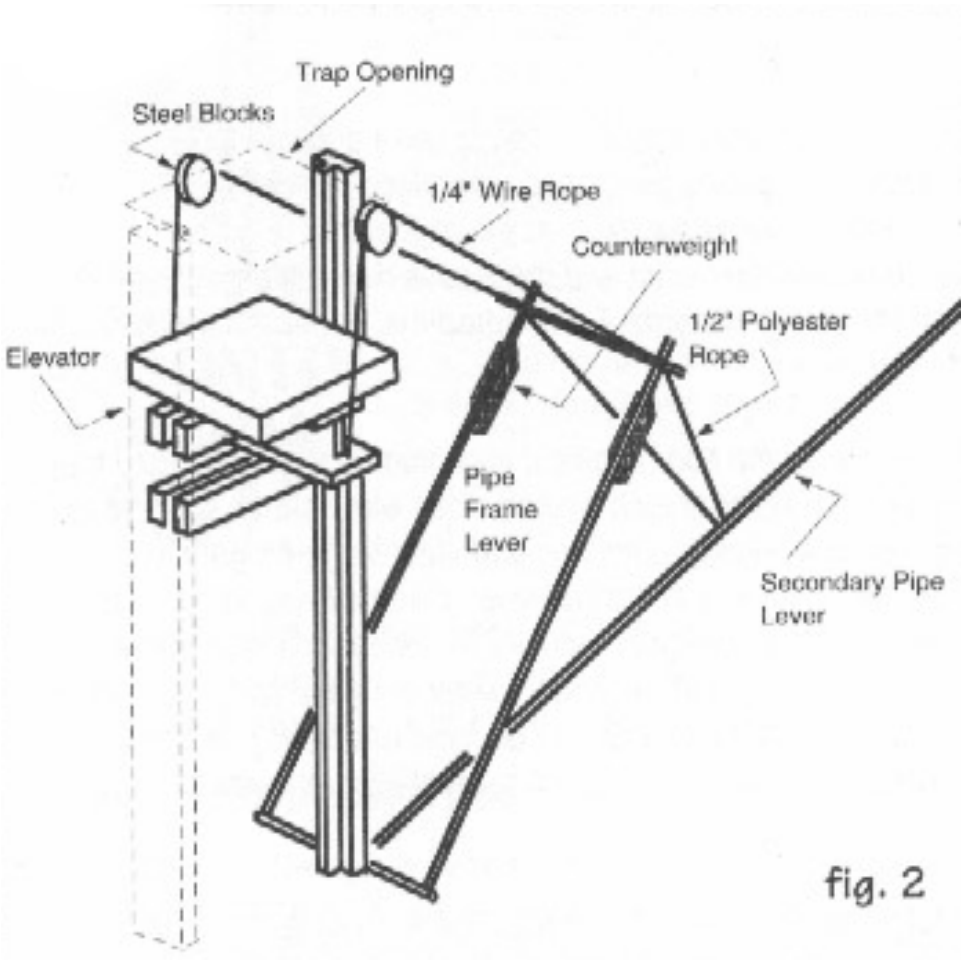

fig. 2

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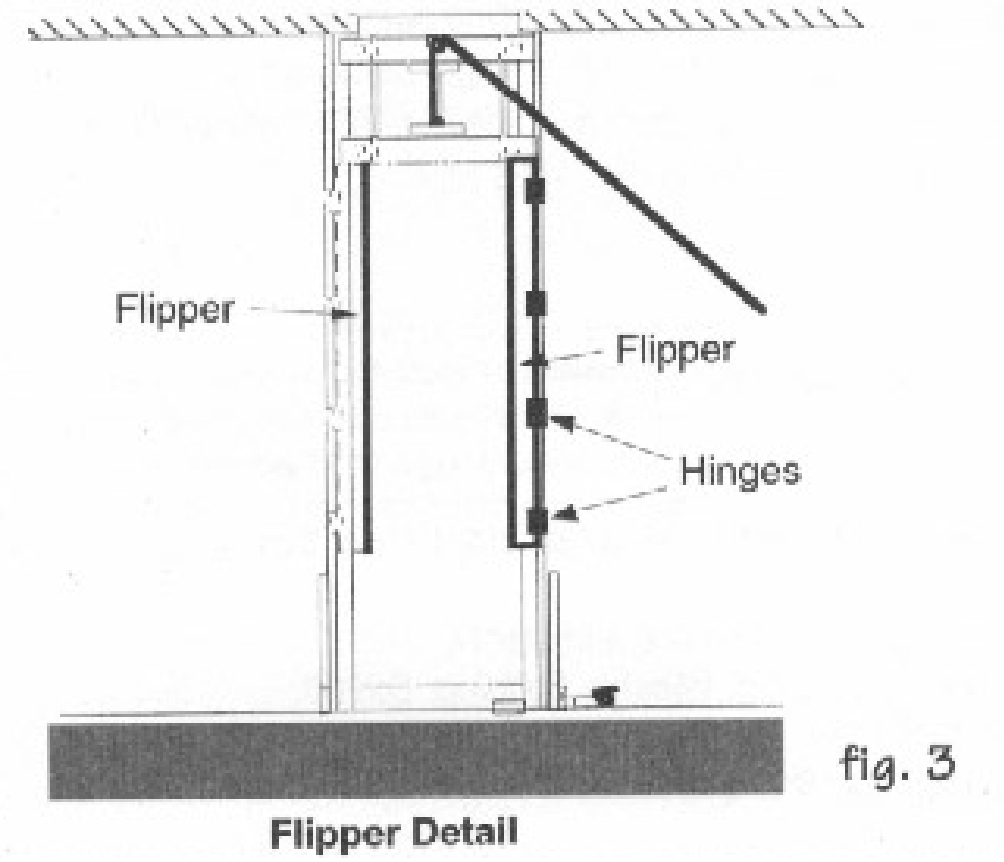

fig. 3

Flipper Detail

In practice, we determined that our particular arrangement required about twice the weight in operators as was riding on the elevator Four stagehands could just raise our two actors, and two could easily hold them at stage level, but we used five operators for security and dependability A sixth hand was on headset with the stage manager; and she also helped the top actor climb onto the bottom actor's shoulders. The two-to-one operator-to-load ratio meant we were using twice the lifting weight as with a single purchase counterweight approach. But applying