MOUNT EMMOT CABLEWAY

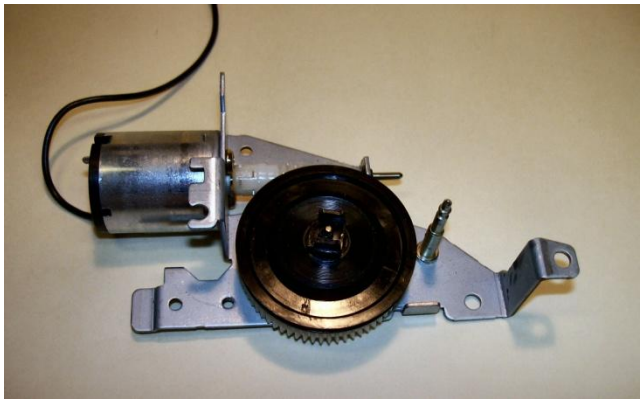
John Emmot has built some new corner modules for the Pikes Peak Division. They have no scenery at present. Casting around for some scenery ideas, I had a 'brain flash'. How about an aerial cableway? A mountain on the inside corner would involve a tunnel obstructing most of the tracks, and would have to be removable so the sections could be separated. I looked at the new outside corner, which should permit a short cableway. So, to work! Remember, throughout this exercise, we're dealing with on-hand items wherever possible. To refresh my memory, I checked out various cableways on the internet, and found photos of one we rode in Japan.

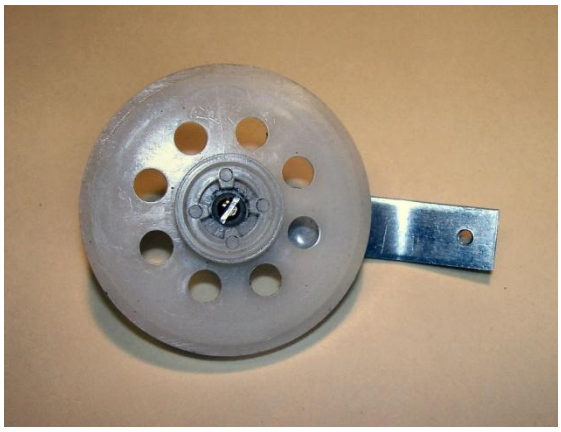
Austria


Hinoyama, Japan

There is enough room for a cableway with a 36 inch x 8 inch base. The base station will be at the right end when facing the module front, and the summit station at the left. A precipitous mountain will support the summit station. Height will be restricted to 12 inches, which is the height of the backdrop. All drive elements will be on a support column under the mountain. Only an idler pulley will be in the base station.

I found a worm drive and motor that operated at an appropriate slow speed at 1.5 volts DC. I found two pulleys with perimeters for a round belt. One pulley was mounted on the worm gear. The other was mounted on an aluminum strip for the idler. Two small micro switches were found for use as limit switches.





A 36 inch x 8 inch x ¼ inch base was cut from some scrap pressed board in the garage. The 5 ¾ inch x 5 3/4 inch x ¾ inch base for the base station was cut from plywood, with a cutout for the gondola docks. It was painted gray and secured to the base with wood screws.

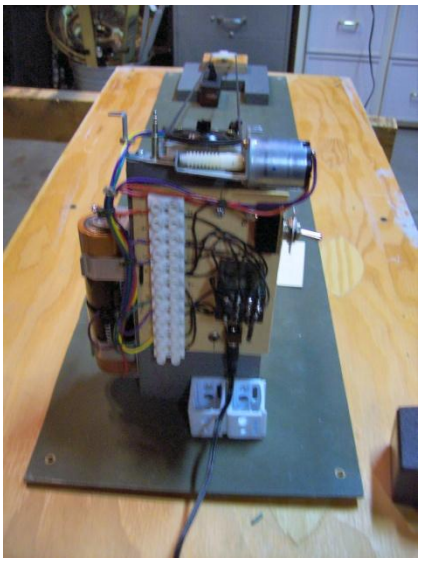
The 7 inch high drive support column was cut from scrap '2 x 4' stock. The top end was cut at the estimated angle to allow a straight shot to the base idler. It was painted gray and secured to the base with wood screws. The drive unit, control board, and battery holders were screwed to the top.

With the base unit and drive support column mounted, a straight edge was used to check the cable angle. It was determined that the idler needed be higher, so a small ¾ inch block was added at that end. The resulting angle was less than anticipated, so shims were added at the support column to adjust the motor drive.

