Rigging Intro

The Art of Not Squishing People

What's Rigging?

From ships to theatre, rigging is the art of safely hanging things above head.

- In proscenium, it's mostly concerned with the linesets and the counter-weight system hung over the stage
- In arena and thrust, it's creating places to hang things from.

Counter weight systems

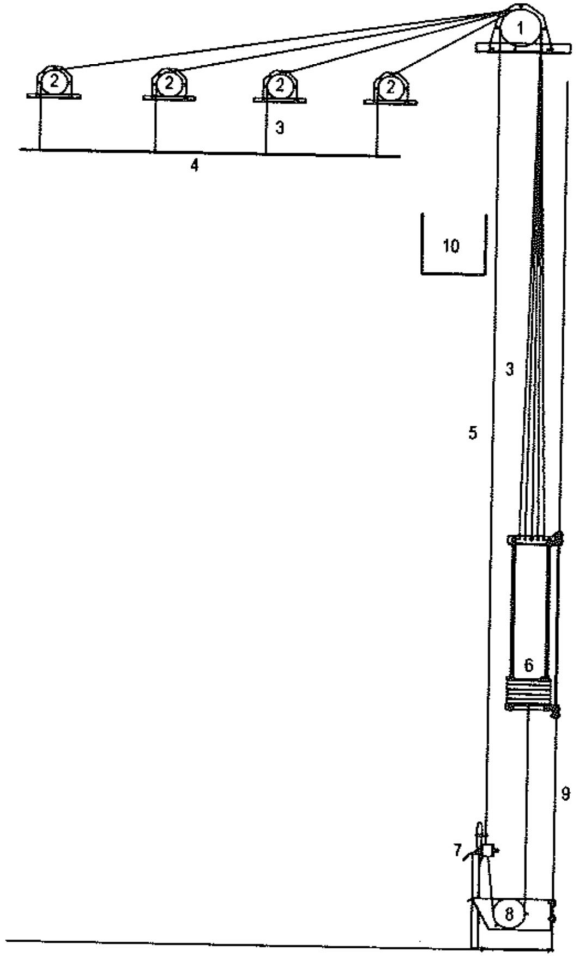
A series of roles, pulleys and weights made to easily move large object over stage.

- Anything hung on the pipes over stage have a counterweight offstage
  - 100 pound object on the pipe, 100 pounds of counterweight
- You are, in theory, only pulling against the friction in the system, never lifting the weight of the object.
- Theatres have Single and Double purchase systems (or sometimes a combination!).

Single Purchase System

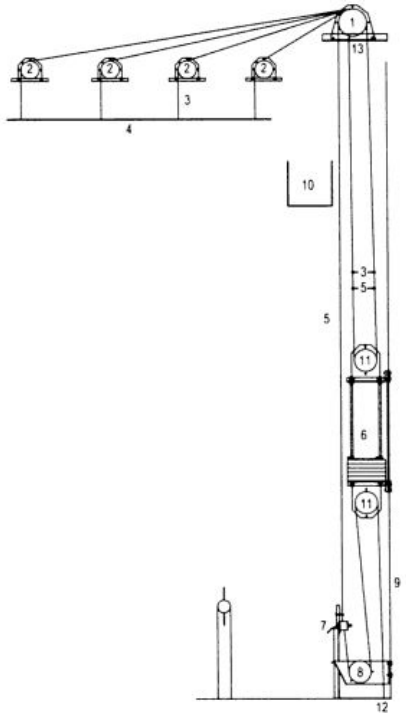
Single purchase systems have a 1:1 weight ratio and the system comes all the way down to the stage floor.

1. Head block: Lift lines and hand line feeds through here
2. Loft Blocks: lift lines go down to the batten
3. Lift Lines: steel cable that holds the batten
4. Batten: a long pipe
5. Operating or hand line: Rope that someone operates
6. Arbor: Holds the stage weights
7. Locking rail: Has locks for the hand line
8. Arbor block: Pulley at the floor.
9. T-Track: Guides the arbor up and down.
10. Load rail/ weight floor: Where the weights are to load onto the arbor



Double Purchase System

- 2 :1 weight ratio. Twice as much weight on the arbor.
- Lock rail is halfway between grid and floor
- Good for doorways, more floorspace.
- More Friction



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

Operating a Lineset

1. Visually Check lineset for safety.
2. Undo locking ring
3. Call out LOUDLY “Attention on Deck, line X going out/ coming in.” Including what it is and where it is (midstage) is also useful.
4. With a hand on the rope, unlock lock.
5. Move the Lineset. Pulling the close rope brings it in, the far brings it out.
    a. While moving a lineset, always keep an eye on the stage to make sure no one is in the way.
    b. When bringing out a lineset, make sure the you slow down so the arbor doesn’t come in too fast and damage things.
6. Once moved, locked the lineset, return the locking ring.

