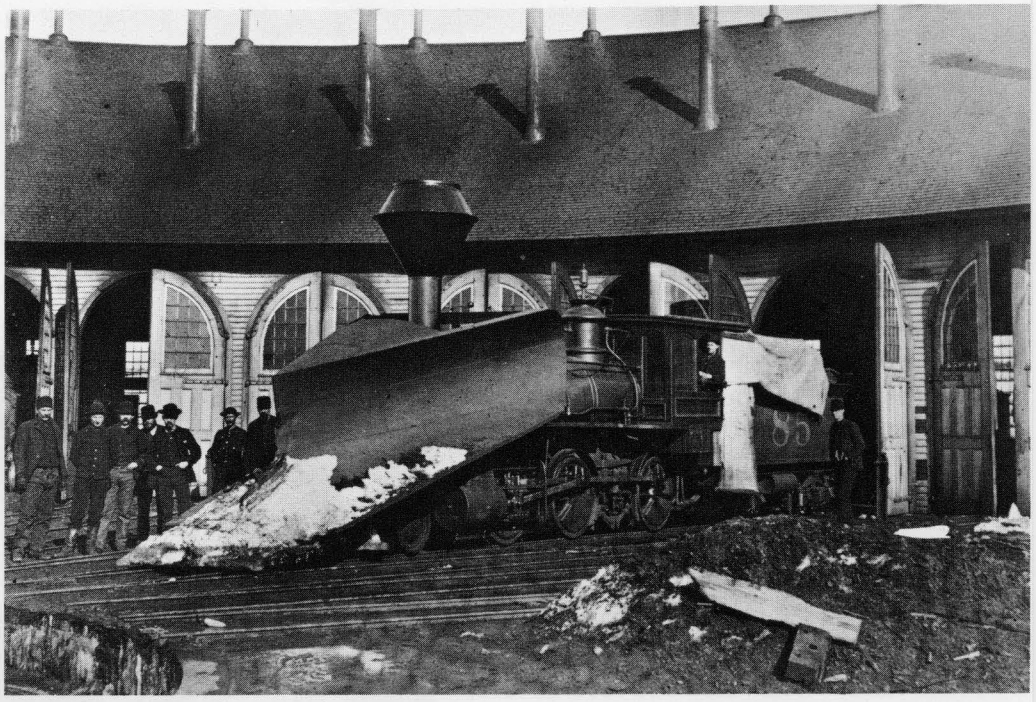
"ROTARY SNOW PLOWS

. . . The Leslie Brothers Had a Better Idea"

Editor's Note—: In parts of the Union Pacific west, winter means blizzards, and to Union Pacific blizzards mean snow plows—rotary and otherwise. This article is the first of a timely two-part series on rotary snow plows. This issue we will take a quick look at plows of the past. Next month we'll take you on a tour of Union Pacific's newest diesel-electric powered answers to winter's old scourge—the blizzard.

INFO would like to thank Harold Rees, general mechanical engineer, for his help in the preparation of this article. Union Pacific is widely recognized for having some of the foremost experts in both snow plow design and operation—few, if any, are more expert than Rees.



In the early days when drifts were big and engines were small, the wedge plows dwarfed the locomotives on which they were installed.

Since the late 1880's, steam powered rotary snow plows have been one of the most spectacular pieces of railroad maintenance equipment. During mild winters they are seldom used—but when winters are severe they are a "must". Blizzards are a rotary's best friend—testing them in a manner which cannot be simulated on the test stand—revealing any short-comings in a glaring manner.

The severe blizzards which occurred in the 1880's were responsible for the development of the rotary snow plow. Wedge plows could handle ordinary snow fairly well but were unable to handle snow that was drifted deep and hard by western blizzards.

The first successful rotary snow plow was purchased by Union Pacific in 1887 after it had successfully demonstrated its capability between Granger, Wyoming and Huntington, Oregon. This successful rotary plow was based on a patent granted inventor Orange Jull and assigned to John S. and Edward Leslie. It was constructed for the Leslie Brothers by the Cooke Locomotive and Machine Works at Paterson, New Jersey. This first rotary was so successful that three more were immediately ordered by Union Pacific for delivery before the next winter. The next three rotary plows built by Cooke Locomotive and Machine Works for the Leslie Brothers were delivered to Union Pacific by December 1887. Other railroads followed suit and by 1903 a total of 64 rotaries had been sold by Leslie Brothers, mostly to western railroads. All of these were constructed by Cooke Locomotive and Machine Works. A total of 5 had been purchased by the Union Pacific.

