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United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instruction in How to Complete the National Register of Historic Places Registration Form (National Register Bulletin 16A). Complete each item by marking "X" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classifications, materials and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Spokane, Portland, & Seattle Railway Steam Locomotive

other names/site number SP&S #700

2. Location

street & number Roundhouse, UPRR's Brooklyn Yard; (S.E. Portland) not for publication

city or town Portland vicinity

state Oregon code OR county Multnomah code 051 zip code 97202

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this _____ nomination _____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property X meets _____ does not meet the National Register criteria. I recommend that this property be considered significant X nationally X statewide _____ locally.

James Hamrick 8 Dec 2005
 Signature of certifying official/Title - Deputy SHPO Date

Oregon State Historic Preservation Office
 State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is:

<input checked="" type="checkbox"/> entered in the National Register See continuation sheet.	Signature of the Keeper <u>B.P.R. Jr.</u>	Date of <u>1/25/06</u>
<input type="checkbox"/> determined eligible for the National Register See continuation sheet.	_____	_____
<input type="checkbox"/> determined not eligible for the National Register	_____	_____
<input type="checkbox"/> removed from the National Register	_____	_____
<input type="checkbox"/> other (explain):	_____	_____

SP&S #700
Name of Property

Multnomah, Oregon
County and State

5. Classification

Ownership of Property
(check as many as apply)

- private
- public - local
- public - state
- public - Federal

Category of Property
(check only one box)

- building(s)
- district
- site
- structure
- object

Number of Resources within Property
(Do not include previously listed resources in the count)

Contributing	Noncontributing	
		buildings
		sites
1	0	structures
		objects
1	0	Total

Name of related multiple property listing
(enter "N/A" if property is not part of a multiple property listing)

N/A

Number of contributing resources previously listed in the National Register

0

6. Function or Use

Historic Functions
(enter categories from instructions)

TRANSPORTATION: rail-related

Current Functions
(Enter categories from instructions)

TRANSPORTATION: rail-related

7. Description

Architectural Classification
(Enter categories from instructions)

OTHER: Steam Locomotive

Materials
(Enter categories from instructions)

foundation: _____
walls: _____
roof: _____
Other: Steel

Narrative Description

(Describe the historic and current condition of the property on one or more continuation sheets)

See continuation sheets.

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DESCRIPTION

The SP&S 700

June 1938. A brand new locomotive powered the Spokane, Portland and Seattle Railway's passenger trains. (One needn't say "steam locomotive" in 1938; locomotives (with few exceptions) *were* steam locomotives). Sixty-seven years later, the SP&S 700 steams as strongly as ever--one of a handful of big American steam railroad engines operating in 2005.

One of the three main American locomotive manufacturers (the Baldwin Locomotive Works) constructed the SP&S 700 and tender near Philadelphia in May 1938. It was designed to pull interstate passenger trains on the principal railroads of the nation. It is type known as a "4-8-4" (meaning that it has four wheels on its leading (or "pilot") truck; eight driving wheels; and four wheels on its trailing truck). On the SP&S and many railroads, the 4-8-4 locomotive was known as a "Northern."

When built, the 700 incorporated almost all of the proven technology and known effective features of steam railroad engines. All the locomotive and tender axles are on sealed roller bearings. The mechanism for reversing and adjusting the drive cylinder valves is powered. Many moving parts have their own lubrication pumps. The boiler is built with "superheaters" that add additional heat (and energy) to the steam as it goes to the driving cylinders and pistons. Pre-heated water is fed to the boiler with steam injector and feedwater pump. Large driving wheels (77 inch diameter) speak of its potential for speeds over 80 miles per hour. The fire in its cavernous firebox was fed by heavy oil (bunker C), which gave both more heat per tender load and less ash and trouble than coal.

The 700's attached tender carries and supplies the locomotive's water and fuel. Its main baffled tank can carry 20,000 gallons of water, and its heated fuel tank can carry 6040 gallons. Fuel and water reach the locomotive via pipes and hoses. The 700's tender's six axles are mounted in roller bearings.

Standing almost 17 feet tall, and stretching over 110 feet, the 700 and its tender are big. Fueled and watered they weigh over 430 tons.

The size of the 700 surprises first-time viewers. It is tall; it would not fit under an overpass on an Interstate Highway. It is long; seven Honda Civics could park alongside the engine and tender with room to spare. Its weight is not easily seen, but watered and fueled, the engine and tender outweigh 350 of those Honda Civics.

The trains it pulled were no less massive. The 10 to 15 "heavyweight" baggage and passenger cars it pulled each weighed 80 to 90 tons. The "lightweight" cars that began appearing in its trains during its service were 45 to 50 tons each. The freight trains it moved comfortably late in its career totaled 2,500 to 3,500 tons (Prager, 108.)

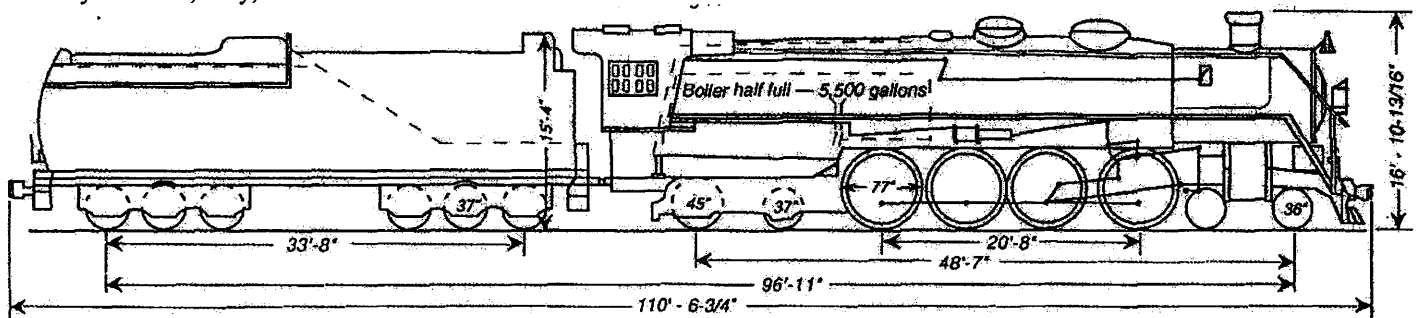
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Dimensions and Specifications

