To Rig or Not to Rig?
The Gravity of the Question

A discussion on different types of theatrical rigging, risk assessment, and safety protocols. We will discuss the dos and don'ts of rigging with current industry standards.

Presented by Bryce Allen, Technical Director
Johnny Carson School of Theatre and Film

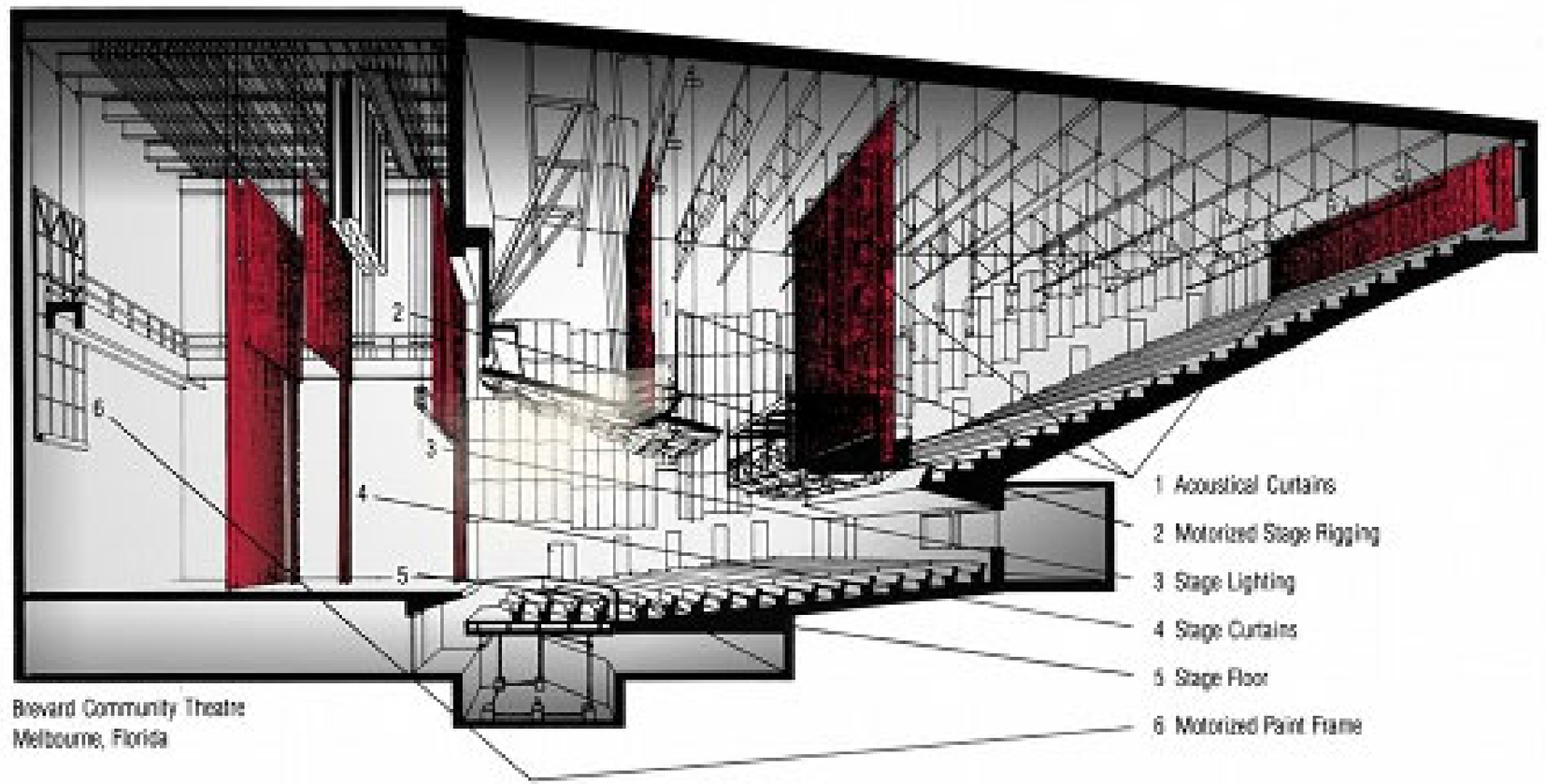
IN OUR GRIT, OUR GLORY™

What is Rigging?

History of Theatrical Rigging

What is Rigging?

Modern Systems



The Science of why things stay up

Newton's Laws of Motion

- An object at rest stays at rest until acted upon by an unbalanced force. An object in motion stays in motion in the same direction until acted upon by an unbalanced force.
- Force = Mass x acceleration. Or the more on object weighs the harder it is to move or stop. Also, the faster an object is moving the harder it is to change direction or stop.
- For every action there is an equal and opposite reaction.

The Science of why things stay up

Stress & Strain

- Stress – the force per unit of material area
- Strain – the amount of movement of the material when the force is applied

Material Stiffness

- Elastic Stretch
- Plastic Stretch

The Science of why things stay up

Material Behavior Under Load

- Tension
- Compression
- Shear
- Torsion

The 4 “K”s of Rigging

- **Know the System you are working with**
- **Keep the Equipment in safe working order**
- **Know how to use the System and Equipment**
- **Keep your Concentration**