The Leslie rotary snow plow consisted essentially of a conventional steam locomotive boiler mounted on an underframe supported by two 4-wheel trucks. Attached to the front end of the underframe was a rotary wheel enclosed in a wheel housing. The rotary wheel was driven by an ingenious mechanical arrangement

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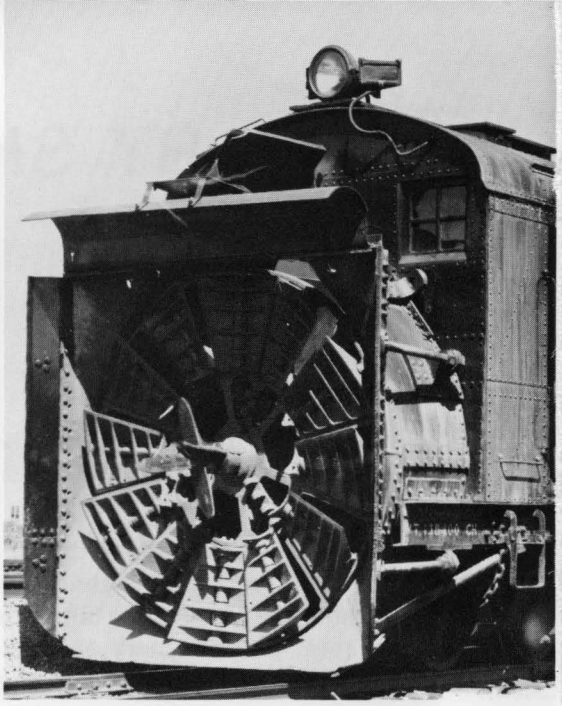
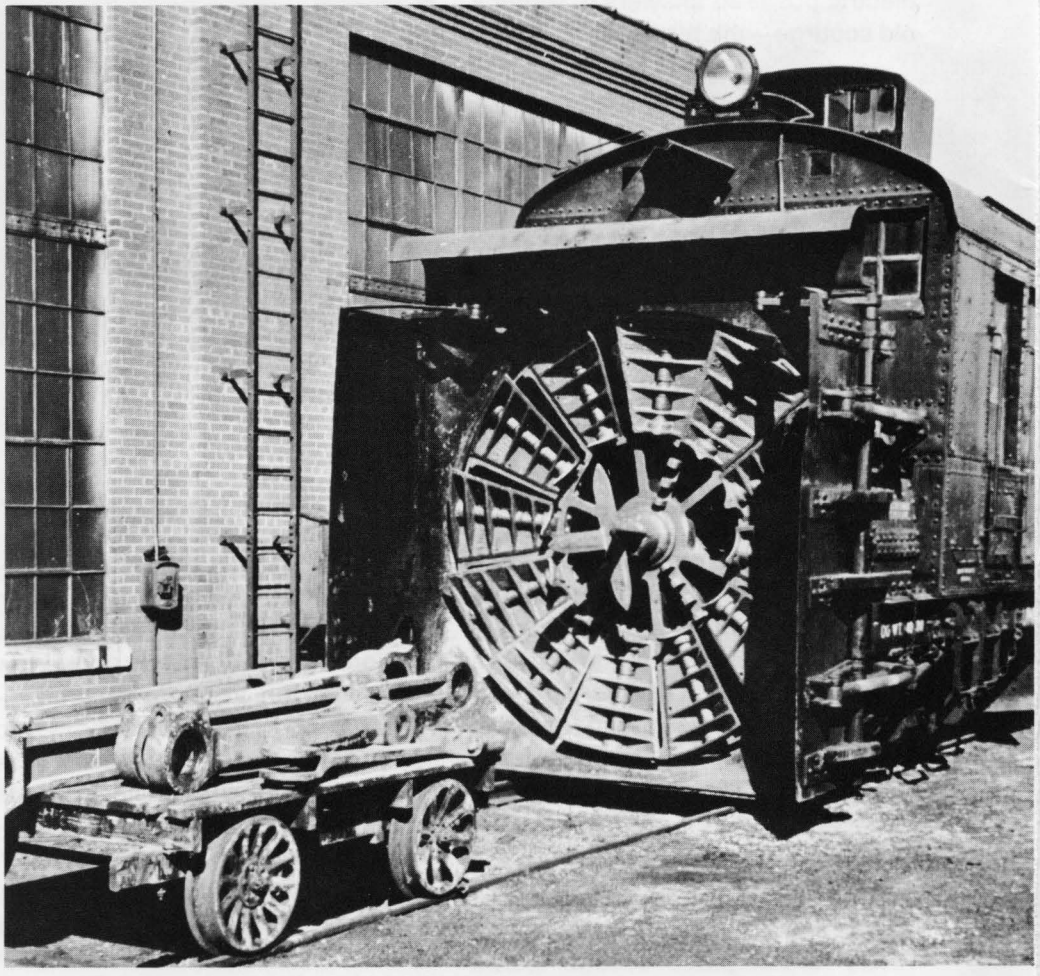
There had to be a better way of removing packed, drifted snow, and the Leslie brothers found it. In this shot from the UP archives an unidentified early rotary plow is at work. At least two locomotives are pushing the plow.