Owned by SP&S Ry.
Class E-1 - Numbers 700-702
Timkin Roller Bearing Journals on All Wheels
Built by Baldwin, May, 1938



Cylinders—28"x31"
Steam pressure—260 pounds psi
Weight on drivers—296,500 pounds
Engine weight—485,820 pounds
Tender weight light—169,950 pounds
Tender weight loaded—379,700 pounds
Engine and tender weight loaded—865,520 pounds

Tender oil capacity—6,040 gallons (bunker C)
Tender water capacity—20,000 gallons
Tubes diameter—2.25" & 3.75"
Tubes length—19'.6"
Tubes no. 58 - 2.25", 186 - 3.75"
Tractive power 85% working pressure—69,800 pounds
Horsepower @ 50mph—4,500

Heat surf. — tubes — 3213sq. ft.
Heat surf. — firebox — 490 sq. ft.
Heat surf. — total — 4703 sq. ft.
Superheating surf. — 2096 sq. ft.
Grate area — 115 sq. ft.
Firebox length — 162"
Firebox height, front — 87.625"

Firebox height back— 79.625"
Firebox width top front — 83"
Firebox width top back — 83"
Firebox width bottom — 102.25"
Alco type "G" power reverse
Worthington feedwater heater
Sellers type - S - injector

Superheater - Type E - modified
2— 8.5" c.c. air pumps
Tender trucks equalized
Stucki side bearings
Brake cylinders—4— 12"x 12"
Timken roller bearings
Journals — 6.75"

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The 700 is steel--cast steel, plate steel, machined steel, and steel pipe and bar. It is held together with steel rivets, steel bolts and nuts, and some welds. Different grades and thicknesses of steel are used to meet different needs. It is all painted black, save for white trim on the engine wheels and walkways, yellow numbers and markings, and high heat grey paint on the smokebox.

Thick firebrick line the sides and bottom of the firebox. Four-inch-thick insulation pads (originally asbestos, now safer mineral wool) wrap the boiler under a sheet steel jacket. Brass, glass, and wood are found in small amounts.

The 700's cast steel frame rests on the four axles of the big driving wheels, and on a pair of two-axle trucks, at front and rear, which pivot to follow curves in the track. Driving and trailing axles are mounted under springs and equalizers to accommodate irregularities in the track and the motion of the locomotive.

The dominant visual part of the locomotive is the eight-foot-diameter cylinder atop the wheels. It houses the firebox in the back, the boiler, and the smokebox at the front. The hot gas and smoke from the firebox are drawn through the horizontal flues (tubes) in the water-filled boiler (making steam) before going into the smokebox and exiting up the stack. The steam (in the enclosed boiler) builds pressure (up to 260 pounds-per-square-inch) and is ducted through the superheaters and throttle to the big valve and drive cylinders in the front of the engine down by the wheels. There the high pressure steam pushes and pulls the pistons (one on each side) and drive rods to turn the driving wheels and move the locomotive and its train.

At the rear of the firebox is the "cab" where the crew sits and operates the locomotive. It takes two people to operate the locomotive. The fireman sits on the left behind fuel and air controls to regulate the fire in the firebox, and has controls to assure proper water supply to the boiler. The engineer sits on the right side, with the whistle, throttle, other controls for the drive gear, and air brake controls for the locomotive and for the train. The back of the cab is open to the tender (save for a canvas curtain.) There is no air conditioning in the cab, nor any cab heater (though with a huge oil fire raging a few inches a way in the firebox, chilliness in the cab is usually not a concern.)

The locomotive has a steam-powered dynamo generating electricity (32 volt, DC). This power is (and was) used only to power the headlight, marker lights, illumination in the cab, and the headlight on the rear of the tender. The 700 has two steam-powered air pumps. The compressed air is stored and used to operate the brakes on the locomotive and tender, some controls on the engine, and most importantly, the air brakes on the train.

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The SP&S 700 is today very much as it was when manufactured in 1938. All of the features that exemplify the 700s character as "state of the art" (previously identified on Section 8 continuation sheets, 9 and 10) were incorporated when it was built. The SP&S Railway found no reason to add to or improve those features during the 700s years of service between 1938 and 1956.

All steam locomotives experienced major maintenance and repair throughout their service. A major overhaul was typically completed every five years. During the overhaul, disassembly and rebuild of the boiler, controls, and running gear enabled inspection, replacement of worn parts, and painting. Driving wheels received new steel tires.

The repair after the accident in 1947 restored the 700 to service to the condition was in prior to the wreck. There is no documentary or physical evidence to indicate that features or capabilities were added, or deleted.

There are indications that during the 700's last years of service (as the railroad anticipated its replacement by Diesel-electric locomotives) some repair and maintenance was deferred. Deferred repairs, combined with the years of exposure to the elements in Oaks Park, meant that significant restoration efforts were needed to return the 700 to high-speed service as a passenger train engine.

The following are the repairs, major maintenance, and restoration work done on the 700 over the last 20 years:

1985 – 1987 (at Oaks Park): Removed asbestos and replaced it with mineral wool and other safer materials; repaired exterior of the boiler; boiler frame and jacketing replaced; wood deck on tender replaced; repaired sheet metal and painted tender; and repaired electrical lines and switches for lights.

1988 – 1994 (at Brooklyn Roundhouse (as was all further work)): Firebox sidesheet and boiler repaired, sheet metal repaired and locomotive painted; drawbars inspected; cab windows, seats, and woodwork replaced; feedwater pump replaced with same model as original; cylinder valves and main pin bored and milled; brass bushings on driving rods inspected and repaired; mineral wool insulation installed on boiler; superheaters tested and repaired; boiler washed out (5 times) and four Federal Railway Administration (FRA) inspections.

1995 – 1999: Radius rod replaced (engineer's side); valve cage re-bored; main springs, equalizer pins, and bushings inspected, some replaced; tender water tank repaired and cleaned; electrical system repaired; and four FRA inspections

2000: Boiler completely rebuilt to comply with the new FRA Form 4 requirements, including: new tubes and flues; ultrasound testing of boiler; sandblasting of boiler, boiler coating; Certified boiler work including welding; and removal and replacement of insulation and jacketing.

