SCOOPING WATER IN THE AGE OF STEAM

When a thirsty locomotive took a drink at high speed, the results could be spectacular

BY JAMES ALEXANDER JR.

"SOUTH BEND, Ind. Nov. 16, 1945—At least 22 persons were injured this afternoon when the eastbound Advance Commodore Vanderbilt *of the New York Central System ran into derailed freight cars at Lydick, eight miles west of here. . . . Seven . . . cars and the locomotive left the tracks and turned over in a cornfield. . . . Six other cars went off the track, but did not turn over. . . . Special relief trains of sleepers and diners were sent from Chicago and Cleveland to take care of the uninjured passengers."*—New York Times, *November 17, 1945.*

THE STORY (below, left) about a New York Central freight train's derailment, and the *Commodore Vanderbilt*'s collision with it, begins with a railroad innovation in England some 85 years earlier. It is related to the insatiable thirst of steam locomotives for water.

Steam locomotives consume much more water than coal. Even though water expands to over 1600 times its volume when changed to steam, it is expelled into the atmosphere, generally after a single brief use. As a result, trains had to stop frequently for water, even though there might be plenty of coal still on board. This meant time and fuel lost while the train slowed to a stop, filled up, and then got back up to speed. Where speed was important, whether to meet competitive pressures or simply to deliver passengers and freight promptly to their destinations, the unending need to replenish water was a significant problem.

As early as 1854, an American, A. W. McDonald, was issued a patent for an odd mechanism he called a "tank feeder." It was intended to siphon water from a raised trough beside the track.

In 1859, John Ramsbottom, locomotive superintendent of the London & North Western Railway in England, developed a water trough that could be installed between the rails. A device called a scoop was installed under the tender and could be lowered into the trough, with the locomotive's forward motion forcing the water up into the tender. He patented the system and placed it into successful operation the following year.

Britain made extensive use of the system for its high-speed, long-distance passenger trains. By 1923, it had water-scooping facilities at 57 locations, with 141 individual water troughs ultimately installed. France also used the system on several lines between 1905 and 1963.

The "Ramsbottom system" soon spread to the United States. In 1870, the New York Central & Hudson River Railroad built its first water trough (also called track pan or track tank) at Montrose, N.Y., along the Hudson River. The Pennsylvania Railroad immediately followed suit, placing two troughs of 800 and 1200 feet in length at Sang Hollow, Pa., by November 1870. NYC and PRR (including Pennsylvania-Reading Seashore Lines) subsequently became the two largest U.S. users of track pans.

Other railroads in the Northeast and Midwest followed in the next several decades. These included Maine Central; Reading; Jersey Central; Baltimore & Ohio; New York & Long Branch; New York & New England; Chicago, Milwaukee & St. Paul; and Lake Shore & Michigan Southern (NYC). Track pans did not spread to Canada, except for five installations in Ontario on the Michigan Central (NYC) line connecting Detroit with Buffalo.

Pans were not generally used outside of the Northeast, however, because of different traffic and climate factors. Some lines used second or larger tenders to carry extra water, but this added weight to the train.

By 1929, the Pennsylvania Railroad maintained about 80 pans at 27 locations, totaling 58 miles in length. By the 1940's, New York Central used 71 pans at 29 locations, including those of the Michigan Central.

"One of the most important matters which received the attention of the Management [of the PRR] in 1905 was to provide a sufficient water supply. . . .The water supply system now embraces 36 reservoirs and intakes . . . their total capacity is 3 billion gallons. The total length of pipelines in the system is 441 miles. The number of gallons furnished in 1926 was over 14 billion. The area of mountain land owned in the water supply system is 27,300 acres.

THE RAILWAY MAGAZINE

Led by 4-6-0 *Welsh Guardsman*, a London Midland & Scottish train (above) scoops water at the Whitmore troughs. Water overflows as a New York Central express train (opposite page) pulled by a Hudson uses the track pan at Rome, N.Y., in a September 1951 photo by S.K. Bolton Jr. of the Rail Photo Service.