which combined the conventional steam locomotive cylinders, pistons, main rods and main drivers with a gear box attached to the rotary wheel shaft. The plow engineer's cab was located directly behind the rotary wheel housing and ahead of the smoke stack. Originally the plow engineer's "controls" consisted of a whistle and emergency brake valve. The throttle and reverse lever for the rotary were located along side the fire box and were operated by another engineman. The pusher locomotive was operated by still another engineman. Both plow and pusher enginemen tried to operate in response to whistle signals from the man in the forward cab. Poor communication made operation very difficult—if the plow was pushed into the snow faster than the rotary wheel could "digest" the snow and cast it out, then the wheel would stick and it would be necessary to thaw it out with steam from the boiler. This thawing operation was laborious and time consuming.

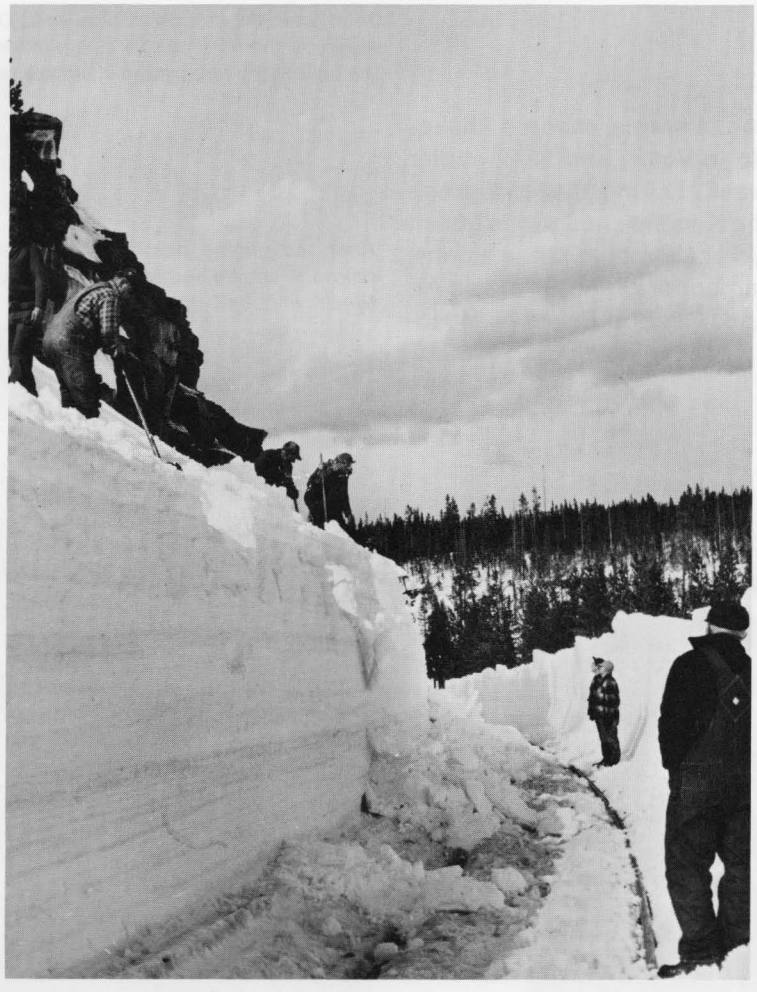
During the years 1887 to 1922 Union Pacific and lines which later became part of the Union Pacific system, acquired a total of 17 rotary plows constructed along lines described above.