it as operators on a lever meant we never had to fight an unbalanced load overhead, as when the elevator was lowered without riders. This added safety factor more than compensated for the extra weight in operators required.

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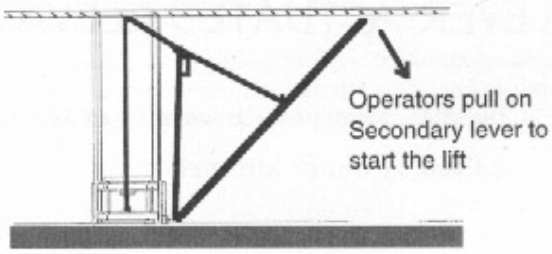
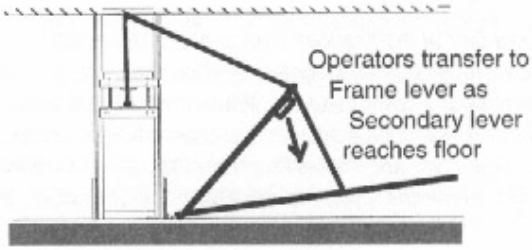
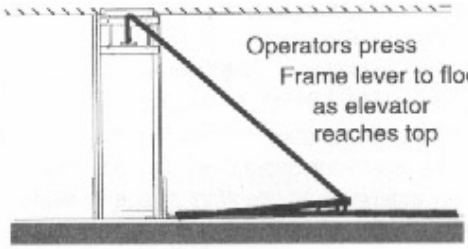


Elevator Down



Elevator Mid-way in Travel



Elevelator Up

fig. 4

Thank you for taking time to read this "classic" Technical Source Guide! Because it has been published a relatively long time ago, addresses (physical & web) and any phone numbers, might not be current!

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