Loading and unloading weights

ONE OF THE MOST DANGEROUS AND SERIOUS JOBS IN THEATRE

That being said, can be done very safely.

- Make sure the line you're adding weight to is locked and snubbed on deck.
  - Snubbing is a type of knot that locks the operating line in place.
- Call out that you're loading weight on the lineset, weight for a response saying you're clear.
- lift off and secure the spreader plates
  - Spreader plates are small metal plates in the arbor that are inserted between sets of stage weights to make the arbor more secure and safe.
- Carefully add weight, making sure you have a firm grasp.
- Once added, return the spreader plate.
- Call out that it's clear.

Check out this guy.

Signs of Danger

- If ever the hand line has slack in it, something is wrong and out of weight, usually too much weight on the lineset.
- If the lineset is moving while locked, something is out of weight, usually too much weight on the arbor.
- If either of these issues are spotted, let someone know immediately.
- When loading and unloading weight, make sure the line is secure with a SNUB LINE
- “Runaway Lineset:” If a lineset is unlocked while out of weight, it will begin to rapidly move one way or the other. DO NOT ATTEMPT TO STOP THE ROPE WITH YOUR HANDS. Instead, re-lock the lineset. If that does nothing RUN DOWNSTAGE OR UPSTAGE, not onstage.
- ALWAYS MAKE SURE THINGS ARE IN WEIGHT OR THE HEAVIEST THING IS ON THE GROUND

Hanging Things

Drapery:

- Most Drapery has tie line every foot.
- Tie the center one first. work out from there, making sure the drape is right along the way.

Hard Scenery:

- Using rigging hardware, attach the scenery to the lineset, making sure the lift lines are straight.

West Coasting

West coasting is a method of bringing a soft good in without letting it touch the floor.

As the drape comes in, people are spaced out under it and they let the drape fall midway up their outstretched forearm. This stops the fabric from touching the floor.

From there, we untie and strike/ move the drape.

LET'S DO IT

- Count off one and two
- We are going to being in a pipe with a border
- Ones will west coast the border as it comes in.
- Once done, twos will take the border from ones.
- Twos will reattach the border

Each of these steps will be called out by the teacher. Do not proceed until it is safe and cleared.

How Rigging Happens

How rigging happens (Arena)

- Long before the event, the **Lead rigger** will determine where things are being rigged and the hardware necessary based on the shows needs and the weight of things being rigged.
- On the day, **Up riggers** will go to the grid with rope and feed an end to the ground meanwhile rigging a point for a chain motor to attach to.
- **Downriggers** will attach the chain of a chain motor to the rope.
- Up riggers haul up the chain motor chain and attach it to the point.
- Downriggers now prep whatever the chain motor is taking up.
- The chain motors lift up the thing.
- Repeat

We'll talk more about arena rigging later!

Safely rigging things: Weight

- Know the weight of whatever you are rigging and how best to hang it.
- Always account for the weakest link in a system.

Breaking strength: How much weight a piece of hardware holds until it will generally fail.

Safety Factor: For safety, we always give ourselves room for error and safety. In theatre, we work with 1/10 of the breaking strength. Other industries use 1/5th or even 1/3rd.

Working Load Limit: The amount of maximum amount of weight we will utilize given the breaking strength and safety factor.

Working Load Limit

Rope Diameter		Minimum Breaking Strength	
(in)	*(mm)*	*(lb_f)*	*(kN)*
1/4	6.4	5480	24,4
5/16	8	8520	37,9
3/8	9.5	12200	54,3
7/16	11.5	16540	73,6
1/2	13	21400	95,2
9/16	14.5	27000	120
5/8	16	33400	149
3/4	19	47600	212
7/8	22	64400	286
1	26	83600	372
1 1/8	29	105200	468
1 1/4	32	129200	575
1 3/8	35	155400	691
1 1/2	38	184000	818
1 5/8	42	214000	852
1 3/4	45	248000	1100
1 7/8	48	282000	1250
2	52	320000	1420

So to figure a working load limit for ¼” wire rope:

Breaking strength is 5480. Safety factor is 1/10.