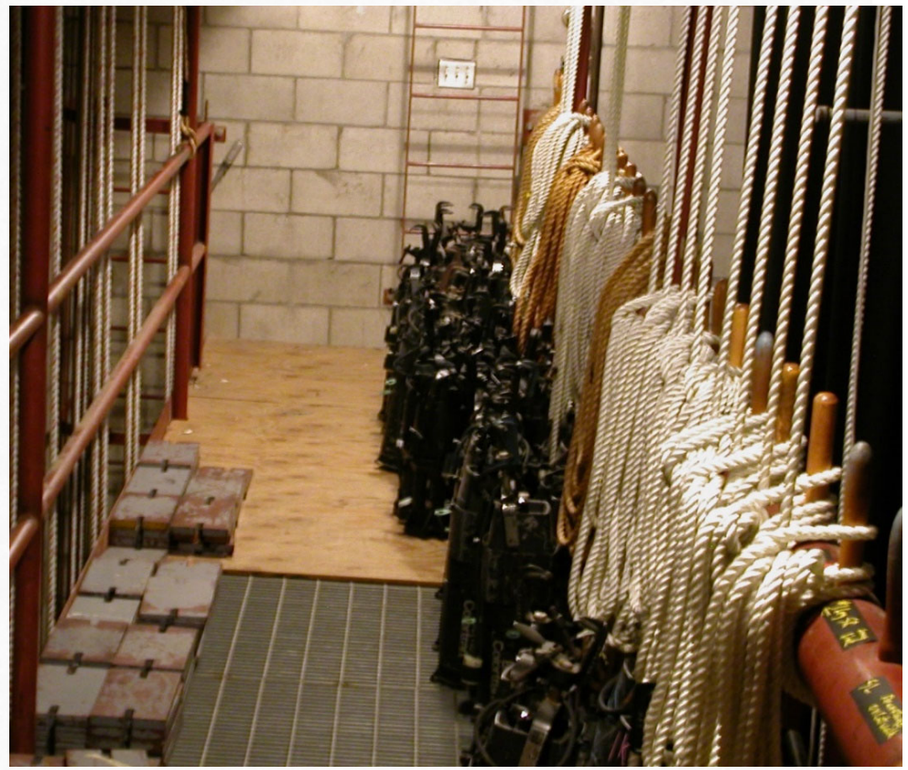
Know Your System

There are 5 main types of Theatrical Rigging Systems used today:

- Hemp
- Single Purchase
- Double Purchase
- Motorized
- Arena Rigging

Hemp Rigging System

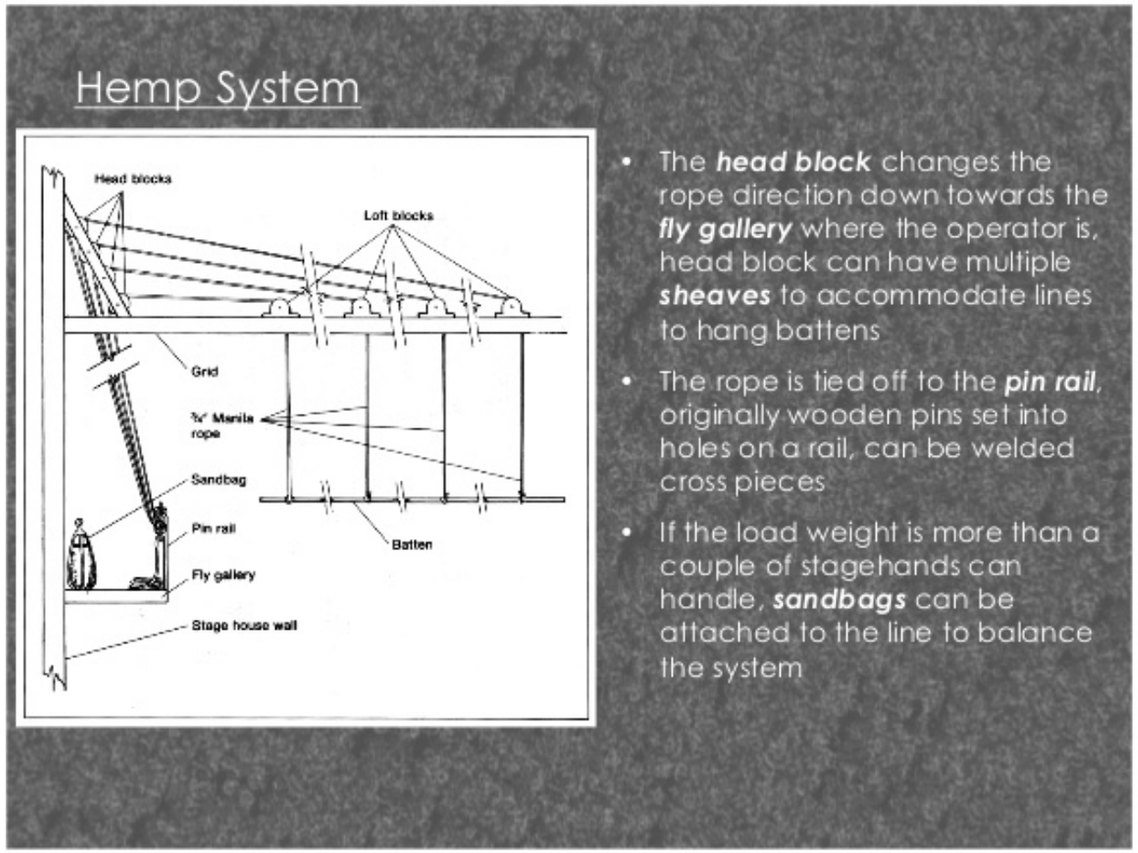
How does a Hemp Rigging System Work?



Hemp Rigging System

What parts does it have?

- Fly Gallery
- Pin Rail
- Sandbags
- Lift Lines
- Head Block
- Grid
- Loft Blocks
- Batten



Hemp Rigging System

What are the Pros & Cons to this type of Rigging System?