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2001 – 2002: Rebuilt the power reverser; new valve cages, rings and bull rings in valve cylinders; removed, inspected, and repaired drive pistons and cylinder heads; rebuilt the feedwater pump; all superheater tubes removed, tested, repaired and reinstalled; removed and rebuilt the cylinder cocks and mechanical lubricators; removed three-fourths of firebrick in the firebox and replaced it with new brick and mortar; replaced all wheels and roller bearings on the tender; inspected and machined driving rod connectors; measured and analyzed driving wheels and main suspension; added Multiple-Unit (MU) controls; repaired one of two air pumps; painted locomotive; boiler maintained and washed; various steam valves machined and repacked; draw bars inspected, and inspection by the FRA.

2002 – 2003: Replaced coldwater line to feedwater pump; rebuilt injector, repainted tender and logo; rebuilt and replaced both airpumps; replaced all lubrication lines.

2004 – 2005: Machined to resurface all eight driver wheel tires to original profile; replaced broken suspension spring; cleaned and inspected main suspension, equalizers, and brake rigging; removed lighted number boards (not original) from the top of smokebox.

2006: Certified metallurgical analysis of possible damage from December derailment (clean bill) and in progress: Replace all wheels on pilot truck; inspect and repair pilot truck suspension, attachment, and brake rigging; inspect and repair airbrake control stand.

Steam locomotives are “high maintenance.” Most of the work on the 700 after the initial restoration efforts is work that accrued through years of the normal wear and tear of operations and deferred maintenance in service. Replacement parts were in-kind, an option made possible by repair technologies unchanged from the 1930s and 1940s. In the few cases where modern materials were used, the overall integrity of the original engineering remained unaffected, and the changes are indiscernible to the untrained eye. All mechanical repairs conform to the original constructor’s blueprints. Except for the installation of the MU controls to let the 700’s engineer operate a following Diesel, none of the work has been an improvement or modification to the locomotive’s initial design and construction.

The 700 today is very close to its 1938 appearance when it was accepted by the SP&S. In the early 1940s, lighted number boards were added atop the smokebox. In its final years of freight service the 700 would have been grimy; with new paint, washing and polishing, the engine now looks like the new engine in the 1938 photograph. For the 1956 “Farewell to Steam” excursion, the engine was cleaned, and the smokebox painted silver. In 1990, the smokebox was again silver, the valve and drive cylinder covers were chromed; and new logos were on the tender. Original logos are now on the tender, cylinder covers are in the original black, number boards are removed, and the smokebox is in its original graphite grey.

SP&S #700
Name of Property

Multnomah, Oregon
County and State

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing).

Areas of Significance
(Enter categories from instructions)

- A Property is associated with events that have made a significant contribution to the broad patterns of our history.
- B Property is associated with the lives of persons significant in our past.
- C Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- D Property has yielded, or is likely to yield, information important in prehistory or history.

TRANSPORTATION
ENGINEERING

Period of Significance
1938-1956

Significant Dates
1938, 1956

Criteria Considerations
(Mark "x" in all the boxes that apply)

Property is:

Significant Person
(Complete if Criterion B is marked above)

- A owned by a religious institution or used for religious purposes
- B removed from its original location
- C a birthplace or grave
- D a cemetery
- E a reconstructed building, object, or structure
- F a commemorative property
- G less than 50 years of age or achieved significance Within the past 50 years

Cultural Affiliation

Architect/Builder
Baldwin Locomotive Works

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets)

9. Major Bibliographical References

Bibliography (Cite books, articles, and other sources used in preparing the form on one or more continuation sheets) See continuation sheets

- Previous documentation on file (NPS):
- preliminary determination of individual listing (36CFR67) has been requested
 - previously listed in the National Register
 - previously determined eligible by the National Register
 - designated a National Historic Landmark
 - recorded by Historic American Buildings Survey
 - recorded by Historic American Engineering Record

- Primary location of additional data:
- State Historic Preservation Office
 - Other State agency
 - Federal agency
 - Local government
 - University
 - Other
- Name of repository: Pacific Railroad Preservation Association

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STATEMENT OF SIGNIFICANCE

Summary

The Spokane, Portland & Seattle Railway steam locomotive 700 is being nominated to the National Register of Historic Places.

The nomination is based on the locomotive's regional and statewide significance in transportation under Criterion A. During its years of active service (1938 – 1956) the SP&S 700 and its trains were a crucial link between Portland, Oregon, and the rest of the nation.

The nomination is also based on the locomotive's national significance in engineering under Criterion C. The SP&S 700 is one of a few remaining operating examples that demonstrate the peak of the practical design and function achieved when "steam was king" on the nation's railroads.

Background

The History of The Spokane, Portland, and Seattle Railway (SP&S)

The SP&S was born at the end of the era of railroad building and financial machinations that typified the last half the 19th century. Among the financial and railroad giants in 1900 were Edward Harriman of the Union Pacific and the Southern Pacific railroads, and James J. Hill of the Northern Pacific and the Great Northern railroads. At the turn of the 20th Century, Portland, Oregon was linked by rail to the east only by the Union Pacific Railroad. The Union Pacific's tracks ran along the south shore of the Columbia River to eastern Oregon, where they continued across the Blue Mountains, Idaho, and the Rocky Mountains.

At the Lewis and Clark Exposition in Portland in 1905, James Hill announced that he would build a line on the north bank of the Columbia to link Portland with Spokane. There it would link with his Great Northern and Northern Pacific railroads which ran east across Idaho and Montana to the upper Mid-West. The SP&S Railway, not surprisingly, was a wholly owned subsidiary of those two railroads. Though owned by two railroad companies in Minnesota, the SP&S's slogan after World War II was "The Northwest's Own Railway" (Gaertner, 72).

"The North Bank Road" was complete between Spokane and Portland in 1909. It was a well-engineered and well-constructed railroad. Despite its regional name and short total mileage, the SP&S was a fully capable member of the mainline railroads linking the nation in the 20th century.