"The . . . benefits . . . more than justified the expenditures . . . of 30 million dollars."—H. W. Schotter, *"The Growth and Development of the Pennsylvania Railroad Company," December 1927.*

The real challenge was getting the water into the tender without having to stop the train. New York Central's scoop system, patented in 1870, was known as a "water jerk." Early scoop designs left much to be desired, with much water wasted and difficulty in lifting the scoop against the water resistance. Faster speeds intensified the problem.

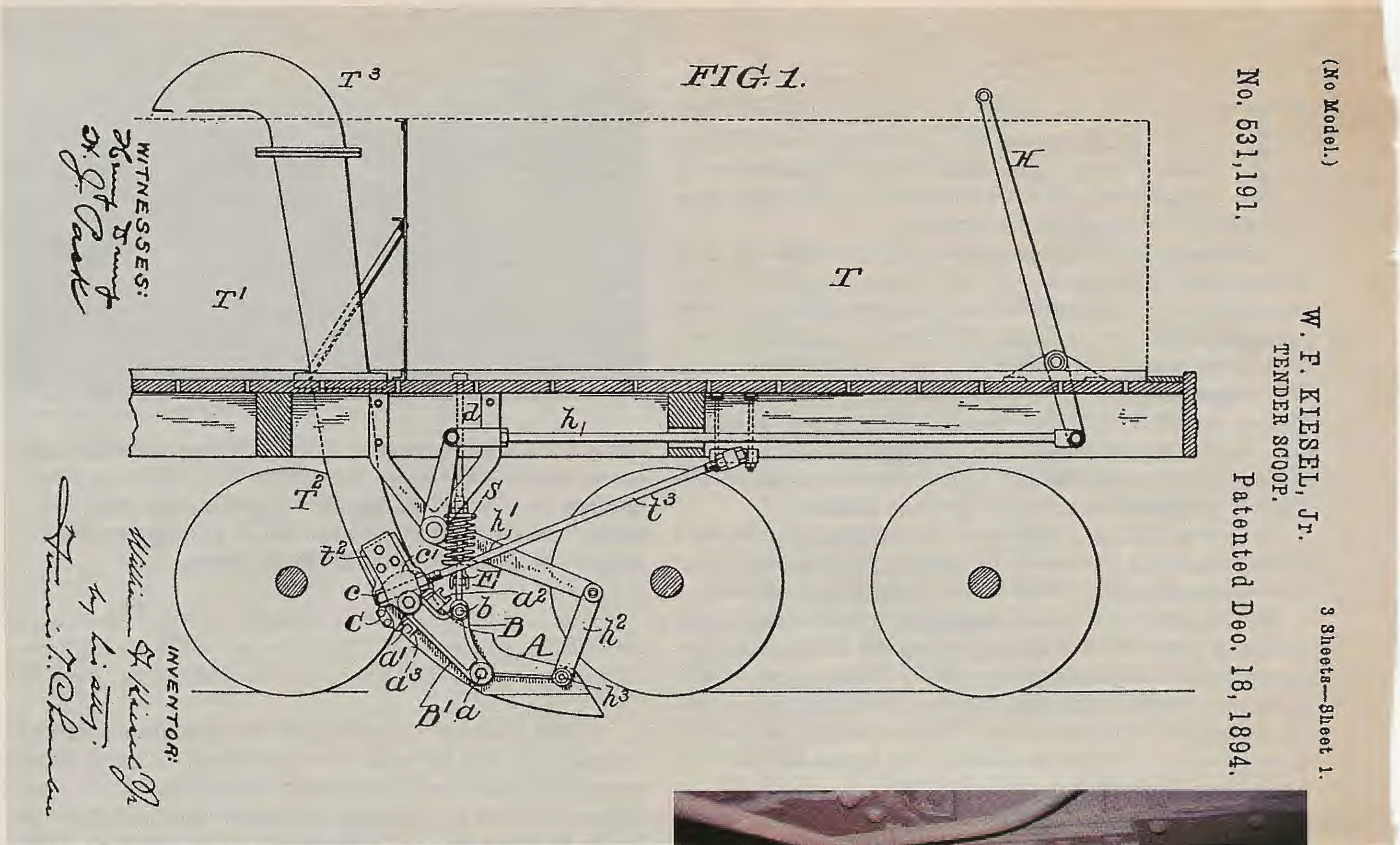
William F. Kiesel IV, grandson of the PRR's famed mechanical engineer, fondly recounts an incident from his family history:

"Little Gladys Rankine, nine years old, travelled in 1910 with her mother from Denver to Chicago, where she changed to the New York Central for the ride to New York City. Throughout her later life, she would tell her family of how she had been impressed by the magnificent spray of a train scooping water on a nearby track. She would always end the story by proclaiming, 'little did I ever expect to marry the son of the man responsible for the water scoop!' "

Gladys by then had become Mrs. William F. Kiesel III. Early in his career, her father-in-law had studied the problems encountered by water scoops. In 1894, he patented a new scoop design which balanced the force of the water entering the scoop against the water exiting the scoop into the tank. This innovation doubled efficiency, with 3.3 gallons picked up per linear foot of trough in an early test at 70 mph.

Kiesel's original patent had the fireman pull a long rod in the front of the tender to lower and raise the scoop. This rod was known to kick back, sometimes causing bodily harm. Later, air cylinders operated the scoop, which improved efficiency and safety. Kiesel's pioneering work established basic industry standards. Scoops could be found on passenger and freight tenders alike, including PRR Atlantic, Pacific, Mikado, and Mountain types, as well as NYC Mohawks and Hudsons, among others.

New York Central installed a new scoop design in the late 1930's that enabled taking on 3 gallons of water per foot at speeds up to 80 mph. A common problem in taking on water at high speed was the rapid buildup of air and water pressure, which would lift the tender hatches open, and in extreme cases spring the tender's side walls. In the 1940's, the Central became concerned about window breakage on trains traveling on tracks adjacent to other trains scooping water. It took movies of a tender



RAILROAD MUSEUM OF PENNSYLVANIA, PHMC

JAMES ALEXANDER JR.

William F. Kiesel's patented scoop of 1894 (above) changed very little over the decades. A similar scoop can be seen under the tender of PRR E6s No. 460 (right) at the Strasburg museum.

hatch overflowing at speed to bring about modified scoops and new overflow vents to direct excess water downward to track level.

Of five scoop-equipped PRR tenders preserved today at the Railroad Museum of Pennsylvania in Strasburg, the most easily viewed scoop is that installed on the Class E6s Atlantic No. 460, built in 1914. Popularly known as the "Lindbergh Engine," its water-scooping ability played a major role in its famous race against an airplane in 1927 to deliver to New York City films of Charles Lindbergh's triumphant welcome in Washington after his solo flight across the Atlantic.

The overall length of the E6 tender's scooping mechanism is about 4 feet. The dipper is 13 inches wide, 8½ inches high, and about 20 inches from its front edge to its pivot point. Retracted, it is about 4 inches above the rail. Scoops on other PRR tenders followed the basic Kiesel design, with the air cylinder up behind the coal bunker or elsewhere down under.

John Prophet, former New York Central employee who spent many summers visiting track pans throughout the NYC and Pennsy systems, recalls this anecdote:

"The mighty Hudson was pulled onto a siding as fireman and engineer tried to figure out what was wrong. Despite having taken on water at the last track pan, and having cleaned out the right-hand feed line's strainer, the injector could not draw any water into the boiler from that side. Finally, a man was lowered into the tank, and shortly emerged holding a dead box turtle that had been sucked up the scoop and was blocking the feed line intake."

Scoops had their problems, and picking up whatever was in the pan was one of them—debris, pieces of coal, junk thrown in by kids just to see what would happen, and yes, dead animals. The famous PRR K4s Pacific No. 3750, now preserved at Strasburg, once failed to scoop water in the late 1940's when its scoop was jammed by a human arm that medical students had placed in a track pan as a prank. While such material could jam or break the apparatus, the intake pipe incorporated a reverse bend above the tender's water level to prevent water from draining back out.

Taking on water was at best an expensive and messy endeavor. Water would spray all over, especially when taken on at high speed. To curtail splashing, shields were sometimes installed around the dippers, and some pans had lips.