- Pros:
  - Versatile
  - Old Standard
- Cons:
  - Difficult to Use
  - High Maintenance
  - Load Limitations

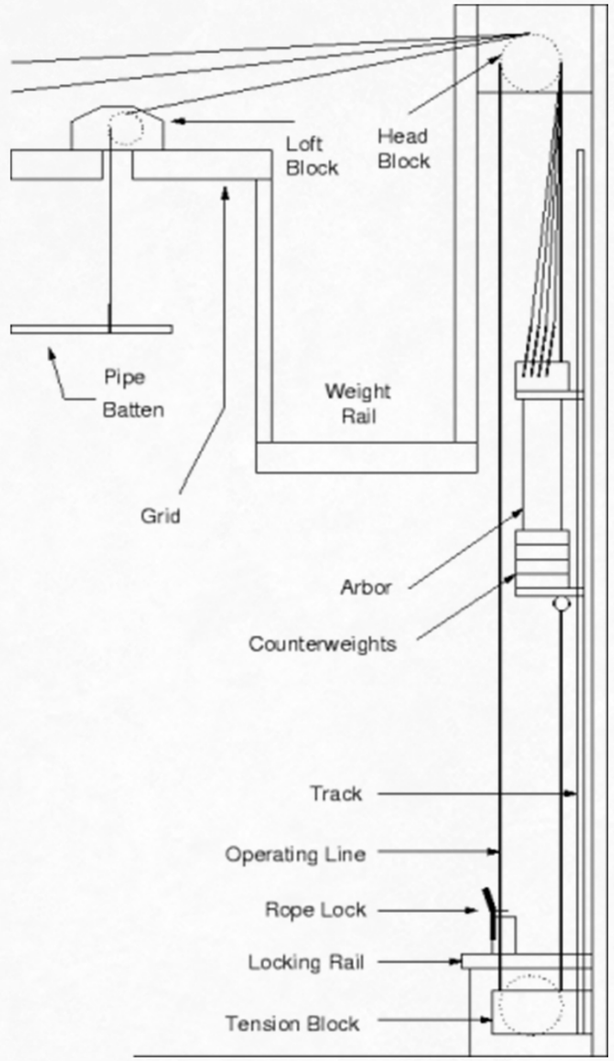
Single Purchase Rigging System

How does a Single Purchase Rigging System Work?

Single Purchase Rigging System

What Parts Does it Have?

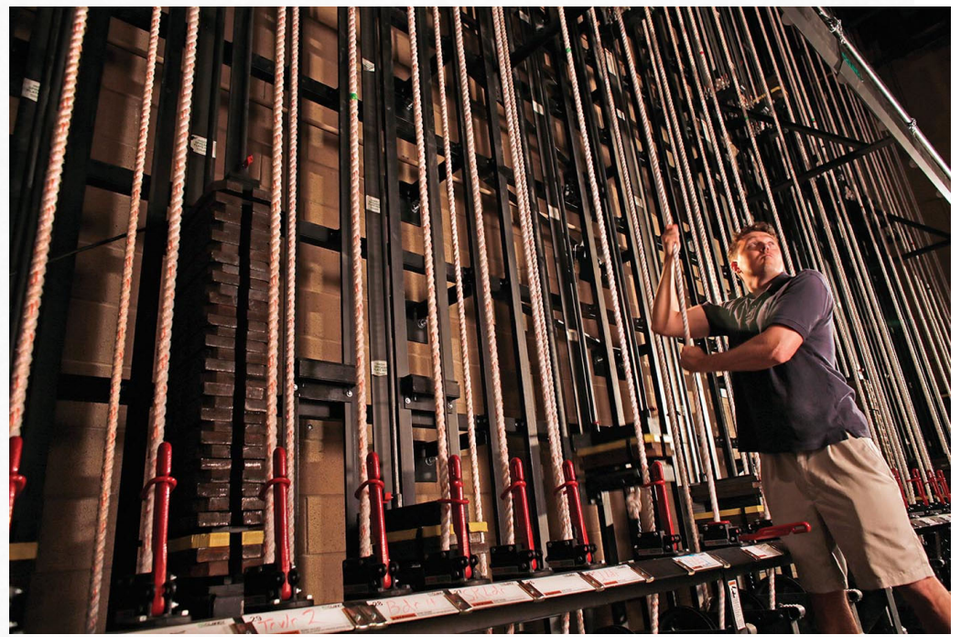
- Lock Rail
- Rope Lock
- Hand Line
- Tension Block
- Arbor
- Counterweights
- Lift Lines
- Head Block
- Loading Rail
- Grid
- Loft Blocks
- Batten



Single Purchase Rigging System

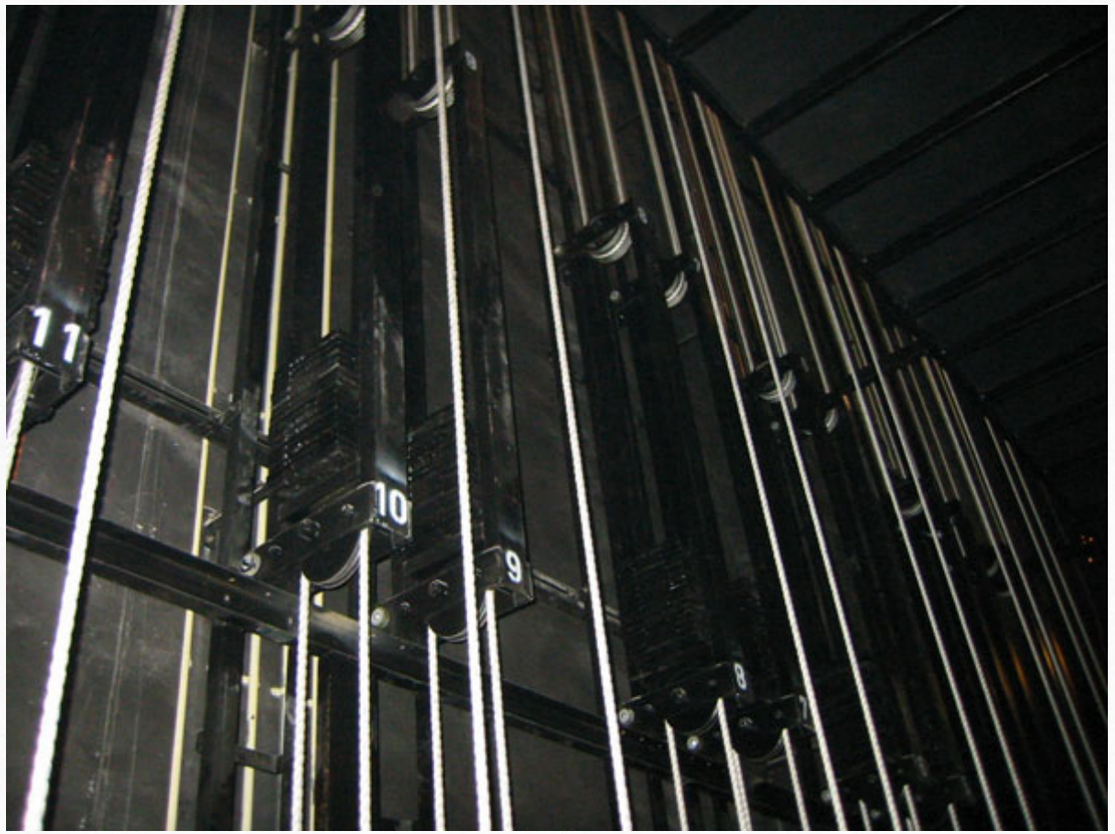
What are the Pros & Cons to this type of Rigging System?