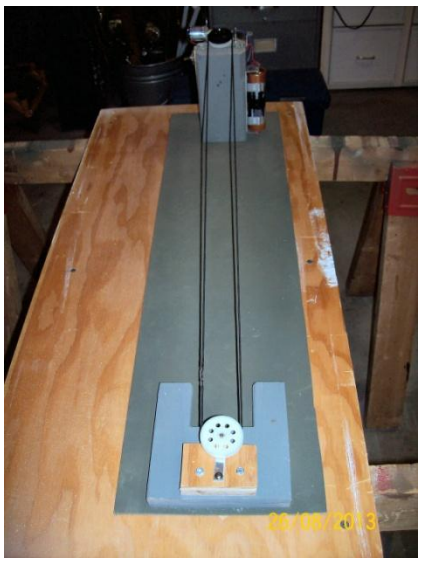
I planned to use picture hanging wire purchased at Hobby Lobby for the cable. It soon became evident that it was too stiff to operate correctly. From my extensive pile of scrap wire came a miniature speaker with a nice soft black cable. Diagonal cutters made quick work of that! I stretched the cable around the pulleys and marked the length. The ends were stripped and soldered. It worked! Black marker helped hide the shine of the copper wires. Extended testing resulted in the cable breaking at the soldered joint. Rummaging through my junk wire produced a long two-wire audio cable. The wires were separated, and another cable assembled. This time the joint was secured with super glue, since the fine audio wires weren't strong enough when soldered. The completed assembly is shown here:

Front View

Back View

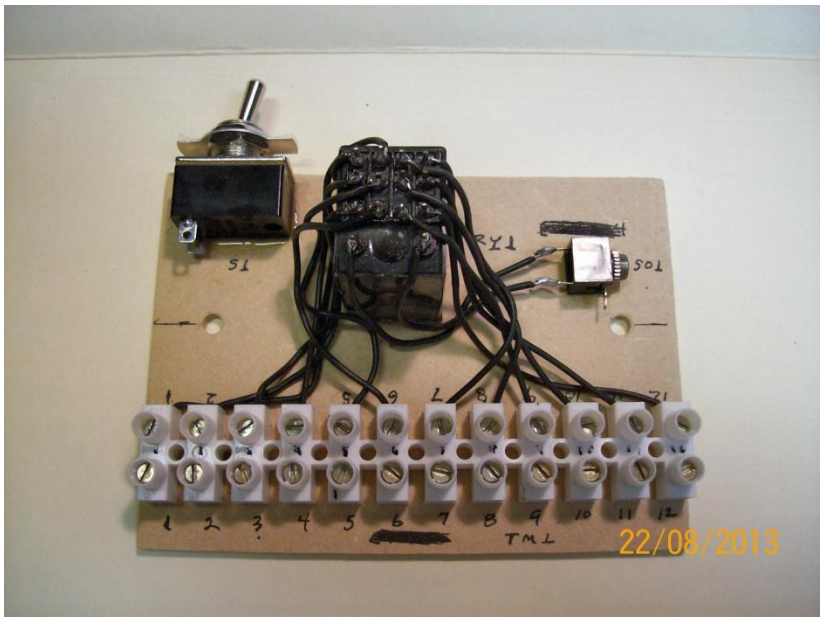


Support Column End



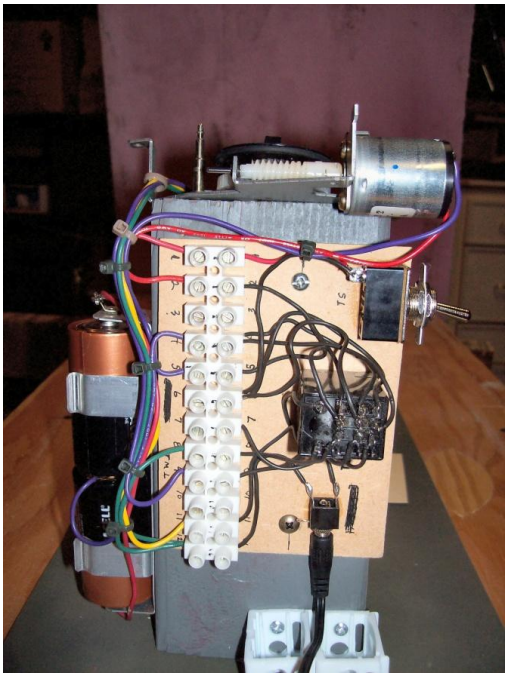
Idler end

The above photos show the control board and D-cells mounted to the support column. Holders for the 2 9 volt batteries are mounted at the base of the support column. More details can be seen in the following photos.