This is the business end of one of the first five Leslie plows. It is identical to the first successful rotary plow.

The date is August 24, 1968 and the last of the Leslie plows pauses in Medicine Bow on its last trip to Cheyenne. When the picture was taken, the plow was over eighty years old.

In later years a more modern, but nonetheless steam powered, rotary plow is seen at work. Few pieces of railroad maintenance equipment can match one of these machines when it comes to drama and spectacular action.

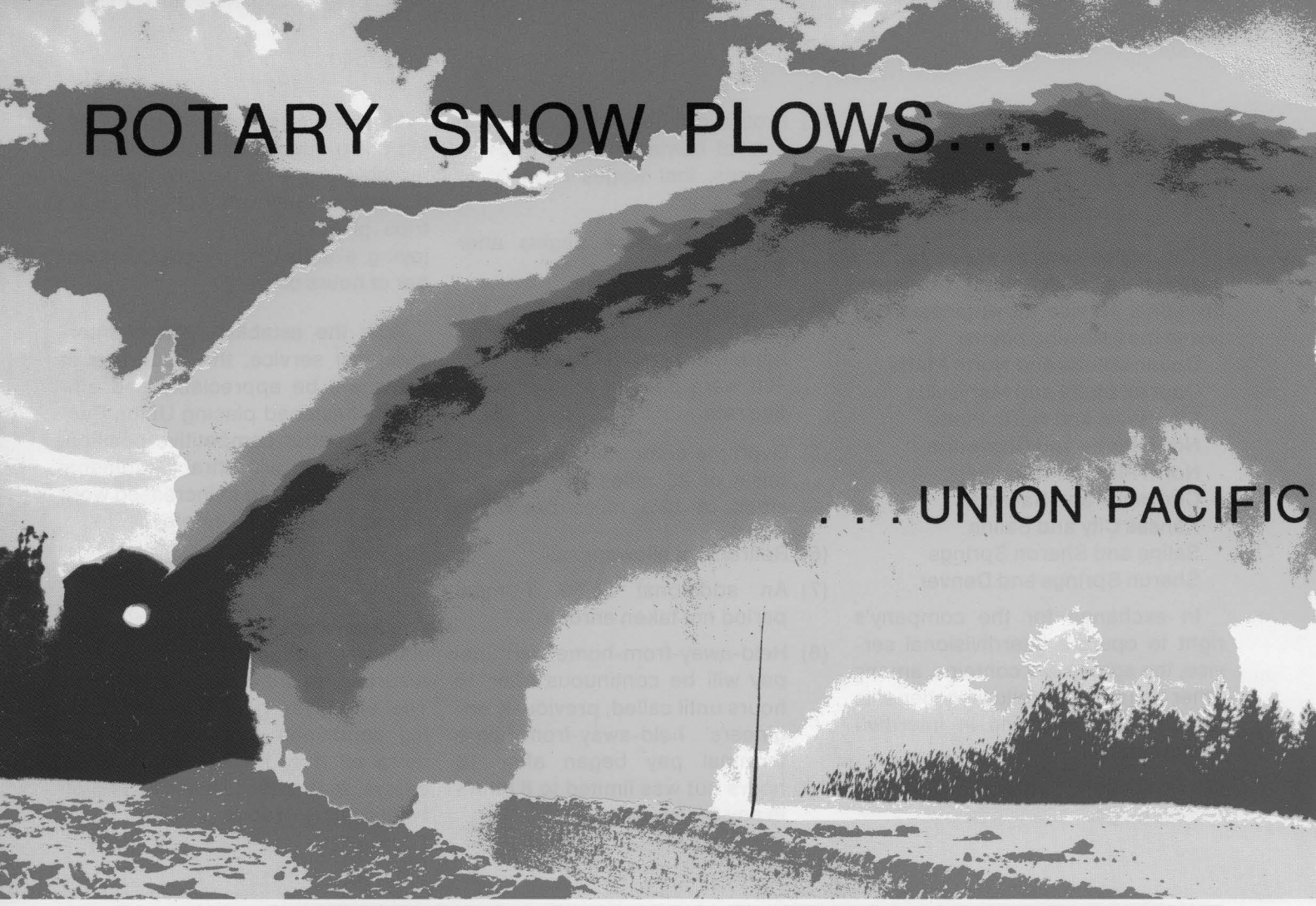


The rotary has been by, but strong arm work still needs to be done. Though the big plows move a lot of snow, they still can't replace good men armed with shovels.