- Pros:
  - Most Common Theatrical Rigging System
  - Easier than old Hemp Systems
  - Higher load capacity than Hemp
  - More Durable than Hemp
  - 1:1 Weight Ratio
- Cons:
  - Less versatility
  - Takes up Space on the Deck



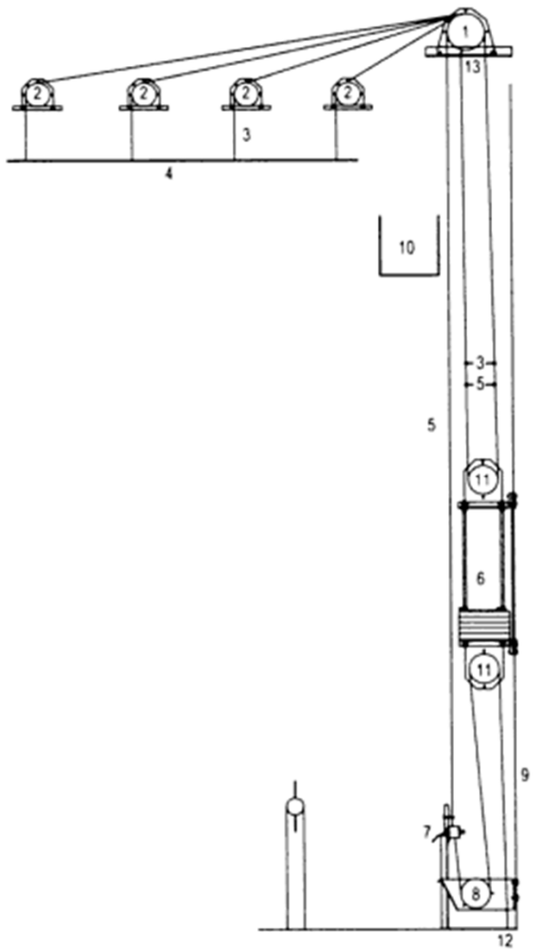
Double Purchase Rigging System

How does a Double Purchase Rigging System Work?



Double Purchase Rigging System

What parts does it have?

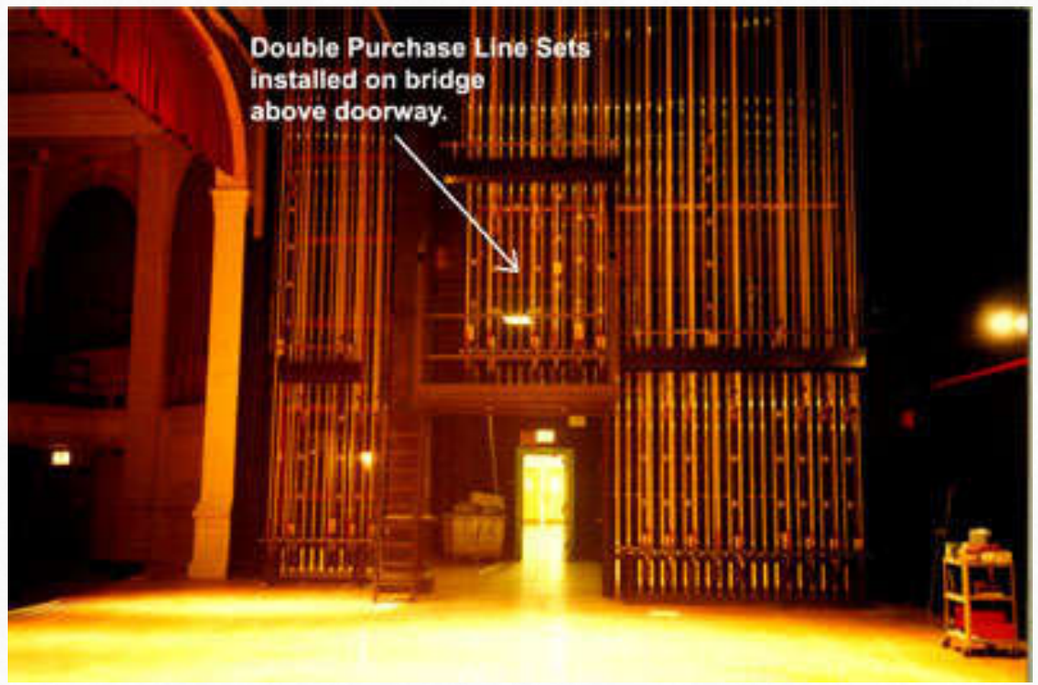


1. Head block for lift line and hand line
2. Loft blocks (mule blocks as needed)
3. Wire-rope lift lines
4. Batten
5. Hand line
6. Counterweight arbor
7. Lock rail
8. Tension block
9. T-bar–guide rails
10. Loading bridge
11. Arbor blocks
12. Hand-line tie-off
13. Hand-line and lift-line tie-off