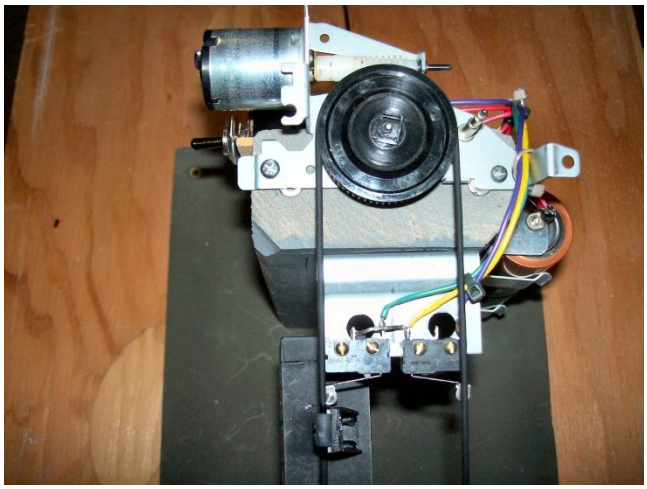
TM1 provides for connecting the various drive items. Switch S1 turns on the 1.5 volt motor. RY1 is the latching relay used to reverse the cable's direction of travel. Two micro switches activated by the gondolas will set and release the relay. The relay is normally not energized, so no switch is provided for the 12 volt supply. SO1 is the jack for the 12 volts required to operate the relay. The relay pulled in at a little less than 9 volts, so two 9 volt batteries in parallel were provided. Testing showed that the 9 volt batteries discharge quickly. A 12 volt "wall wart" was available and was used with good results.

The original control and power setup:



Detailed view of the support column

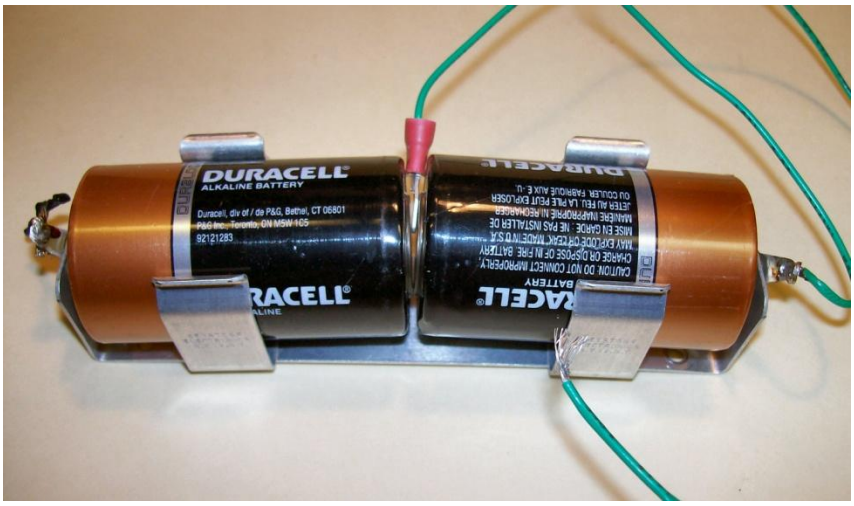
The motor drive is located at the top. Motor batteries are on the left. S1 is the motor power switch. The latching relay is located at the middle right. The jack for the 12 volt relay input is at the lower right. Connections are made on the large terminal strip on the left. Holders for two 9 volt batteries are secured to the bottom of the support column.



Top view of support column showing limit switches.

The UP limit switch is on the left. When the front gondola closes the switch, the latching relay is energized, reversing the action. The DOWN limit switch on the right is closed by the rear gondola, releasing the relay, again reversing the action.

Batteries, holders and wall wart



Two 1.5 volt batteries wired in parallel

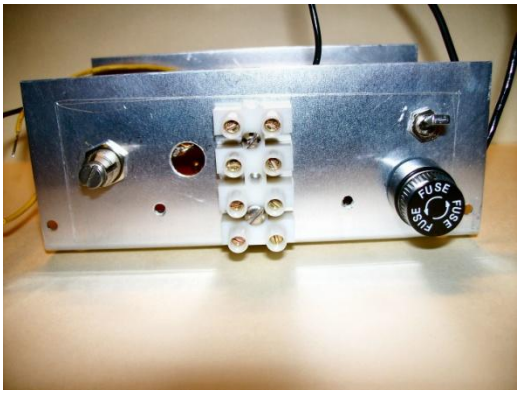
Testing showed that the motor drew about 37 milliamperes at 1.5 volts, which provided very good battery life. My initial tests ran for over twelve hours on one battery, with no loss of battery voltage. To increase the life, the two batteries were wired in parallel, with a negative lead located in the center between the two batteries' negative terminals. A temporary lead is shown above. The final lead was constructed of a piece of copper sheet soldered to the negative lead.