The greatest amount of water-flying occurred when the tenders overflowed. With only the crudest water level gauges available, it was difficult to know when the tank would be full, and the topside hatches would be lifted by the incoming rush of water, spilling all over. Conductors commonly warned passengers in the first several coaches to close their windows when approaching pans. Water was known to come crashing through an improperly secured vestibule door on the first car and wash down the aisle. Charles A. Eggie, retired PRR plumber foreman assigned to the Wilmore (Pa.) pans, recounts this family story:

"Even through the windows closed against the bitter night, the scream was heard in the house alongside the track pans. The occupant, a railroad man, knew exactly what it meant, and he grabbed the phone to have the eastbound freight flagged down at the next tower.

"There, the body of a tramp was found frozen against the back end of the tender. Hitching a ride 'in the blind,' hanging on the back of the tender, the man had been soaked when the tank had overflowed down the back of the tender, and the water rapidly turned to ice. He screamed, but dared not let go, and died."

Winter was a difficult time for scooping water, both on the engine and on the ground. When approaching the pans in very cold weather, some firemen would make the dangerous climb over the coal pile to look back for any poor soul hiding in the blind.

"At first there was considerable complaint that the troughs were often not more than two-thirds full. . . . The pumpmen were instructed to inspect the troughs 5 minutes before schedule time of trains. . . . It has been suggested that a float valve might be installed to allow the troughs to be filled automatically, but . . . it is not considered that this would be any advantage, as it might make the pumpmen careless."—E. E. Russell Tratman, "Railway Track and Track Work" McGraw-Hill, New York, 1909.

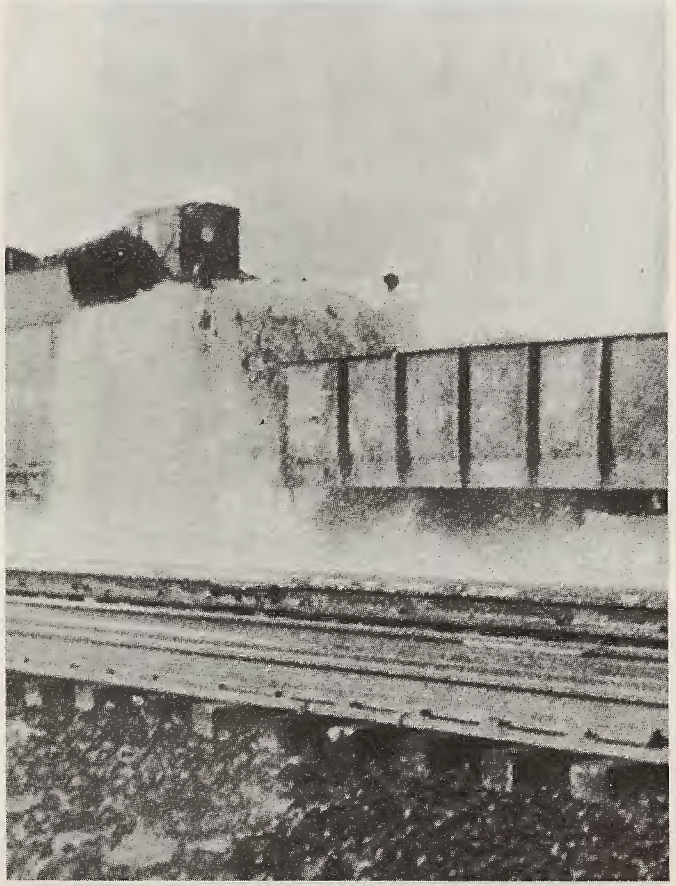
Track pans were not all uniform. Their length grew over the decades, with early ones ranging up to 1200 feet. By the 1940's, the typical length was between 1500 and 2500 feet; the PRR pans averaged 1500 feet. The longest pans were on the PRR: 2685 feet at Wilmore, Pa. Length depended in part on the characteristics of typical trains, whether locomotives were doubleheaded, and the effect of topography on water consumption. Typically, several tracks had pans in parallel operation. They were constructed on flat terrain, preferably not on curves. With many variations, they averaged 30 miles apart.

Except for some very early wooden construction, and some of bolted cast iron, pans were constructed of steel—first riveted plates, and later formed steel sections welded together. They were usually fastened to the ties by spikes applied to flanges welded on the sides, to permit expansion and contraction. Depth was between 6 and 8 inches; width varied between 19 and 29 inches.