Double Purchase Rigging System

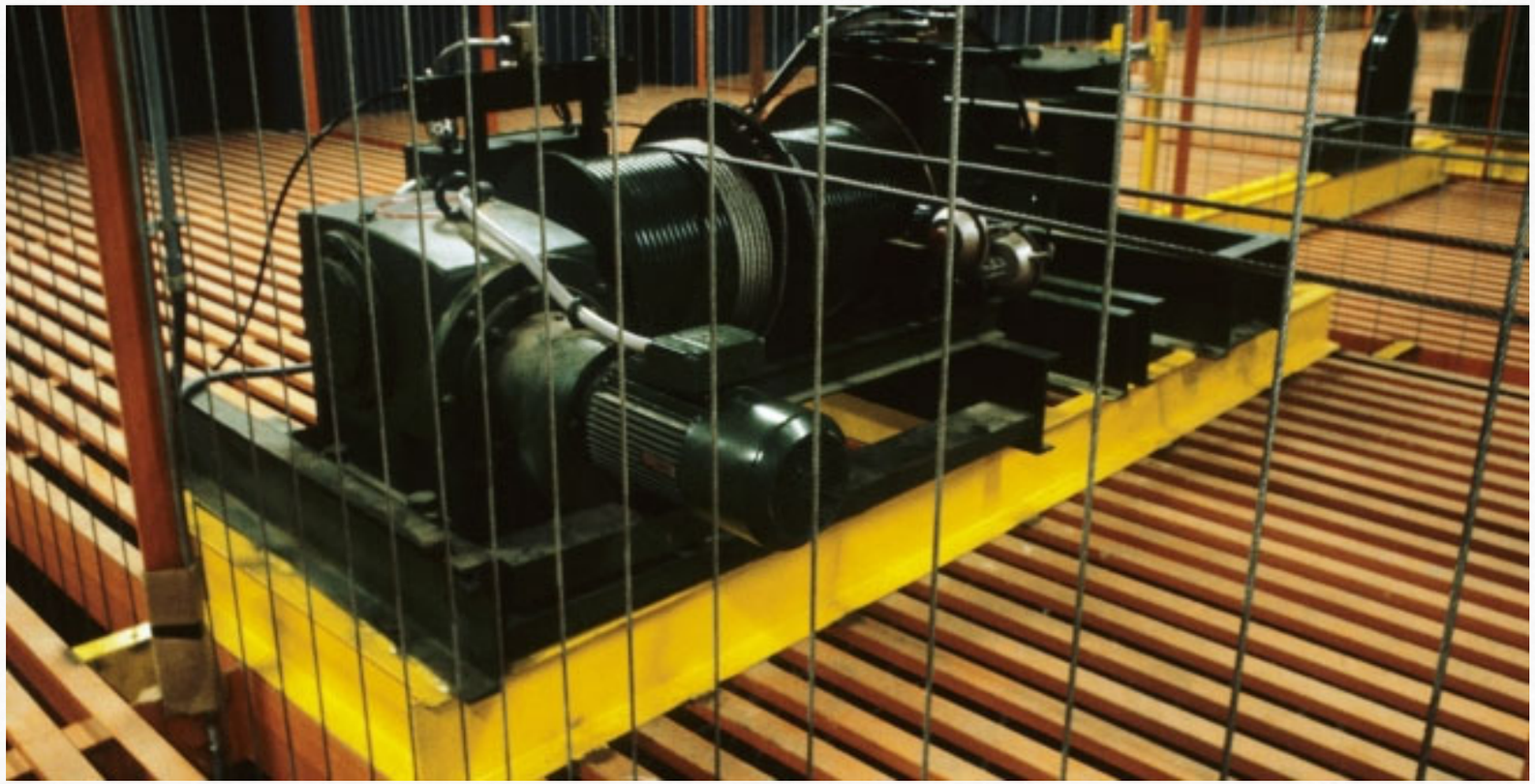
What are the Pros & Cons to this type of Rigging System?

- Pros:
  - More Wing Space
  - Faster Operation
  - 2:1 Mechanical Advantage
- Cons:
  - Double the weight
  - More parts to maintain