The two gondolas are made from small plastic boxes found at Hobby Lobby. The hangers were constructed of plastic pieces from the scrap box. A few human figures were found, and glued inside. The gondolas were painted and temporarily mounted to check clearances and determine the mounting location for the micro switches. Two nice easy-action micro switches on hand were glued to plastic angles. MISTAKE! The super glue got into the switches, ruining them. Two replacement miniature micro switches were found at Radio Shack.

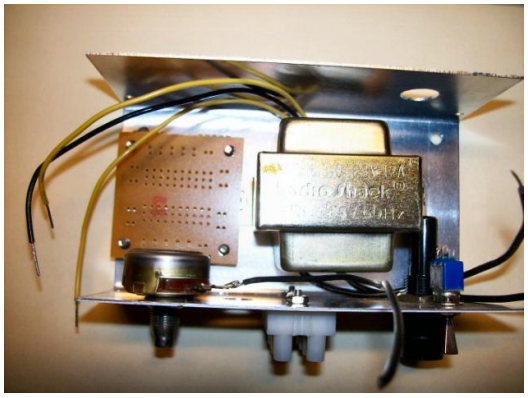
The gondolas are mounted to the cable with fabricated clamping devices which are secured with 4-40 machine screws and small amounts of Tacky Glue. This glue, applied sparingly, makes removal easier.

Testing showed that 1.5 volts didn't provide enough "kick" to initiate the reverse action when the micro switches were activated by the gondolas. An old model railroad power supply was hooked up. Testing showed that its minimum voltage of 2.4 volts provided the "kick" (too much "kick", as the gondolas would swing excessively). It seemed that 2 volts might be the magic number.

Also I wasn't too thrilled with the wall wart setup for relay power. In the cabinet under my layout was a small aluminum box with a 12 volt center-tapped transformer. Scrounging through the vast junk pile produced a bridge rectifier, a rectifier diode, a couple of electrolytic capacitors, a small printed circuit board, and various pieces of hardware. So-I built a power supply!



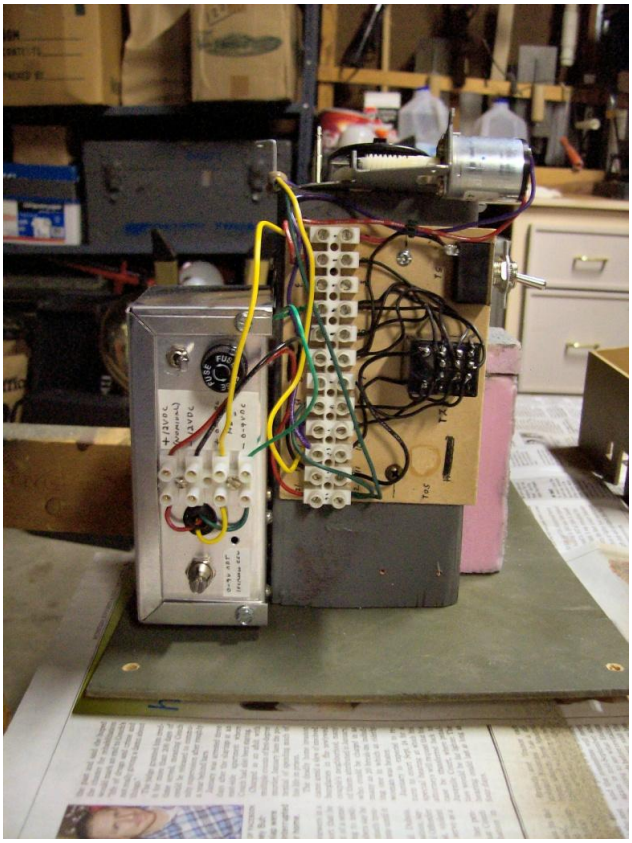
Front of partially assembled power supply



