
Making Things Move
with content from Tim Keenan



Making Things Move in Your Display







Objectives

- Understanding the types of motors to use
- Understanding pneumatics
- Connecting motors/pneumatics
- Identifying things that can be motorized
- Ideas for controlling the mechanisms
- Learning where to find the good stuff!

We hope to inspire your creative and imaginative energy. We would like to answer some of your fundamental questions so that you can begin to make your Christmas Display move.

Starting out, be sure to take your time, avoiding going too large with your ideas. Start small and build from there.

What kind of motors should you use?

What's important to look at when selecting a motor?

AC vs. DC

Servo

Amperage

Voltage

Duty Cycle

Torque

RPM

AC vs. DC

- Generally you want to use a 110 AC motor as it can plug directly into an outlet.
- DC motors are good for trains or other figures that cannot be plugged in because they travel or because it would be impractical to have them plugged in.

AC vs. DC

- The speed can be adjusted very easily with a DC motor.
- The rotational direction can be changed easily on a DC motor by changing the polarity.

Servo Motors

- These are usually seen in RC cars and airplanes.
- They make great motors for small figures and robot items.
- They need electronic pulsing to make them move.
- They are always low voltage
- They have lots of torque for their size.

Amperage

- This is important to know to make sure you size wire correctly.
- Make sure you size batteries correctly.

Amperage

- Make sure your controller will handle the motor.
- Always use the peak amperage in the rating sheets.

Voltage

- Use AC motors rated at 110 volts so they can plug directly into an outlet.
- DC motors typically run from 6 to 24 volts.

Duty Cycle

- Intermittent or continuous: the relationship between operating time and rest time.
- Try to use continuous duty.

Torque

- Torque is the twisting power applied to the shaft.
- It is measured in foot-pounds (ft-lbs.) or inch pounds (in-lbs).

RPM

- Revolutions per minute, or speed.
- Usually you want 5 to 350 RPMs.

Snow Man

3M099

115 vac

.55 amps

18 RPM

9.5 In.-Lbs

Ski Tow

6Z909

115 vac

1.4 amps

50 RPM

15 In.-Lbs

Train

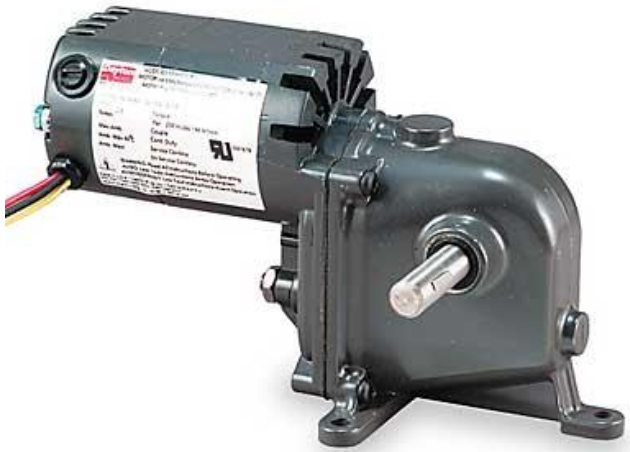
1L476

12 vdc

3.5 amps

40 RPM

26 In.-Lbs



Santa

1L482B

115 vac

1.3 amps

50 RPM

45 In.-Lbs

Skiers

4z063

115 vac

.51 amps

28 RPM

50 In.-Lbs

Christmas Display Item	Grainger P/N	RPM	Torque	Voltage	Drive Type
Snow man & Snow lady	3M099	18	9.5	110 ac	Direct Drive
Spinning bear	3M099	18	9.5	110 ac	Direct Drive
Elves	3M099	18	9.5	110 ac	Direct Drive
Raccoon	3M099	18	9.5	110 ac	Direct Drive
Ski tow	6Z909	50	15	110 ac	Belt
Train	1L476	40	26	12 dc	Chain and Sprocket
Spinning bear	3M099	18	9.5	110 ac	Direct Drive
Santa	1L482B	50	45	110 ac	Chain and Sprocket
Penguin	6Z908A	25	45	110 ac	Chain and Sprocket
Skiers	4Z063	28	50	110 ac	Belt and Pulley

In Summary

- Look for 110 AC gear motors to make things move or turn.
- A good torque is around 20 in/lb.
- A good speed for a train to travel is 3 feet per second or 2 mph.
- Look for a 12 to 24 volt motor for a train.
- The shaft size of the motor is important to know so as to find sprockets or pulleys to fit.
- Look for motors that have mounting holes.