Motorized Rigging Systems

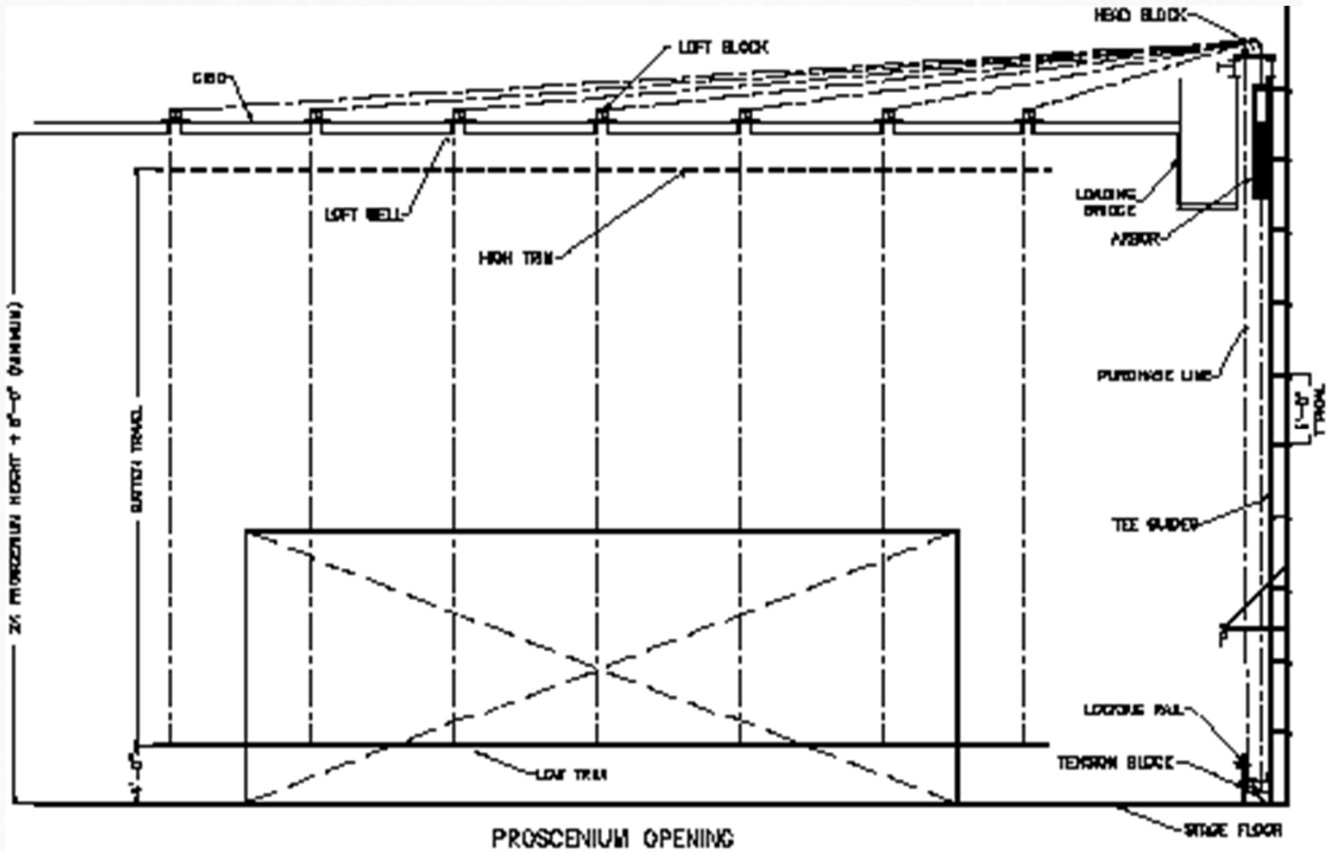
How does a Motorized Rigging System Work?



Motorized Rigging System

What parts does it have?

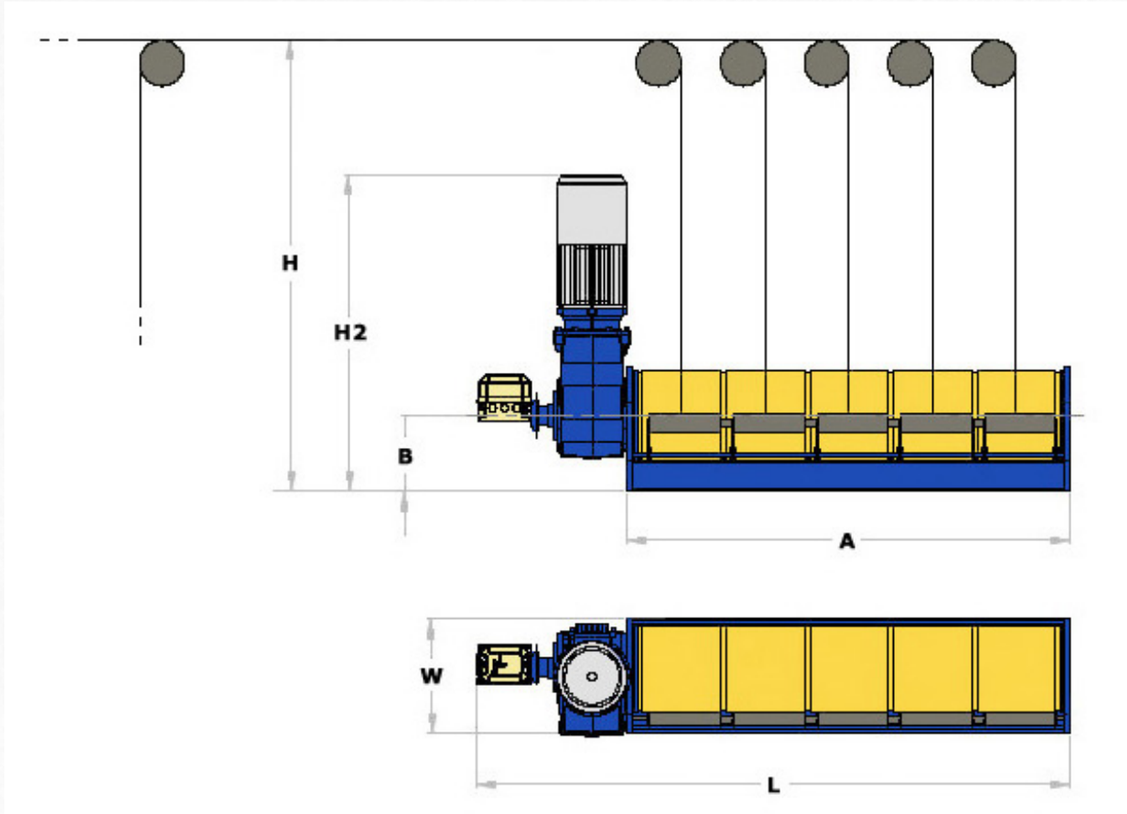
- Lock Rail
- Rope Lock
- Hand Line
- Tension Block
- Arbor
- Counterweights
- Lift Lines
- Head Block
- Loading Rail
- Grid
- Loft Blocks
- Batten
- Electric Motors