Top view of the power supply

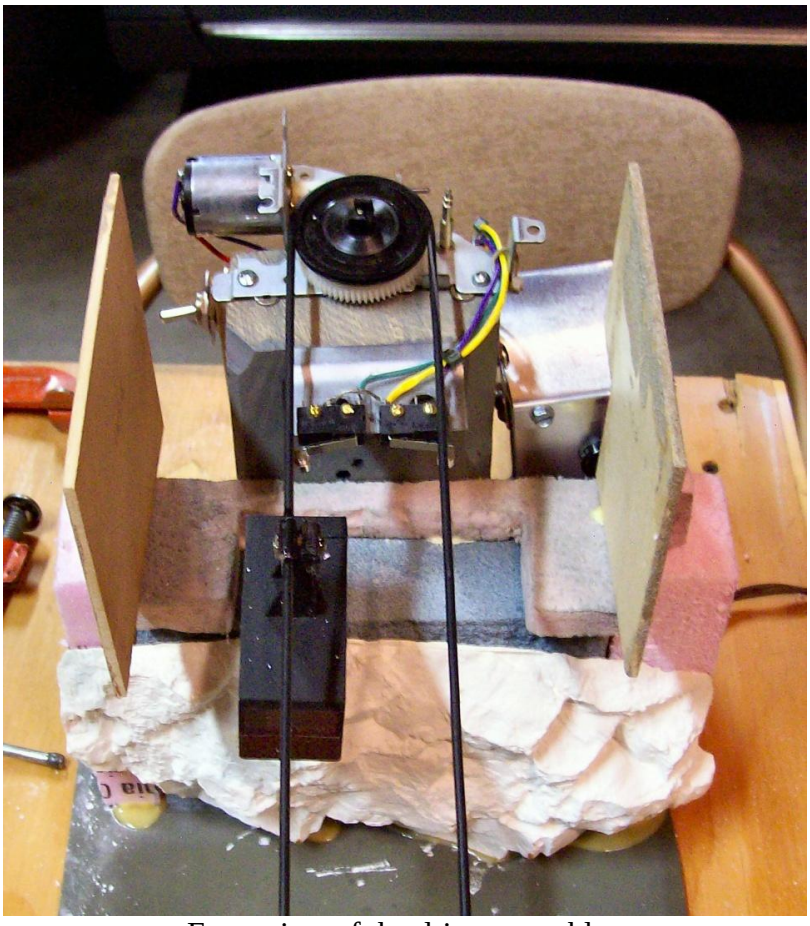
The rectifiers and capacitors were mounted on the printed circuit board. A fuse holder and toggle switch are on the right. The adjustment pot for the motor drive is on the left. A hole for wires and the output terminal strip are in the center.

The completed power supply produced no-load 20 volts DC at the relay terminals, and 0 to 9 volts DC variable at the motor terminals. It was screwed to the support column in place of the D-cell holder, and wired to the control board.



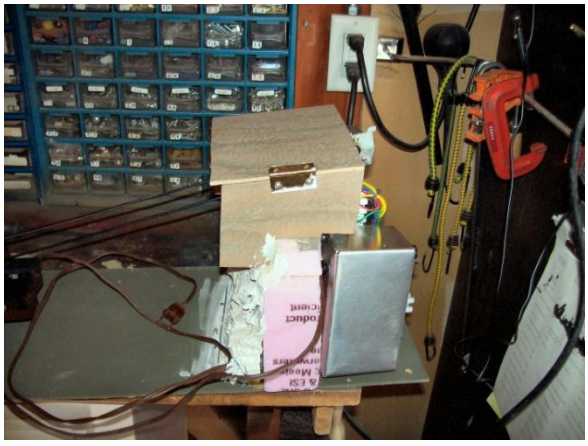
End view of the drive unit assemblies.

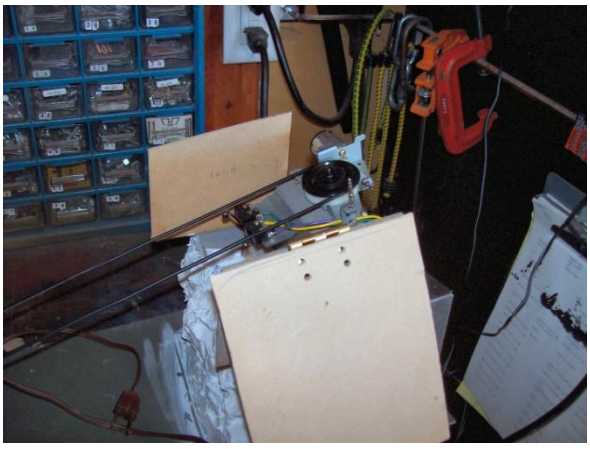
Testing showed good relay operation, and the motor speed could be varied. We measured the voltages in operation. The line voltage was 119.7 VAC. The "12 volt" output was 19.0 VDC. The "2 volt" output was approximately 5.2 VDC at the operating threshold (where the gondolas moved and operated the reversing micro switches). The gondolas moved faster than I desired, but lower voltages didn't work!