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The SP&S also acquired additional rail lines that linked Portland to Astoria, Eugene, and Bend. (Its name notwithstanding, the SP&S Railway never linked Portland and Seattle). In 1970, the SP&S was merged with its parent railroads and others to form the Burlington Northern Railroad. In 1995, the Burlington Northern combined with the Santa Fe to become today's Burlington Northern Santa Fe Railway (now known as BNSF).

The SP&S's corporate headquarters was in downtown Portland. They moved to different office buildings at different times (Grande, I, 67–69). Before World War I, its passenger terminal was at 11th and Hoyt in northwest Portland; during and after that war, passengers used Union Station. With its subsidiary rail lines reaching Astoria and Seaside, through the Willamette Valley cities up to Eugene, to Bend, and to Forest Grove, the SP&S's associated lines provided interurban passenger and freight links throughout northwest Oregon.

The railroad entered Portland from Vancouver through the St. Johns cut and the Willamette River Bridge at Willbridge. Though its principal freight yard was in Vancouver, the SP&S had two freight yards in northwest Portland. Its engine roundhouse and turntable was between NW 9th and 10th and Lovejoy (Grande I, 53ff; Grande II) Using the Union Pacific's Steel Bridge, it also accessed the warehouse and industrial district of east Portland.

The SP&S 700's History

In March 1938, the Northern Pacific Railroad ordered 11 new 4-8-4 locomotives from the Baldwin works; it would keep eight coal burners for its own use labeling them type "A-3s." But three would be modified in production to burn oil; they would go to the SP&S where they would be known as "E-1s" (Grande, p. 282). They carried the numbers 700, 701, and 702.

An official delivery photograph of June 21, 1938 shows the shiny new 700 entering service with the SP&S. The three E-1 locomotives headed the premier passenger trains. Their principal charge was an overnight run between Portland and Spokane, one train in each direction (Grande, 282). The SP&S trains connected with the Great Northern's *The Empire Builder*, *Oriental Limited*, and *Western Star* and the Northern Pacific's *North Coast Limited*, *Alaskan*, and *Mainstreeter*. These trains divided into both Seattle and Portland sections at Spokane. The SP&S's excellent track and grade enabled the Portland sections to cover their route in less time than the Seattle sections despite a longer distance (Wood and Wood, 34).

The E-1's served throughout the 1940s and the heavy World War II rail traffic without crisis or fanfare. Engine crews appreciated their dependability, power, speed, and comfort (Prager). The 700 and 702 were assigned to passenger service, the 701 served as a relief engine and on freights (Prager, 99). The 700 pulled trains of 12 to 14 passenger cars, often at speeds above 70 miles per hour.

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June 29, 1945 saw the 700 draw memorable duty as it pulled a special train with Eleanor Roosevelt and 200 attendees on their return from the signing of the Charter of the United Nations in San Francisco.

On March 25, 1947, a rockslide across the rails just east of Pasco derailed the 700 and the first three baggage cars of Train #4. The 700 was thrown down the hillside, and because of its weight, wreck crews had to separate its boiler and frame so cranes could retrieve the 700 (Gaertner, 64). The 700 was rebuilt in the Northern Pacific's shops in Tacoma. (Austin and Dill, 126). The 700 still bears a small dent at the bottom of its pilot as the only sign of this accident.

After World War II the mainline railroads began a decade in which they replaced their steam locomotives (even new ones with decades of service still in them) with new Diesel-electric locomotives. The new Diesels required less maintenance, could go farther without stopping for water or fuel, and four or more could be linked and operated by only one crew. They were usually no stronger or faster than the steam engines they replaced, but were far more economic to operate (Swengel, 242).

Nationally, the "Postwar decline in passenger traffic, and rapid Dieselization resulted in the mighty 4-8-4 type being reassigned to freight, where they proved to be extremely capable pieces of machinery" (Swengel, 258). The SP&S followed the trend, and in 1953, the E-1s were taken off their passenger train service and assigned to freight trains (Austin and Dill, 67).

By the mid-1950s, the transition was nearly complete on most major railroads. The SP&S acknowledge the end of an era on May 20, 1956 when it sponsored a "Farewell to Steam" excursion from Portland to Wishram. The 20-car train, pulled by the 700, carried 1,400 people who wanted to experience a steam-drawn train ride one last time (Austin and Dill, 89).

The 700 then sat on a storage track with other steam engines (all capable of decades more service) waiting to be cut up for scrap. The public sentiment for steam locomotives was still strong, and in mid-1950s the three mainline railroads serving Portland each donated a retired steam locomotive to the city for a future transportation museum. The Southern Pacific donated the 4449, a 4-8-4 that had pulled the *Daylight Specials*. The Union Pacific offered the 3203, a 4-6-2 that had been the 197 on the OR&N before it was absorbed into the Union Pacific. And the SP&S donated the 700 on January 14, 1958 (O'Toole, 1993, 14 and Grande, 325).

These three locomotives were stored in the open at Oaks Park, subject to weather and vandalism, in the Sellwood neighborhood of Portland. In 1974, the 4449 was removed from the park, overhauled, and pulled the American Freedom Train through the West in the Bicentennial year of 1976.

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Led by Chris McLarney, then an Explorer Scout, a group of volunteers in 1976 began cleaning and painting the 700 as it rested in the park (O'Toole, 1993, 15). By November 9, 1987, it had been refurbished enough that it was removed from Oaks Park and housed in the roundhouse in the Southern Pacific's Brooklyn Yard. There the volunteers, now incorporated as the Pacific Railroad Preservation Association (PRPA), continued the restoration of the locomotive.

On May 8, 1990, 34 years after its retirement, the 700 again had a fire in the firebox and steam pressure in the boiler (O'Toole, 1993, 17). A week later, the 700 moved at speed under its own power. On June 28, 1990, the engine pulled the "Return to Steam" excursion to Wishram and back, recreating the outing of 1956. Later in 1990, the 700 pulled a 14-car excursion on the old Washington Central between Yakima and Cle Elum, Washington.

Over the last 15 years, the restored SP&S 700 has made a number of outings in the Portland area, as well as two major trips. The "Homecoming 2000" excursion saw the engine pull carloads of rail fans from Portland to Spokane, trodding again the territory where it had originally served. In October 2002, the 700 made a flawless 2,000 mile round trip between Portland and Billings, Montana. On the 1,200 miles from Sandpoint, Idaho to Billings and back, the 700 pulled 17 baggage and passenger cars across the Rocky Mountains with only rare help from an accompanying Diesel.