Motorized Rigging System

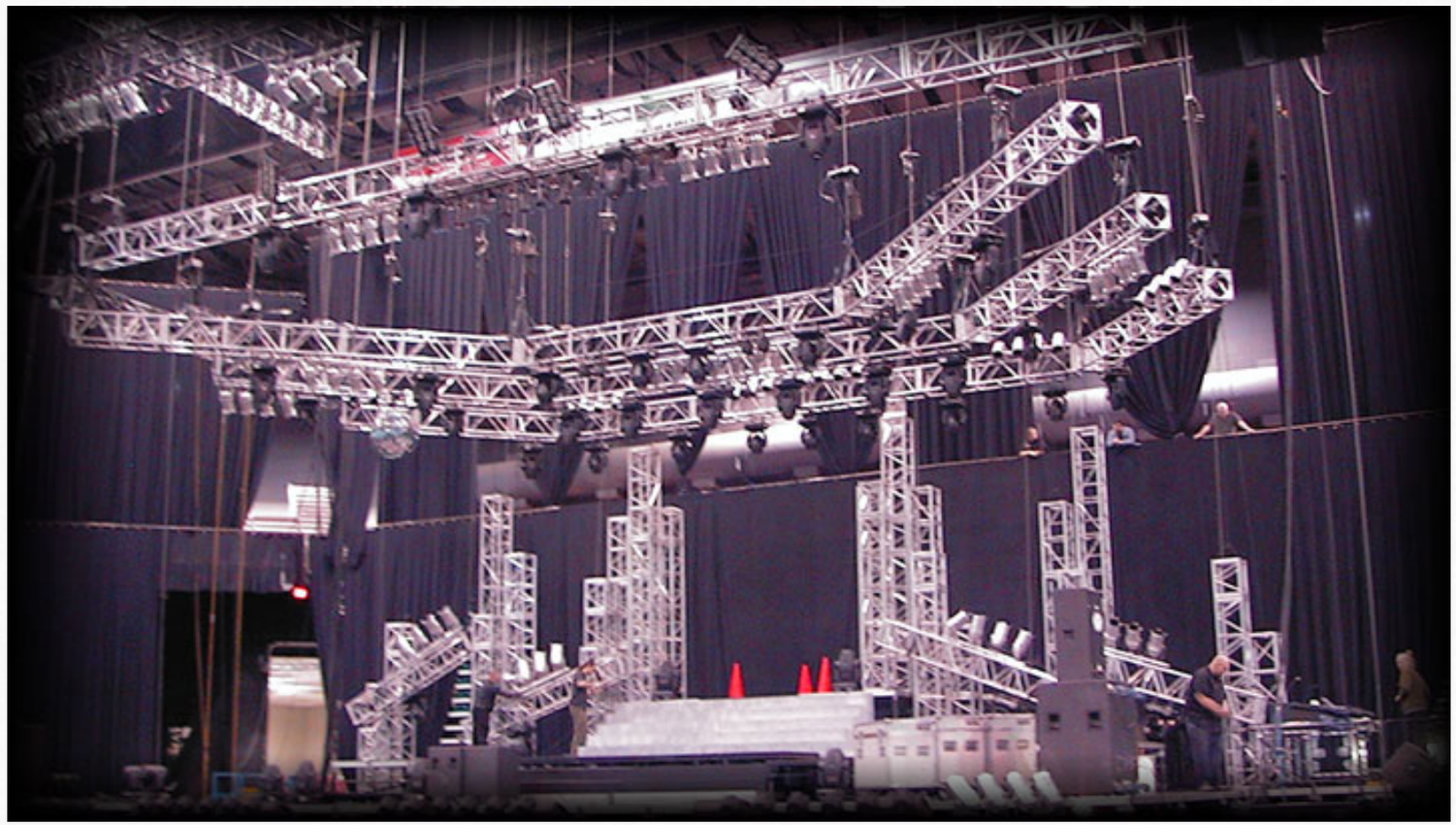
What are the Pros & Cons of this type of Rigging System?

- Pros:
  - Speed
  - High Loads
  - Precision
- Cons:
  - Space
  - Inhuman
  - Expensive



Arena Rigging System

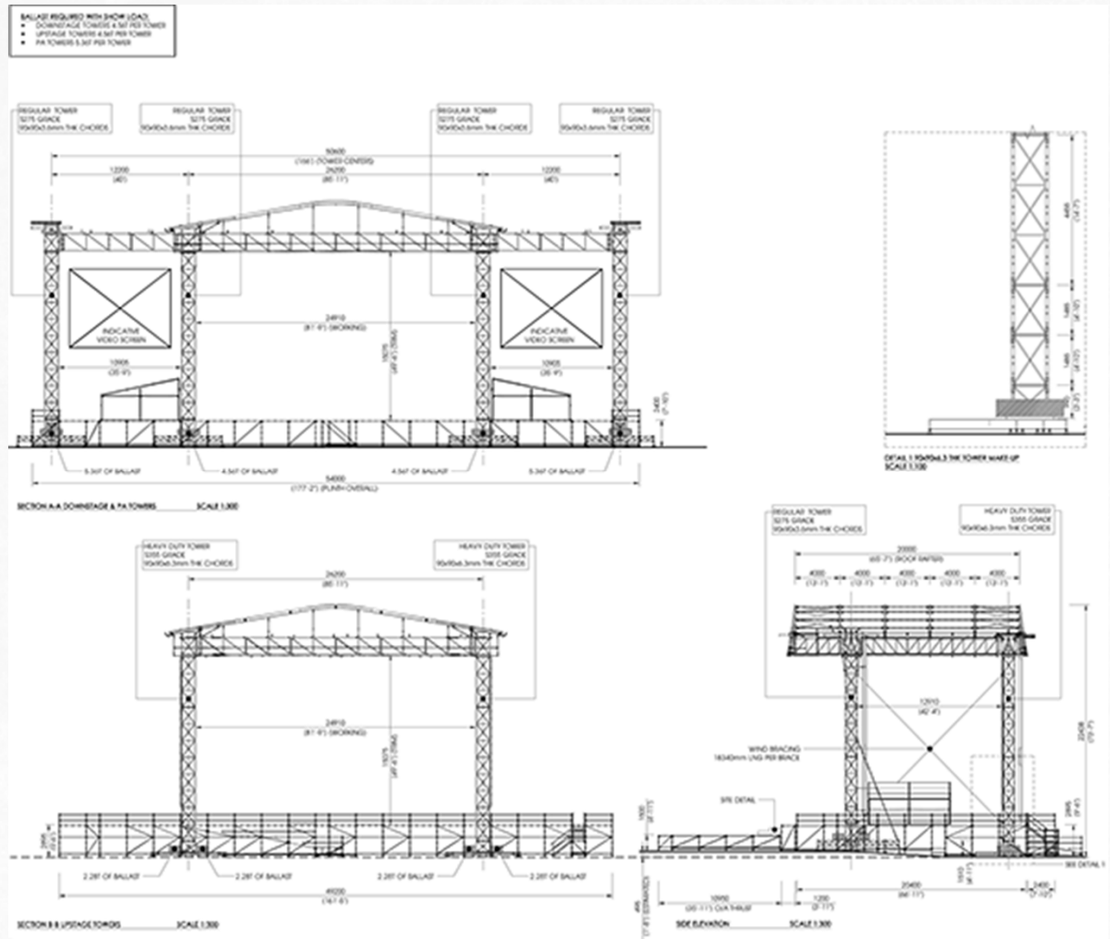
How does an Arena Rigging System Work?