Front view of the drive assembly.

My original plan was to make the top of the summit station part of the removable mountain. After considering how to secure the top, I decided to hinge it to the station walls. The result is shown here:





The hinge should be hidden by the removable mountain.

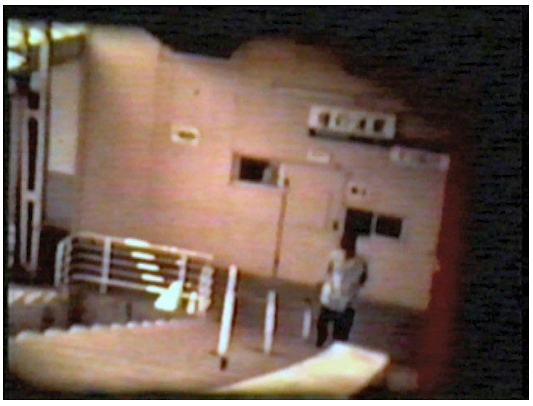
Just when it seemed we were home, the cable broke. As mentioned above, a new cable was built. It is a bit shorter than the original, so the idler was moved closer to the support column. During testing, stretching of the cable was noticed, so the idler was moved to tighten it. As usual when I hit a hiccup, a diversion is indicated, so I turned to the cable stations.

Cable stations are required at the summit and at the base. These photos show typical stations.

Unzen summit

Hinoyama summit

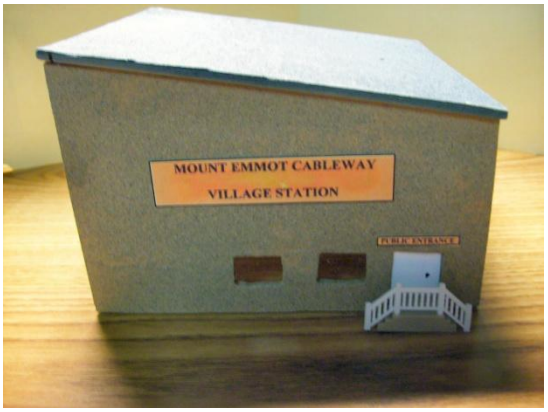
Burger base



Danoura base (Hinoyama)

I decided to build the base station using pressed board scraps. It is a 6 inch square, rather plain building, with a height sufficient to clear the cable. It fits snugly over the 5 ¾ inch square cableway base, being removable for cable maintenance. Minimal inside walls can be mounted to the base, so the cable can be removed from the top. I sprayed the outside with some coarse paint picked up at Hobby Lobby. The roof is also pressed board, with 100 grit sandpaper glued on top, and painted gray.

Bay opening



Front side

End view

Back side

An attempt was made to keep the entire unit light. The gondola docks, micro switches and any interior walls are mounted on the front of the support column. A rock casting is glued to the front of the support column. The top, sides and back of the mountain are removable as a unit. A foam "armature" for the mountain was glued up, but didn't turn me on!

The foam mountain shell.

A second " armature" of plaster cloth over cardboard frame was built. Howard Smith volunteered to do the final scenery. He may use a different "armature". Wouldn't blame him! I'm making some rock castings for him.

The plaster cloth over cardboard shell is shown drying. More plaster rock casts are being cast.

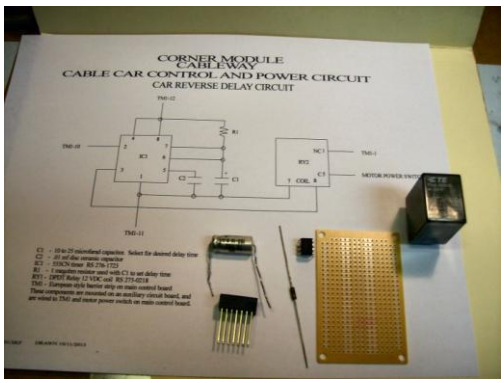
The mountain shell after applying rock casts needs coloring and final adjustments. Hopefully, Howard will complete it (or make his own)!

I planned the cableway and mountain to be readily removable. Holes in the corners of the base are provided to secure the ends with wood screws during operation, to keep the unit stable. I'll leave the final scenery around the base to John.

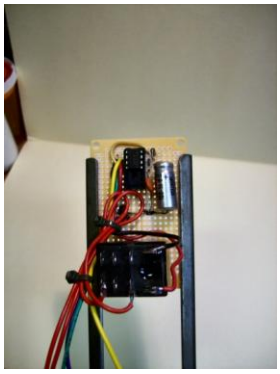
I wanted a tourist destination for the top of the mountain. A search at TECO didn't produce a building that I wanted. When I emptied a batch of DVDs, the plastic container gave me the idea! The Summit View Restaurant was the result!