The 700 was restored and is maintained by the volunteers of the PRPA. In 2000, the 700's re-tubed boiler was the first to pass the Federal Railway Administration's new Form 4 requirements for steam locomotives. 2004 saw the driving wheels resurfaced. A typical year sees over 10,000 hours of volunteer crew work.

The 700 is featured in commercially available rail videos of its major trips, as well as in the professionally produced telecast and video *Tracks in Time*. The PRPA maintains a website (www.sps700.org) which has numerous pictures of the 700 and its outings as well as information about the engine and the PRPA's activities.

Significance

The SP&S 700 is a robust survivor of a time when railroads dominated inter-state transportation, and steam locomotives dominated rail power. It typifies large steam locomotives as they were at the end of the era of steam-powered mainline railroading. Its appearance and function are virtually unchanged since its manufacture. Its public appearances today, with all the speed, size, noise, heat, smoke and steam of old, are dramatic presentations of the 'way things were' in the mid-20th Century.

Criterion A: "That are associated with events that have made a significant contribution to the broad patterns of our history."

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American history is in large part the history of the movement of people and goods across long distances. The railroads' crucial part in the growth and change in American society and its economy between the middle of the 19th and the 20th centuries is well studied and acknowledged. The SP&S 700 is an icon in steel and steam of that era.

Interstate travel in 1938 meant rail travel. Most people traveled by train for business, family visits, or to tour. Highways were narrow, often steep and curvy, and ran through the middle of every town; cars lacked today's comforts. The airlines flew twin-engine aircraft that were noisy, un-pressurized, and vulnerable to weather delays. Travel by train, particularly in a Pullman sleeper car, was the most comfortable, safest, and practical way to get to and from Oregon in the 1930s and 1940s.

In the mid-20th century travel to Oregon from the upper mid-West (a principal locus of family ties then) meant travel on one of the rail lines across Montana to Spokane, and then on the SP&S to Portland. Business travel and freight to and from the cities of the upper Mid-West also went on the SP&S.

In recognition of the growing importance of Oregon, and to take advantage of the river-level route through the Cascade Mountains for freight, the owners of the SP&S Railway ordered a fleet of new, powerful, locomotives. These replaced the decades-old and hand-me-down engines from the Great Northern and the Northern Pacific that the SP&S had had to use until then. This order included six 4-6-6-4 "Challengers" for freight service, and the three 4-8-4 "Northerns" including the 700 (Drury, 375).

From 1938 to 1953, the 700 and the two other 4-8-4s pulled the fastest and most luxurious passenger trains between Portland and Spokane. In Spokane the passenger, baggage, dining, and Pullman cars would be made up to named trains heading east. And reciprocally, Portland-bound cars from trains from the east would be separated in Spokane from cars going to Seattle and go to Portland on the SP&S.

In 1953, after 15 years of passenger service, the 700 was bumped by the new Diesels from the more prestigious passenger train service and assigned to duty powering freight trains on the SP&S. Crews report it and the other 4-8-4s performed well. In 1956, it was chosen as the engine to power the "Farewell to Steam" passenger excursion.

The SP&S was one of four interstate railroads serving Portland and western Oregon, but one of only two with direct links to states to the east. The Southern Pacific ran to California, the Northern Pacific linked Portland to Tacoma and Seattle. The Union Pacific and the SP&S ran east on opposite banks of the Columbia until it left Oregon, where they diverged to the southeast and northeast, respectively.

The SP&S Railway and its steam locomotives (as represented by their sole survivor, the 700) were a key part of the transportation network moving people, goods, and mail between Oregon and the other 47 states.

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Criterion C: "That embody the distinctive characteristics of a type, period, or method of construction. . . or that represent a significant and distinguishable entity whose components lack individual distinction"

The SP&S 700 is one of few operable mainline steam locomotives remaining. It is a working example of the peak of proven steam and rail technology at the end of the Era of Steam. As such, it represents the state of the practical design and function when "steam was king."

The steam powered railroad locomotive was invented in the early 1800's and had become standardized by mid-century. Pictures of locomotives in Civil War photos and in cowboy movies all show a machine with large driving wheels. These drivers were turned by cranks and rods moved by pistons. The pistons were pushed forward and then pushed back in cylinders mounted near the front of the locomotive. Those pistons were moved by steam under pressure from the boiler. Valves, linked to the drivers, alternately let steam in, and then out of the cylinders. The steam exhausted up the smokestack at the front of the engine, thereby creating a draft to pull the fire from the firebox at the rear of the engine through horizontal tubes in the water-filled boiler. The exhausting steam from the cylinders also created the "chuff-chuff-chuff" or "choo-choo" sound we associate with the steam locomotive. The crew (an engineer and a fireman) rode in a cab behind the firebox.

The elements and arrangement of the 1860 locomotive are the same as those of a 1940 locomotive. How did we get from the fragile wood-burning 30-ton antiques of 1860 to the 430-ton, 5,000 horsepower SP&S 700 of 1938? Engineering. Economics. And evolution.

In the last 15 years of the 19th Century, the adoption of train air brakes, stronger cars and couplers, and track signals opened the way for longer, heavier, and faster trains. The 20th Century responded with a dramatic evolution in locomotives.

Longer, heavier, and faster trains required more power. More power could come from adding locomotives to the train. But each locomotive added made coordinating their actions more difficult, and each locomotive had to have its own crew of two. If locomotives were more powerful, faster, and had more traction, fewer engines (and fewer crews) would be needed.

The first four decades of the 20th Century saw many innovations tried, tested, and some adopted as steam locomotives grew in size and capability. The SP&S 700 features are an inventory of those successes of steam locomotive design.

Large driving wheels: The larger the driving wheel, the greater distance it can travel with each stroke of the piston. Each revolution of the 700's 77" Boxpok drivers covers over 20 feet of track. These wheels made speeds over 70 miles per hour normal on good track.