Through the years the basic design did not change—it was eminently successful. Since rotaries were only used when winters were severe, their total operational time was short, hence they were exceptionally long lived.

Of the first five rotaries built in 1887 and 1888 for Union Pacific or its later acquired lines, none were officially retired until 1958. In that year two were retired and two were stored unassigned. They were later scrapped.

The fifth plow (it was actually the third constructed) was stationed at Rawlins until 1969. Though seldom used because rotaries built at a much later date stationed at Green River and Cheyenne were used in preference, Leslie Brothers No. 3 (also known as UP 900072) served as standby protection—80 years after it was constructed. Finally retired, the plow was scrapped in November of this year. —To be continued.



Editor's Note—: This article concludes a two-part series on the development and use of rotary snow plows. We would like to invite our readers' comments on this material. If you have any suggections for future articles, please let us know—we're always looking for new ideas.

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With the passing of the steam locomotive, the fuel and water facilities used with steam power were also phased out. Without these facilities, the steam-driven rotary snow plow was found in somewhat the same situation as the great dinosaurs when their swamps dried up. Extinction was just a question of time.

Immediately following the historic 1949 blizzard engineering studies were started to develop a diesel-electric rotary snow plow. The design concepts of this rotary plow were to utilize as much as possible the components in use on diesel-electric locomotives, and to have at least as much power as the newest, largest steam-driven rotaries constructed in 1949. It was also desired to make the plow self-controlled so that the plow engineer would have full control of both the rotary plow wheel and the diesel pusher units. This would simplify operation and eliminate the problem of coordinating the operations of plow and pusher engineers.

As a result of these, a new design rotary snow plow, road number 900080, was constructed in the Omaha shops during 1958. Stationary load testing was completed during November, and the plow moved to Pocatello, for road testing.

On March 3, 1959, the new plow made its initial road plowing trip, opening up the 56-mile-line of branch track between Ashton, Idaho and West Yellowstone, Montana in twelve hours. Removal of the snow which accumulates during the winter months is a major operation. This particular winter the snow varied from 2 to 8 feet in depth. Forward speed of the plow during the operation varied from 2 to 14 mph. A single GP-9 pusher unit was used throughout the 56-mile run, except for 7 miles of one to two per cent grade through Reas Pass, where it was necessary to cut in a second GP-9. During the trip the rotary engine operated in maximum throttle position for 5 hours 39 minutes. Total time for main track plowing was 8 hours 12 minutes. The remainder of the time was consumed in digging out switches, plowing

sidings and wyes, reversing the rotary wheel to cast on opposite side of track, etc. There was no mechanical or electrical trouble. The plow operated with much less vibration and noise then a steam-powered plow. The speed of this operation was phenomenal—had the steam-driven Lima-Hamilton built rotary been used it would have required 32 to 40 hours of plowing.

Diesel-electric rotary 900080 has been used seven times to open up the Yellowstone Branch after a winter's accumulation of snow. This branch has proven to be an excellent test site. Had it not been for this branch, testing would have been impossible because of a succession of mild winters. Each test trip has developed refinements which have been added to the basic design.