The story is that access from the cableway station is through the center of the restaurant, as is access to the observation deck. Two doors could provide access to a mountaintop patio, or such. Hopefully, Howard can fit it to the mountain top.

John Emmot and I desired that the gondolas would pause each time they arrived at the Summit Station. I came up with a delay circuit to accomplish that. A small printed circuit board with a 555 timer and relay was constructed. The circuit was designed to disable the motor power for a selectable period of time when the up and down limit switches were activated.

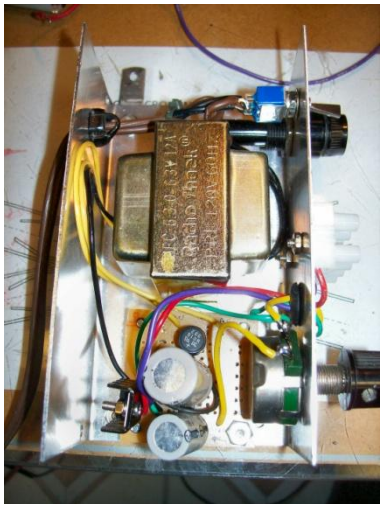


Circuit diagram and parts

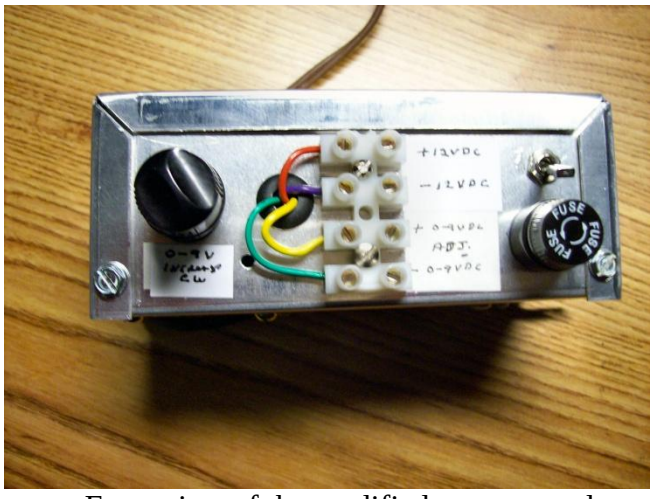


Original assembly

Various values for the timing resistor and capacitor were tried, with varying degrees of success. When I thought I had a workable circuit, the assembly was installed and hooked up. IT DIDN'T WORK! The 555 timer didn't trigger! I also noted that the relay on the main board was quite warm. The 19 volts was too much. So-off came the power supply. I added a 7812 voltage regulator to get the voltage under control. Nice, the voltage was 11.8 Volts!



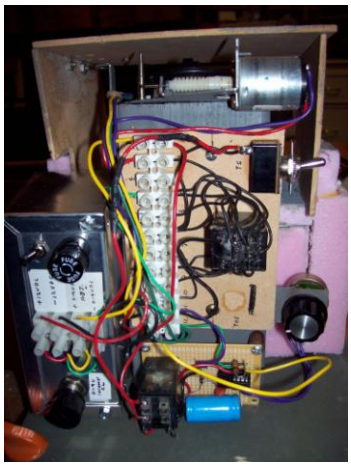
The 7812 regulator is on lower left



Front view of the modified power supply

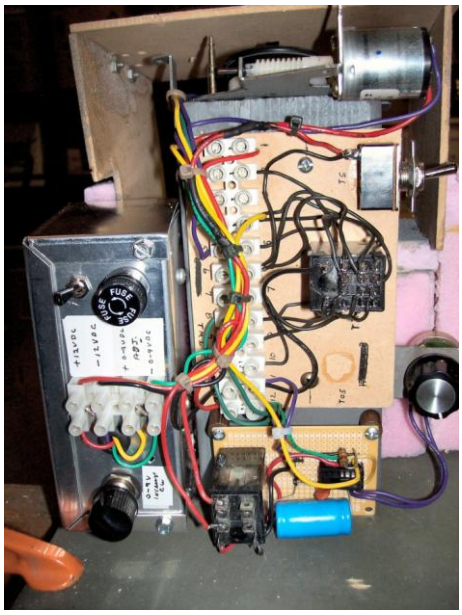
I also went back to the drawing board to determine optimum timing components. Study of the 555 timer showed that a 470 microfarad capacitor and resistor values up to 100 kilohms should produce usable delays. With that capacitor and a 100 kilohms potentiometer installed, the delay circuit was connected to the modified power supply. Testing produced delay times up to a minute! Great! Would it work on the cableway?