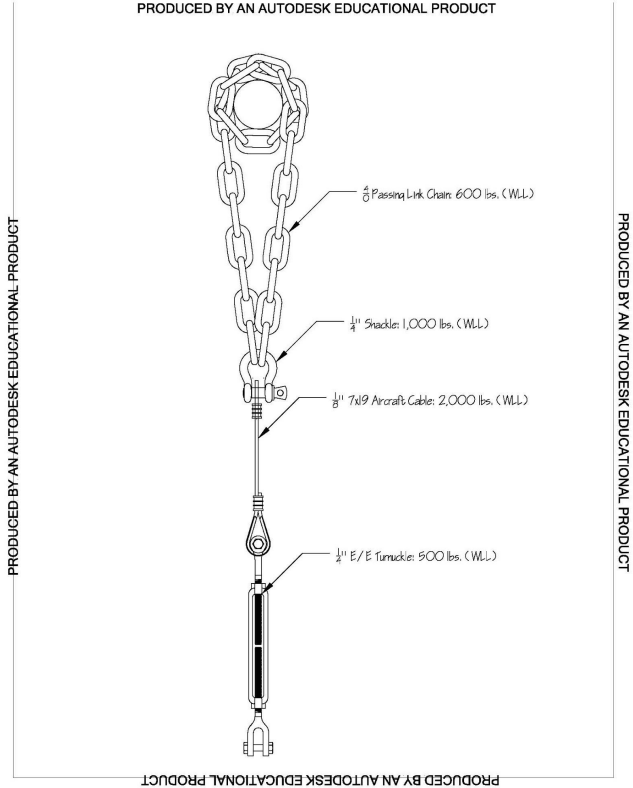
So 1/10th os 5480 is 548.

The working load limit is 548 pounds.

So you do that for everything

Now you do that for the whole system.

If your system is chain to a shackle to wire rope to a turn-buckle to a d-ring, you have to make sure all of that can handle however much weight you're hanging.



LET'S TRY IT!

⅜” shackle Breaking strength: 1 Ton (2,000 lbs)

Working Load limit…. 200 lbs!

¼” Chain Breaking strength: 12,600 lbs

Working Load limit…. 1260 lbs!

1” Hemp Rope Breaking Strength: 8100 lbs

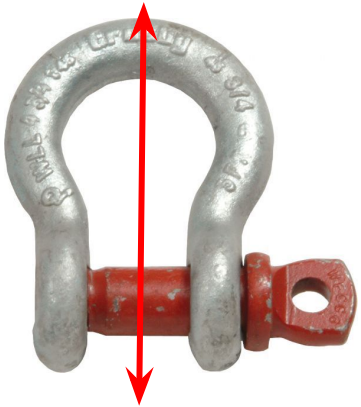
Working load limit… 810 lbs!

WHY?

IT seems a bit wasteful, huh? Why have this huge safety factor?

- Theatrical rigging moves a lot. Something coming to a stop or starting has more force than something standing still.
- Constantly over the heads of actors and audience, so better to be on the safe side.
- This also gives us plenty of room for error.

Hardware



Shackle:
Great for attaching hardware together
Always keep IN LINE

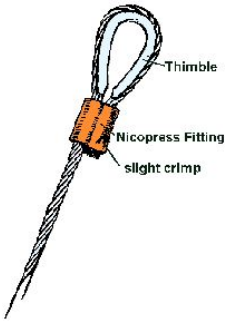
Turnbuckle:
For making fine adjustments to height.

D-ring:
Generally attached to the object being hung.

Batten Clamp:
Attached to a pipe. Connects pipe to the rest of the system.

More hardware

Cheeseborough:
For attaching two pipes together. Either swivel (as above) or fixed, which only makes pipes perpendicular.



Wire Rope Stuff!

Nicropress sleeve:
Holds the loop at the end of wire rope. Is crimped tightly.
Permanent.

Crosby Clip:
A temporary version of the nicopress sleeve.
Can be adjusted.
Not as strong, though.

Thimble:
Goes inside of loop to protect rope from being damaged.

MORE!?

Verlock:
An adjustable end to aircraft Cable

Quick Link:
A (not very structural) way to terminate or link chains.

Caribeaner:
A quick to install, load bearing object. Best used at the end of a rope. Rarely permanent.

EVEN MORE!

Wire Rope:
Comes in many thicknesses and configurations. Very strong and generally what we use to rig anything,

Chain:
While stronger than wire rope, a lot bigger and clunkier. Generally used to begin a rigging system. Wrapped around I-beams and pipes, for example.

Gakflex:
A very strong and gentle loop used to rig things. Is most often used to connect a rigging system to truss because it won't damage the truss.

Other common rigging things: TRUSS

- Truss is the workhorse of entertainment rigging. It's incredibly strong, very light and it's used for everything. Lights are hung on it, speakers are hung off it. Roofs are put on them. They come in all many lengths and can even come in many shapes.

- There's also more advanced types of truss, such as self climbing. It allows you to build everything on the ground and it lifts itself up.

Chain Motors

The best friend of the Rigger.

- Variety of strengths
- Climbs its own chain
- Hook underneath to attach to things
- Controlled via “pickle” or “pendant”
- Several utilized at the same time, generally.

TO THE SKIES!

We are going to see our system and go up to the grid.

Please empty your pockets

We are going to the load rail to load weights.

Please be attentive and do not become distracted, this is a dangerous place.