Arena Rigging System

What parts does it have?

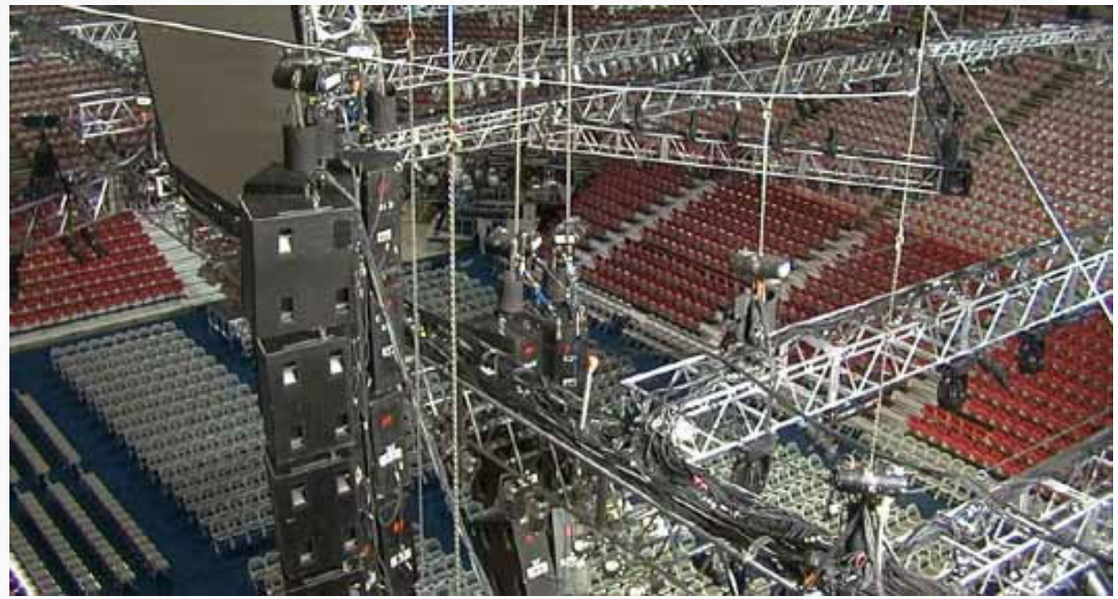
- Grid/Structure
- Catwalks
- Rigging Points
- Steel/Gack
- Chain Motors
- Slings
- Truss



Arena Rigging System

What are the Pros & Cons to this type of Rigging System?

- Pros:
  - Extremely Versatile
  - High Loads
  - Mobile
- Cons:
  - More training required
  - Expensive



Keep it Safe

Hardware Strength & Working Load Limit

- Rope
  - Natural Fiber Rope
  - Synthetic Fiber Rope
  - Wire Rope (Aircraft Cable)

Keep it Safe

Hardware Strength & Working Load Limit

- Connectors
  - Shackles
  - Pipe Clamps
  - Trim Chain
  - Sleeves
  - Crosby
  - Shackle Plates
  - Other Hardware

Keep it Safe

Loads

- Static
- Dynamic
- Shock Loads

Keep it Safe

Safety Factors

- 5:1
- 8:1
- 10:1

Keep it Safe

Inspections

- Frequency
- Signs of Wear and Fatigue
- Damaged or Defective or Incorrectly Installed Hardware
- Check Lists
- Planning & Implementation

Know How to Use It

- **Safety Training**
- **Operator Training**
- **Venue Specific Training**
- **Logs**
- **Procedures**
  - Moving a Line
  - Loading a Line
  - Unloading a Line
- **What to do in case of failure**

Keep Concentration

- **Competency**
- **Be Careful & Cautious**
- **Distractions**
- **Line of Sight**
- **Impairments**
- **Gut Instinct**

Resources

- **Entertainment Rigging by Harry Donovan**
- **Stage Rigging Handbook by Jay O. Glerum**
- **An Introduction to Rigging in the Entertainment Industry by Chris Higgs**
- **Rigging Math Made Simple by Delbert Hall**
- **Introduction to Fall Protection by Nigel Ellis**
- **Entertainment Rigging for the 21st Century edited by Bill Sapsis**
- **The Theatre Riggers' Handbook by Delbert L. Hall & Q. Brian Sickels**

- **Bryce Allen, Technical Director at University of Nebraska – Lincoln**
  - bryceallen@unl.edu
  - www.brycedaleallen.com