A Few Speed Notes

- Distance traveled per revolution = wheel diameter x 3.14
- Speed in feet per second = distanced traveled x rpm divided by 60 divided by 12
- Example:
  - **If the wheel is 12 inches in diameter and the motor turns at 50 rpms**
  - **Then the distance traveled is 12 x 3.14 = 37.7 per revolution**
  - **Then the speed = 37.7 x 50 rpm/60/12 which is 2.6 feet per second (which is ideal)**

Pneumatics

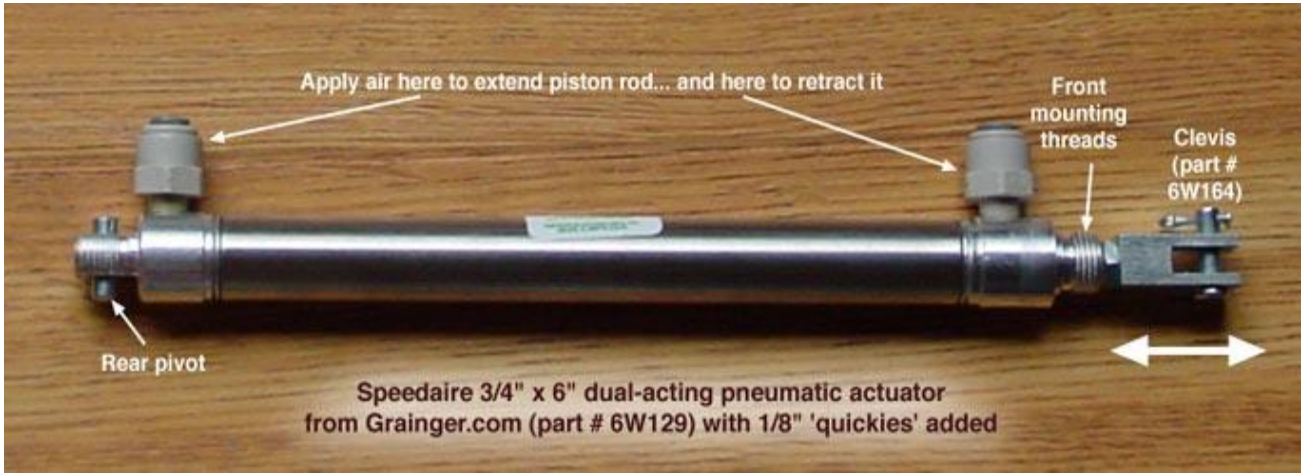
- A great way to make props move.
- It is a little daunting as there is a bewildering array of devices, connectors, and parts, to include power and an air supply.
- You can make some great things move with air if you are willing to explore this awesome area.

Pneumatic Parts

- Small air compressor up to 60lbs
- Tubing: ¼ nylon tubing from Home Depot
- Regulator
- Air Valve with 1/8 inch connectors
- Flow restrictor
- Air Cylinder
  Double action and single action