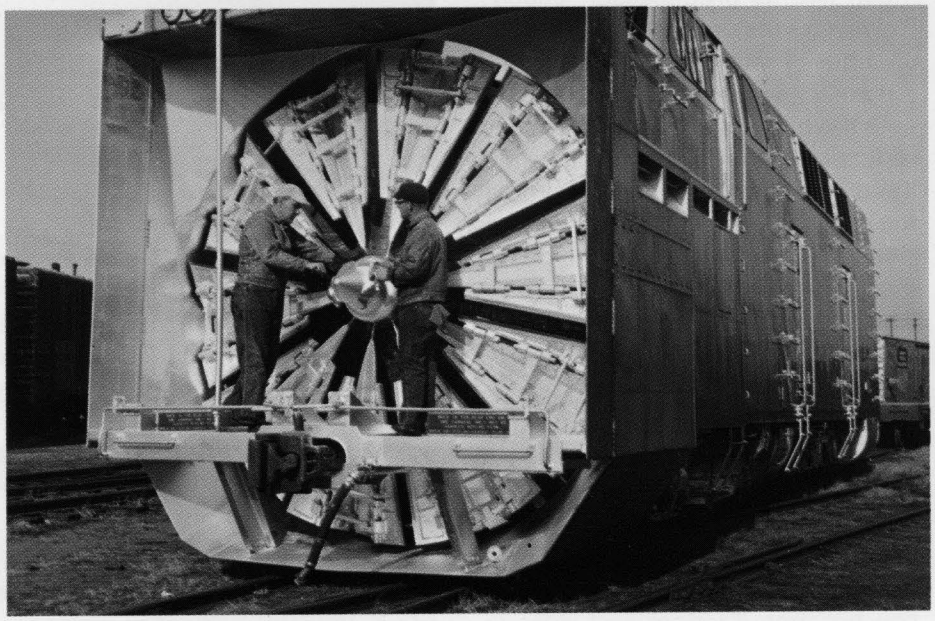
The tremendous development which has taken place in freight car design has been reflected in snow fighting equipment. Longer and wider cars require a wider cut on curves to provide clearance at the mid point of the car. Since rotary wheel housings were already close to the maximum clearance, it was not possible to make the wheel housing wider. To obtain a wider cut on curves the plow housing of the 900080 was equipped with hydraulically actuated wings which increase the width of cut from 12'6" to 14'0".

The successful operation of the 900080 and the wealth of test data accumulated between 1958 and 1965 provided the impetus for design and construction of a second diesel-electric plow. The second plow was to be essentially the same as the 900080, except larger and more powerful. Wheel diameter was to be increased from 11'2½" to 12'0" and diesel engine power raised from 1800 to 2500 h.p.

The second diesel rotary, road number 900081, designed and constructed by Union Pacific, was completed and stationary tested at Omaha in November of 1966. Its design and construction incorporated many special features. In order to reduce weight as much as possible, maximum use was made of high strength alloy steels. Special welding techniques were used for these materials and every weld was supervised and inspected. Only in UP's own shops could such insistence on welding perfection be satisfied. It is questionable whether or not this plow could have been built anywhere else.

Operation of both 900080 and 900081 was so successful that a third diesel-electric plow was designed and built in Omaha. The first two plows were heavy, powerful machines designed for main line operation. In fact, 900081 is the world's largest rotary snowplow; it is over 56 feet long, 17 feet tall and weighs over 180 tons when fully ballasted and ready for operation.

The third rotary, designated 900082, was completed in October 1971. It is designed for use either on branch lines over light rail and bridges or on the main line. Much has been learned on the first two rotary plows and these lessons were put to good use in designing 900082. With an eye towards branch line operation, weight reduction was of primary importance. Still heavy



The 12-foot diameter of the rotary wheel on 900081 is apparent when compared to the height of the men working on the blades.

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900082, the newest of UP's diesel-powered behemoths as she appeared fresh from Omaha shops in October, 1971, is a credit to those who designed and built her.

From the rear of the train, 900080 can be seen chewing her way through the drifts on the Yellowstone branch.

(142 tons), special long wheel base trucks were designed to spread the plow's weight over a larger area and thus permit it to operate anywhere on the system.

From the outside, 900082 looks much like its predecessor, 900081. However, inside there are many changes. From the engine through the rotary wheel drive, all components have been selected with weight reduction in mind. New devices have been incorporated which simplify the equipment arrangement, reduce weight even more and still deliver over 2000 horsepower at the rotary wheel.

Rotary snow plows have come a long way since the Leslie brothers had "a better idea." Union Pacific's mechanical department has been in large part responsible for this development. From that time in the last century when the first rotary plow proved its usefulness over the line between Granger and Huntington, until the mid-1950's, few changes were made in the original design. It remained for Union Pacific designers and craftsmen to engineer and produce a new machine. The new diesel rotaries have the characteristic "big wheels" and they ride on rails, but there the similarities end. The "internal workings" are strictly a product of modern technology.

The credit for building these machines belongs to a lot of people like F. V. (Bud) Lubischer, engineer-design, and Fred Christensen, engineer-design, who worked out many new concepts and designs. Credit also goes to the welders who pioneered new techniques needed for special metals, to the boilermakers and blacksmiths who turned the blueprints into hard steel; the projects' successes were due to the imagination and craftsmanship of many.

The diesel-electric rotary snow plow is another tool which helps Union Pacific mean "Dependable Transportation" both summer AND winter.