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Four-wheel pilot and trailing trucks: The four smaller wheels at the front of the engine add to its stability as it follows the track--a welcome and necessary feature at high speed. The four-wheel trailing truck carries the weight of the rear of the locomotive, particularly the large firebox. (The trailing truck could have accommodated an auxiliary steam-powered driving engine to add power and traction in starting and other slow speed movement. Called a "booster engine" it could have been added during construction, but the railroad felt that it would not be needed.)

Large firebox: The size of the 700's firebox (imagine a low-ceilinged 8' by 13' room) was needed on her Northern Pacific sisters that burned a low-grade coal. The 700 was built to burn oil, which had a much higher heat value per pound and produced no ash and less trouble. The 700 could always produce as much steam as it could use.

Superheaters: From early in the 20th Century new locomotives used a boiler innovation that piped steam from the boiler through the hot flue gases to add additional heat to the steam (thus "superheating" it.) This innovation gave locomotives 25 to 30 percent more power for a given quantity of fuel (Drury, 381.)

Roller bearings: Not until the 1930s were the axles of production steam locomotives supported in roller bearings. Previous sleeve bearings used up to 8 percent of the engine's power just to overcome their friction and when starting cold, these older bearings could require up to a quarter of the locomotive's peak power to just turn the wheels (Swengel, 234.) Roller bearings imposed negligible drag at speed, and it took less than ½ of 1 percent to start the locomotive rolling (Swengel, 234.) All axles on the 700 and its tender are in sealed roller bearings.

Power reverse: The 700's Alco Type G power reverse mechanism lets the engineer, as the name implies, shift from 'forward' to 'reverse', and also lets him finely adjust the valve timing for the steam entering the drive cylinders for greater power and efficiency.

Traction: The power of steam locomotives was compared using a calculated figure called "tractive effort" or "tractive power". The 700 is rated at 69,800 pounds. That much power (generating 4,500 horsepower at 50 miles per hour) could cause the drive wheels to spin if it was applied too suddenly, if the rails are wet or slippery, or the locomotive is too light. The 700's driving wheels carry 296,500 pounds, putting it well above the 4:1 ratio of weight to tractive effort sought by designers. The 700, like all locomotives, has a sanding system to put sand on the tracks when needed for traction.

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Feedwater systems: To force water into the boiler, the 700 has both a steam-powered feedwater pump which takes pre-heated water from a feedwater heater, and a steam driven injector.

Walschaerts valve gear: The complex of rods, eccentrics, and cranks that link the motion of the driving wheels to the cylinder valves is known as the valve gear. The valve gear designed by Walschaerts was the most common among North American locomotives (Drury, 411.)

Air pumps: The two cross-compound steam-powered air pumps mounted on the fireman's side (right side) of the 700 compress air, which operates the air brakes throughout the train as well as the brakes on the locomotive and tender and some other accessories.

"State of the art" may be an over-used phrase, but it surely applied to the 700 as it entered service on the SP&S in 1938. It had everything that the designers, builders, and railroaders thought a top-rate mainline passenger steam locomotive needed. Through its faithful service for 18 years, it proved them out.

The 700 was not revolutionary; it is representative. It was, and is, representative of the design and manufacturing accomplishments of the steam era.

Many of the locomotives that shared the tracks with the 700 had all these features; many did not. Locomotives were long-lived. For example, the 700's roundhouse-mate, the UP 3203, was built in 1905, re-built by the railroad in 1923, and was still earning money for the company after 1950. Locomotives assigned to yard work (switchers) and to short hauls and short trains were typically older, smaller, and less modern.

Steam locomotives showed considerable variation in their features. Railroads considered a whole array of features and options, their costs and advantages, before placing an order for a small number of engines. Thus, the 700's roundhouse-mate, the SP 4449, though built three years after the 700, does not have roller bearings on its driving axles, while it does have a booster engine in its trailing truck.

Many passenger train engines of the 1930s were streamlined; the 700 was not. The air resistance of a locomotive was a minor part of the energy required to move 1930s passenger trains; streamlining locomotives was cosmetic

The 700 was "state of the art". But bear in mind that "the art" was defined somewhat differently by different railroads; and that many locomotives what were far from that "state" were still productive machines in the right niche on the nation's railroads.

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The 700's "state of the art" didn't apply only in 1938. Were one to have ordered a new steam locomotive of proven design in 1956 (the 700's last year of service) it would have been substantially like the 700 and her sisters. (No one, of course, did order a new steam locomotive in 1956; Dieselization of the mainline rails was nearing its completion.)

While the 700 served, further steam innovations were tested on the nation's rails. Steam-turbine-electric and steam-turbine locomotives were tried; as well as multi-cylindrical duplex drive engines. None were successful. The larger articulated engines were variously successful in freight service, but were usually overly powerful and slow for passenger service. Geared and narrow-gauge locomotives found their niche in logging and industrial operations, and in rugged terrain. But the 4-8-4 mainline passenger locomotives (like the 700) were a success throughout their service.

"The 4-8-4 was the ultimate development of non-articulated steam power, and it became the standard modern American steam locomotive." (Drury, 314-5.) "The 4-8-4's were 'top drawer' power. The type ran in some numbers in every geographical area of the country, in Canada and in Mexico, and in every case these engines lasted right down to the end of the steam era". (Swengel, 230.)

Integrity

If the ghosts of the engineers, firemen, and hostlers who operated the 700 were to find themselves in the cab, and the machinists, steamfitters, and foremen sensed the 700 in the roundhouse or shops, they would find the 700 much as they had left her. The cab crew might ask about the added railroad radio and the "black box" to control a following Diesel. And the shop crew might note new lube lines and her overall clean and good condition. The 700 is now very much as she was in 1938, despite a million miles of service and 30 years in a park.

Its caretakers, the PRPA crew, are proud of the 700's authenticity and its full functionality. Mechanical maintenance and repairs conform to the complete set of constructor's blueprints. Recent appearance choices (as in the re-painting and re-lettering of the tender, and the removal of the number boards from the front of the engine) were made to restore its 1938 look.

Rarity

More than 1,100 4-8-4 locomotives were built between 1926 and 1950 (Drury, 315.) Of these, only seven (including the 700) can still be operated. (Two of these, the AT&SF 3751 and the SSW 819 are now listed on the National Register of Historic Places.) While perhaps 50 4-8-4s still reside in parks and museums, deterioration and the cost and expense of restoring them to operating status make it unlikely they will run again. (The PRPA has calculated that it has performed over \$1 million in repairs to the 700.)