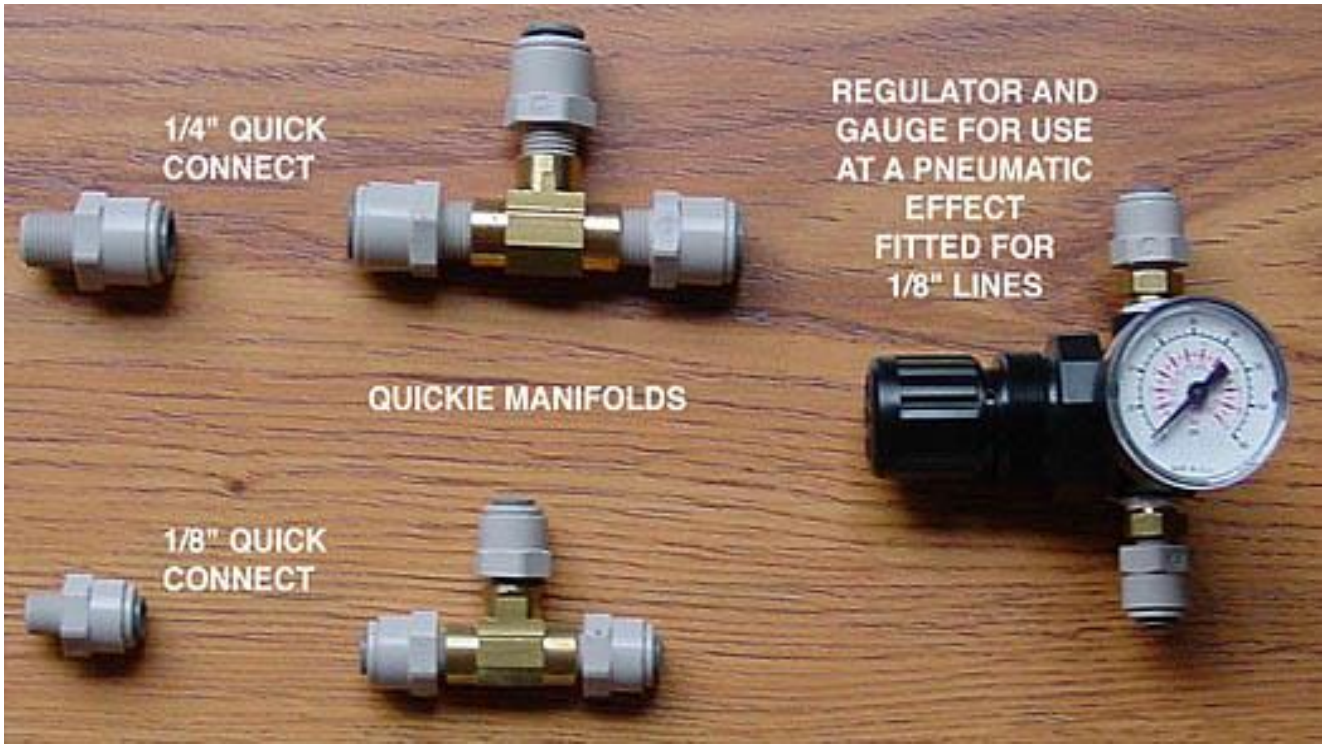
Pneumatic Cylinder

Picture by Doug Ferguson Phantasmechanics



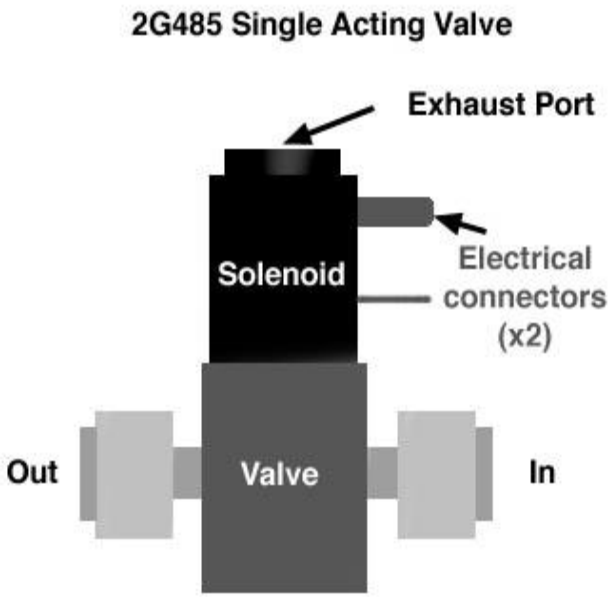
Pneumatic Regulator

Picture by Doug Ferguson Phantasmechanics



Pneumatic Valve

Picture by Doug Ferguson Phantasmechanics

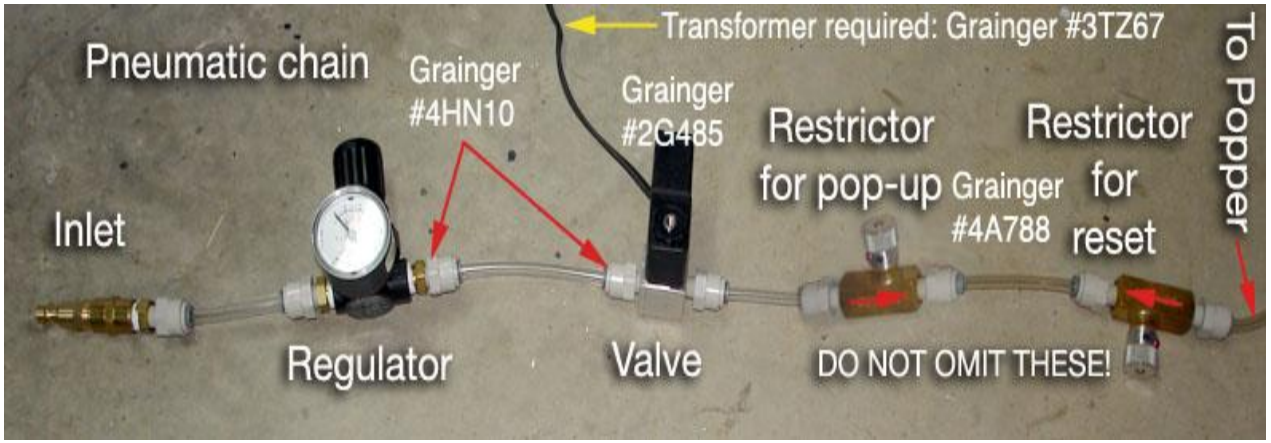


Pneumatic Flow Restrictors

Picture by Doug Ferguson Phantasmechanics

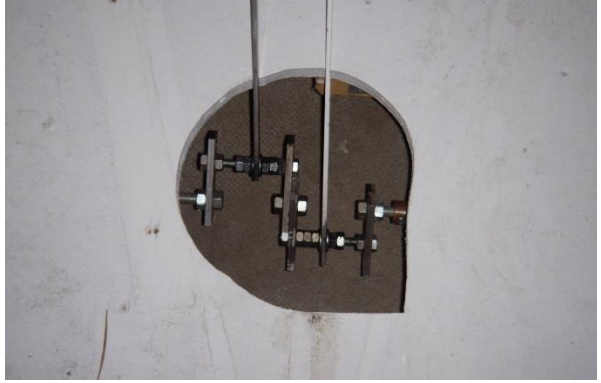
Pneumatic Chain

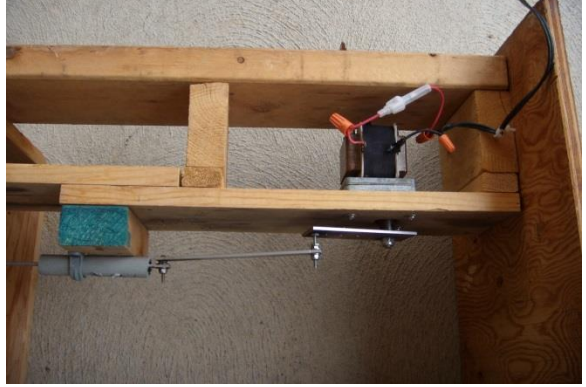
Picture by Doug Ferguson Phantasmechanics



Pneumatic Lift

Pneumatic Lift





How to Connect the Motors

- Crank arms
  - Make your own
- Couplers
  - Grainger and McMaster are good sources
  - Make sure your shaft is sized correctly
  - I try to use 5/16 in. motor shafts

How to Connect the Motors

- Chain and sprockets
  - Grainger, McMaster, and surplus places have a large assortment of these.
  - Pick one ANSI standard size for all your projects and stay with it.
  - Consider using ANSI 35

How to Connect the Motors

- Belts and pulleys
  - Grainger and McMaster are good sources
  - Make sure your shaft is sized correctly
  - Sometimes belts are tough, as you need to keep tension on the belt.

How to Control Motors and Pneumatics

- X-10 Products
- Animated Lighting Relay Board
- Light-O-Rama Relay Board
- D-Light light show products
- Other similar relay board
- Home Automation Controller

What do you want to motorize?

What do you want to motorize?

What do you want to motorize?

Beyond “Making Things Move...”

*Voice recording
*Easter eggs
*Strobes
*RF ID
*Parade
*Teddy moving on a cable
*Sound effects
*Fog or bubbles
*Limit switches
*Motion Sensors
*Nutcrackers
*Ferris wheel or carousel

Where to find the good stuff:

- *Grainger has a large selection of motors
- *All Electronics
- * Surplus Center
- Small Parts Inc.
- McMaster Carr
- *Herbach & Rademan
- Edmund Scientific's
- American Science & Surplus
- Ramsey Electronics
- Jameco Electronics
- MCM Electronics
- *Garage sales
- Parts from toys, drills, or appliances
- Ebay
- Winfield Collection for wooden patterns

Conclusion

- We reviewed the types of motors to use
- We covered pneumatics,
- Connecting motors/pneumatics,
- Identifying things that can be motorized,
- Ideas for controlling the mechanisms &
- Learning where to find the good stuff!