I installed the reworked delay board and wired it to the control board. Initial testing showed that the rear gondola would pause when it reached the top, but the front gondola would not. Connecting the trigger lead to various terminals produced no change. My usual technique was employed, I watched football!



Initial test configuration, with yellow trigger lead disconnected.

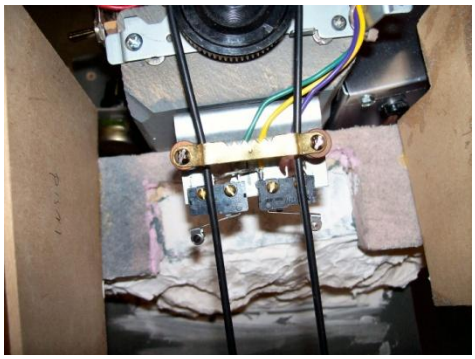
On Wednesday, after the Broncos won again, I addressed the problem again. This time, when the trigger lead was connected to the motor minus terminal, IT WORKED! Both gondolas paused at the top, and the delay could be varied from nothing to a LONG DURATION. Didn't have a watch on, so didn't record exact times. A video shows the operation. It added tie wraps to clean up the wiring.



Final configuration.

The main power switch is at the upper left of the power supply next to the fuse. The motor switch is at the upper right on the control board. The speed control knob is at the lower left on the power supply. The delay knob is on the lower right by the control board. The delay board is at the very bottom.

A problem was found-the gondolas jumped outside of the micro switches at the top, which caused the cable to move around. I added an assembly to keep the cable inside, for better operation.



Cable Guide Assembly.

Things are looking up! The thing works as desired. I'll do a little more work on the scenery, then plan to bring it the modules for TECO.

MOUNT EMMOT CABLEWAY
OPERATING INSTRUCTIONS

Startup:

Place the assembly on the module with the support column on the left. Secure with wood screws at the four corners.

Turn power supply and motor switches OFF.

Plug the power supply cord into a 115 volt AC outlet.

Turn the power supply switch ON.

Set motor switch ON. Adjust the speed control pot as needed to get the slowest consistent movement of the gondolas. MAKE POTENTIOMETER ADJUSTMENTS GENTLY. A LITTLE MOVEMENT PRODUCES A LARGE SPEED CHANGE!

Adjust the delay potentiometer to obtain the desired delay when each gondola arrives at the Summit Station.

When the mechanism is operating correctly, place the mountain over the support column. Make sure that the AC power cord fits into the slot on the rear of the mountain.

Shutdown:

Remove the mountain.

Observe the gondolas. When they are about midway on the cableway, turn the motor switch off. This will help on the next startup.

Turn the power switch off and remove the power cord from the AC outlet.

Coil and secure the power cord. Store the removable mountain for transport.

Notes:

1. To access the idler at the base station, lift the base station building straight up. This will allow adjustment of the cable.

2. The 3AG fuse is rated at ½ ampere.

3. Spare cable material is supplied. If the cable must be replaced, carefully loosen the screws on the gondolas, pick off the Tacky Glue, and remove the gondolas from the cable. Measure the new cable to fit, bare about ½ inch of insulation on each end, wrap the wires

and internal insulation tightly, and secure with super glue. Keep the joint as close as possible to the cable diameter.

4. a. When replacing the cable, locate the joint so that it doesn't pass either the drive or idler pulleys, since the glued joint will probably not pass around the pulleys. If the cable is too tight or too loose, the idler pulley can be relocated to provide correct cable tension. The pulley must be centered to allow gondolas to enter the base station bay without interference. A second screws has been added to keep the idler centered.

   b. Place the rear gondola immediately next to the splice, on the side toward the mountain. Position the gondola so that it is level. Tighten the mounting screw and apply a sparing bit of Tacky Glue on both sides of the clamp to keep the gondola in position. When the Tacky Glue is dry, move the rear gondola to its stop location at the base station with the splice just clearing the idler pulley.

   c. Place the front gondola on the cable at its stop position with the micro switch lever closed. When it is level in the correct position, tighten the mounting screw and apply a sparing bit of Tacky Glue on both sides of the clamp, to keep the gondola in position.

   d. Turn on the power supply and motor switch. Check to see that both gondolas move to their correct positions at the base and mountain, and that the micro switches operate correctly to reverse the gondolas.