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Experience

Being six years old, I had seen some trains before,
So it's hard to figure out what I'm at the depot for.
Trains are big 'n' black 'n' smoke 'n' steam, screaming at the wheels.
Bigger'n anything there is, 'least that's the way it feels.

Trains are big and black and smokin', louder'n July Four.
But everybody's acting like this might be something more
Than picking up the mail, or the soldiers from the war
This is some'n' that old man Wyman never seen before.

from "Texas 1947" by Guy Clark

Big steam locomotives occupy a special place in American art, lore, and memory. The sensory, even visceral, experience of a large engine under steam and in motion is not forgotten. The ground shakes, the heat radiates, whistle and bell deafen, and smoke and steam flavor the air. When someone has experienced an operating big steam locomotive, the railroad engine's place in his or her pantheon of American images is secure.

The 700 is from a time before miniaturization, before electronics and remote control, before systems that worked without direct human input. It is also from a time before climate controlled and ergonomically correct workstations. It is how things got done 60 years ago.

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Additional Information on Operability and Engineering Significance under Criterion C

Of the thousands of large steam passenger engines that ran in the 1940s, few still exist, and even fewer can be operated to pull passenger trains on main-line railroads. To illustrate, the web-site www.steamlocomotive.com reports that of the over 1,100 4-8-4 "Northern" locomotives built for North American railroads, fewer than fifty still exist. And of these, although ten are identified as "operational" only five in the United States have operated in 2004 or 2005.

The remaining large locomotives are typically in parks and museums; a few are in private ownership. Most are stored outdoors. The previous inventory of work done on the 700 indicates the difficulty of bringing a display engine back to life. Cost and effort aside, almost none could be revived because of fifty years of corrosion, vandalism, or parts "gone missing."

The 700 is a member of a small and unique cohort of large steam locomotives that are complete, in good repair, and capable of performing the kind of work for which they were designed. This is an important aspect of its engineering significance because the heat, noise, steam, and smoke emitted by the 700 represent the publicly perceptible aspects of the physical engineering that gives the train its significance under Criterion C. The 700 is not full of modern parts; the late-1930s technology crystallized in the design of the 700, including large driving wheels, four-wheel pilot and trailing trucks, large firebox, boiler innovations, roller bearings, Walschaerts valve gear, and air pumps, remain intact, with high integrity. This high engineering integrity allows the train to convey the feeling widely associated with the steam engine experience; an increasingly rare experience in the United States. Other currently operating large locomotives are the AT&SF (Santa Fe) 3751, the Milwaukee Road 261, the Southern Pacific 4449, the Union Pacific 844, and the larger Union Pacific 3985 (a "4-6-6-4"). The two Union Pacific engines are the largest; the SP&S 700 is the third largest operating steam locomotive in the world. The sensory impact provided by the action of the SP&S 700 cannot be underestimated in conveying the train's historical associations. The operation of the locomotive, as representative of "the age of steam" is essential to understanding and conveying its full historic and engineering significance.

The 700 has been inspected by, and certified by, AMTRAK for use with AMTRAK trains. This level of present-day competence is achieved by a locomotive unmodified since built in the 1930s; it speaks to the strength of its manufacture and the completeness of its design. The SP&S 700, a robust survivor, is a significant example of the Nation's achievements in steam and rail engineering, manufacture, and operation.

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Section number 9 Page 1

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Construction drawings (“blueprints”), operating manuals, and recent maintenance and inspection records for the SP&S #700 are maintained by the Pacific Railroad Preservation Association, Post Office Box 2851, Portland, OR 97208.

SP&S #700
Name of Property

Multnomah, Oregon
County and State

10. Geographical Data

Acreage of Property less than one acre

UTM References

(Place additional UTM references on a continuation sheet)

1 10 527770 5037400
Zone Easting Northing

3 _____
Zone Easting Northing

2 _____

4 _____

Verbal Boundary Description

(Describe the boundaries of the property on a continuation sheet)

Boundary Justification

(Explain why the boundaries were selected on a continuation sheet)

11. Form Prepared By

name/title Arnold G. Holden, Ph.D. Member, PRPA

organization Pacific Railroad Preservation Association date November 16, 2005

street & number P.O. Box 2851 telephone (503) 804 - 7772

city or town Portland state Oregon zip code 97208

Additional Documentation

Submit the following items with the completed form:

Continuation sheets

Maps: A USGS map (7.5 or 15 minute series) indicating the property's location.

A sketch map for historic districts and properties having large acreage or numerous resources.

Photographs: Representative black and white photographs of the property.

Additional items (check with the SHPO or FPO for any additional items)

Property Owner

name City of Portland, Bureau of Parks and Recreation

street & number 1120 SW 5th Avenue, Suite 1302 telephone (503) 823 - 7529

city or town Portland state Oregon zip code 97204

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C.460 et seq.).

Estimated Burden Statement: Public reporting burden for this form is estimated to average 18.1 hours per response including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Chief, Administrative Services Division, National Park Service, PO Box 37127, Washington, DC 20013-7127; and the Office of Management and Budget, Paperwork Reductions Project (1024-0018), Washington, DC 20503.

SP&S #700

Name of Property

Multnomah, Oregon

County and State

NPS Form 10-900-a

OMB Approval No. 1024-0018

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VERBAL BOUNDARY DESCRIPTION:

All the area encompassed within the extreme, contiguous length of the locomotive and not including the rails or ground beneath.

BOUNDARY JUSTIFICATION:

The boundary incorporates only the structure of the locomotive. It does not include its surroundings including the land and rails beneath, as well as the structure in which it is housed because they are not directly associated with the history of the locomotive. The locomotive is also occasionally operational and may be moved to other locations on a temporary basis.

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Note on Photographic Prints:

These seven prints submitted are printed from digital images. (The two historic black and white pictures were converted to digital images and enhanced.)

All are printed on Epson Enhanced Matte Paper using Epson UltraChrome pigmented inks. This paper and these inks are identified as meeting the NR-NHL 75-year permanence standard in the National Park Service's March 2005 bulletin "Photo Policy Expansion."

