

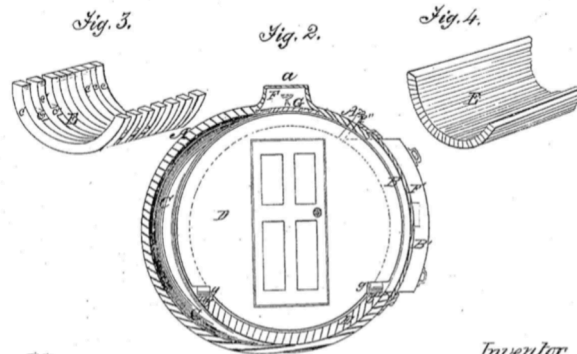
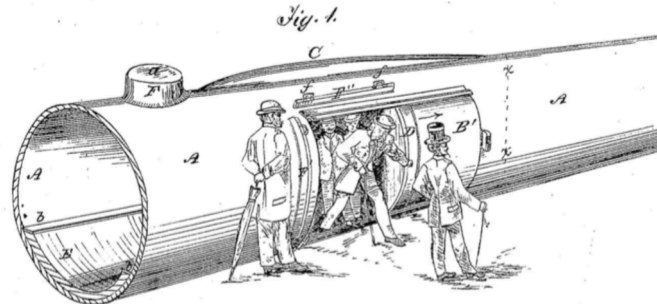
Workshop: Build a Pneumatic Subway



“Interior of the pneumatic passenger-car,” 1872. The New York Public Library Digital Collections. Rare Book Division, The New York Public Library

Alfred Ely Beech was an inventor who built New York’s first underground railway below Broadway in 1870. It was a pneumatic, or air-powered, train; it used a huge steam-powered fan to blow a cylindrical train car through a brick tube at 10 miles per hour. This pneumatic train was also known as the ‘Secret Subway’, as Beach didn’t actually have the proper permission to build a subway at the time.

A.E. Beach,
Pneumatic Railway,
No. 70,504, Patented Nov. 5, 1867.



Witnesses,
E. L. Topkoff
W. P. Brown

Inventor,
A. Ely Beach,

Patent for the Pneumatic Railway, 1867
United States Patent and Trademark Office

LOOK

Take a moment to look closely at all of the details in this picture. What do you notice?

THINK and SHARE

- What shapes can you find in the design of this vehicle?
- What might figures 3 and 4 be telling us?
- How big do you think this vehicle was?
- If you could design your own vehicle, how might you illustrate your design?

ACTIVITY

Now that we've seen Alfred Ely Beach's Pneumatic Subway, let's build our own wind-powered vehicle. We'll make a vehicle, then add a pinwheel and see if we can make it move using air from a hairdryer or balloon.

Materials: plastic bottle or milk carton, scissors, two pencils, paper, push pin, 4 bottle caps (or some cardboard)

Step 1 – Build your vehicle. This is just one idea for how to make a vehicle—you might come up with a different design based on the materials you have at home.

- Take your bottle or milk carton, and with a pair of scissors, poke a hole at the top on one side, then again at the same point on the opposite side, so that you can pass a chopstick, straw or pencil through both holes. Repeat at the bottom of the carton, so that both chopsticks are parallel and pointing in the same direction.
- Next, attach your wheels. You can use bottle caps, or you can make your own wheels from cardboard by tracing circles onto it and asking a grown-up to help you cut them out. You can use Fun-Tac or Poster Putty to attach your wheels – put a little inside each bottle cap, then squish them onto the ends of each chopstick. If using cardboard, you can poke holes in the middle and push the sticks right through. Now you should have a functioning vehicle!

Step 2 – Make your pinwheel. Start with a square of paper or cardstock (paper will be easier to cut and bend).

- Draw a horizontal line across the middle of the paper, then a vertical line from top to bottom, dividing your paper into 4 equal parts. Then, draw two diagonal lines, from corner to corner.
- Using scissors, cut along the diagonal lines going towards the center, stopping before you reach the middle.
- Fold every other cut corner towards the center, using one hand to hold the points in place until you've gathered the four alternating corners together. Ask a grown-up to help you attach your pinwheel to the eraser end of a pencil by pushing a thumbtack through the center of the pinwheel and into the eraser.

Step 3 – Attach the pinwheel to your vehicle. You can use tape to attach your pinwheel to your vehicle, just make sure that the pinwheel is facing the opposite direction from the way you want your vehicle to go.

Step 4 – Make your vehicle move. Now, for the moment of truth—let's see if we can make our vehicle move using only the power of wind!

- First, try using your lungs to blow air into the pinwheel to see if you can make it move. Maybe it only moved just a little bit, and maybe that was pretty tiring...
- Perhaps we can try using a hairdryer instead?
- How about blowing up a balloon, then pointing the open end of the balloon towards the pinwheel and letting the air out?
- You might need to experiment to find the right angle to aim your balloon or hairdryer for maximum effect!

Do you have any other ideas of how we can use air to make our vehicle move?

We'd love to see all the unique and creative ideas that you come up with. Please share photos of your creations using #nytransitmuseum