They were printed by Redmond Photo in Redmond, Oregon.

I have also submitted a CD-R with the seven digital images, labeled as requested in the March 2005 bulletin.

PHOTOGRAPHS

Photograph #1

1. Spokane, Portland & Seattle Railway Steam Locomotive #700 (SP&S 700)
2. Multnomah County, Oregon
3. Lacey Studios (Spokane, WA)
4. June 21, 1938
5. Copy of negative with Greg Kamholz; PRPA; P.O. Box 2851; Portland, OR 97208; digital image with Dale Birkholz; PRPA; P.O. Box 2851; Portland, OR 97208
6. The 700 in Spokane, Washington on the day of its delivery to the SP&S Railway
7. Photograph #1 of 7

Photograph #2

1. Spokane, Portland & Seattle Railway Steam Locomotive #700 (SP&S 700)
2. Multnomah County, Oregon
3. Unknown photographer
4. June 29, 1945
5. Copy of negative with Greg Kamholz; PRPA; P.O. Box 2851; Portland, OR 97208; digital image with Dale Birkholz; PRPA; P.O. Box 2851; Portland, OR 97208
6. SP&S 700 at Bonneville, Washington heading a special train with attendees from the signing of the United Nations Charter in San Francisco.
7. Photograph #2 of 7

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Photograph #3

1. Spokane, Portland & Seattle Railway Steam Locomotive #700 (SP&S 700)
2. Multnomah County, Oregon
3. Dale Birkholz
4. October 22, 2002
5. Digital image with Dale Birkholz; PRPA; P.O. Box 2851; Portland, OR 97208
6. SP&S 700 at Sandpoint, Idaho. The 700 begins its two-day return to Portland after the eight-day "Montana By Steam" 2002 excursion.
7. Photograph #3 of 7

Photograph #4

1. Spokane, Portland & Seattle Railway Steam Locomotive #700 (SP&S 700)
2. Multnomah County, Oregon
3. Dale Birkholz
4. October 23, 2002
5. Digital image with Dale Birkholz; PRPA; P.O. Box 2851; Portland, OR 97208
6. SP&S 700 at Pasco, Washington. The 700 awaiting its return to Portland after the eight-day "Montana By Steam" 2002 excursion.
7. Photograph #4 of 7

Photograph #5

1. Spokane, Portland & Seattle Railway Steam Locomotive #700 (SP&S 700)
2. Multnomah County, Oregon
3. Greg Kamholz
4. October 19, 2002
5. Digital image with Greg Kamholz; PRPA; P.O. Box 2851; Portland, OR 97208
6. SP&S 700 at Clarkston, Montana. The 700 pulls the 17-car "Montana By Steam" 2002 excursion train between Bozeman and Helena, Montana.
7. Photograph #5 of 7

SP&S # 700
Name of Property

Multnomah, Oregon
County and State

NPS Form 10-900-a

OMB Approval No. 1024-0018

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Photograph #6

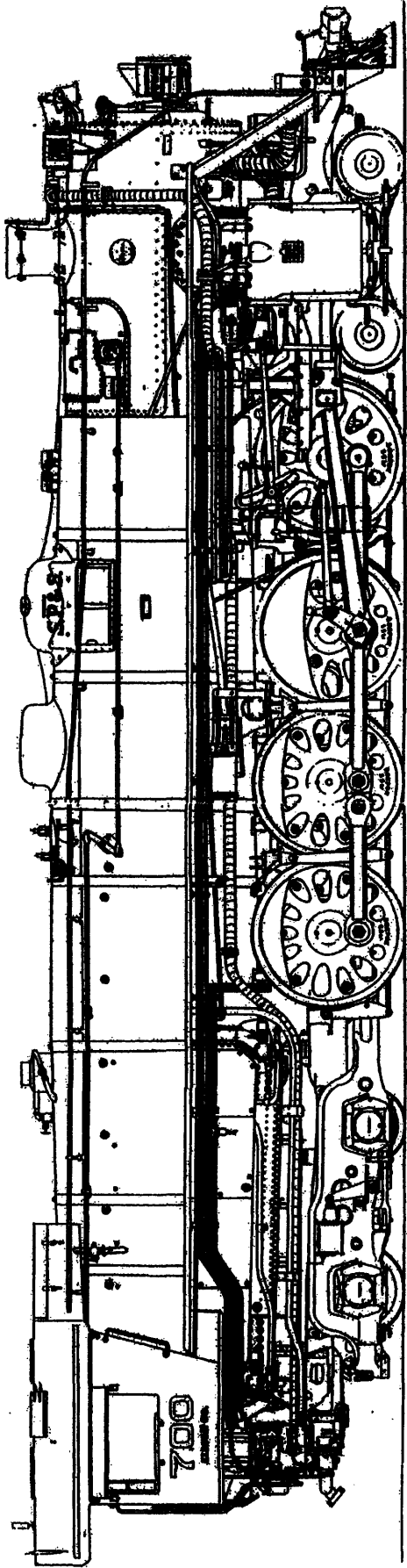
1. Spokane, Portland & Seattle Railway Steam Locomotive #700 (SP&S 700)
2. Multnomah County, Oregon
3. Arnold Holden
4. September 8, 2005
5. Digital image with Arnold Holden; PRPA; P.O. Box 2851; Portland, OR 97208
6. Engineer's seat and controls; Cab, SP&S 700 at Brooklyn Roundhouse, Portland
7. Photograph #6 of 7

Photograph #7

1. Spokane, Portland & Seattle Railway Steam Locomotive #700 (SP&S 700)
2. Multnomah County, Oregon
3. Arnold Holden
4. September 8, 2005
5. Digital image with Arnold Holden; PRPA; P.O. Box 2851; Portland, OR 97208
6. Fireman's seat and controls; Cab, SP&S 700 at Brooklyn Roundhouse, Portland
7. Photograph #7 of 7

SP&S #700

Multnomah County, Oregon



Drawing by Chris McLarney based on constructors drawings. From pages 8 and 9 in:

O'Toole, Randal, ed. *The Northwest's Own Locomotive*, 2nd ed. Portland, OR: Pacific Railroad Preservation Association, 1993.

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