In order for the top of the pan to present the required 1 inch of clearance below the top of the rails, the standard 8-inch ties were sometimes notched out by up to 2¼ inches, creating a recess for the pan. (In Britain and France, the top of the trough was higher than the railhead, requiring a modified scooping operation.)

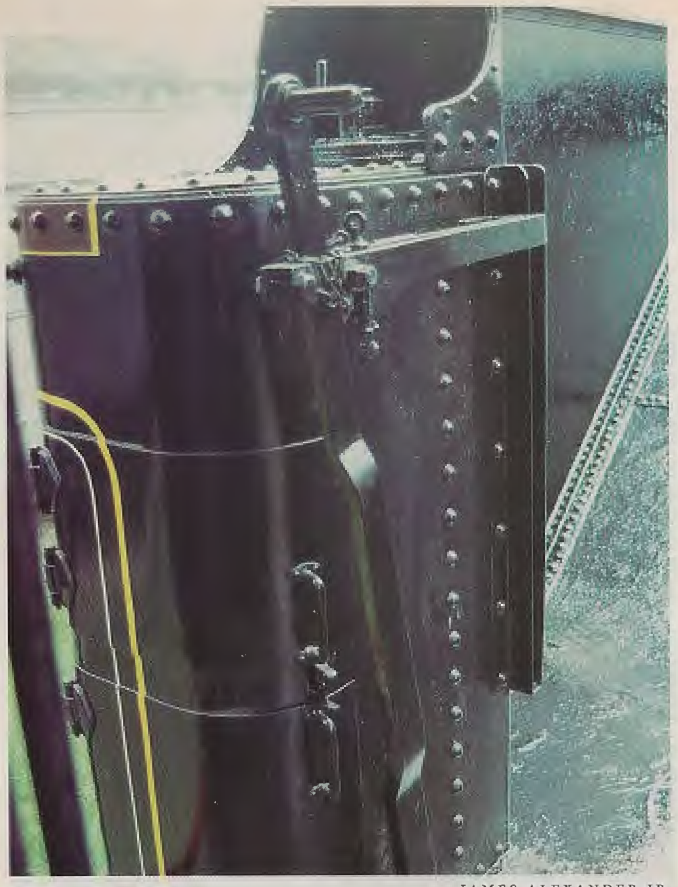
Pans were ramped with thicker steel on both sides of each end, to present a gradual rise that would protect the end of the pan from collision with a scoop either lowered prematurely or raised too late. This incline would guide the scoop into its "up" position,

NEW YORK CENTRAL



MARK BLAISDELL, COLLECTION OF CHARLES EGGIE

Curbing protects thawing pipes at a typical NYC track pan near New Hamburg, N.Y. (top). Water cascades from the rear of a PRR tender (right) at the Wilmore (Pa.) track pans in the late 1940's.



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Manual levers such as the one on PRR 7002 at Strasburg (left) were difficult to operate and could snap against an unwary hand. On the engineer's side of PRR No. 460's cab, the air-operated valve handle for the scoop (below, left) is in the left, or raised, position.

from which it would descend again if not properly secured. Especially in the earlier days before air-operated controls, firemen sometimes let the ramp push the scoop back up, rather than risk a broken bone from the control rod bucking back on them.

Water was fed to the pans from nearby pumphouses, and automatic float controls on pans found widespread use. When freights were being pushed from the rear, it was important to refill the pan as rapidly as possible after the lead engine(s) had taken on water, 4 minutes being a standard refill time.

Turtles in pans were sometimes joined by small fish that came through the pipes from reservoirs. They, and accumulated minerals and debris, had to be cleaned out periodically. Pan maintenance was especially difficult in winter, with attendants on duty 'round the clock. Water could freeze in the pans, and spray coated the adjacent ground and structures. Boilers were maintained, some from old locomotives, to shoot live steam into the pans at intervals. Some railroads heated and recirculated the water. Steam or hot water lines ran parallel to each track to melt away spray ice. These pipes often continued some distance past the end of the pan to cope with the icing mist that followed a pickup. Crews of workers were sometimes dispatched to chip away the ice and keep the drains clear, a dangerous job. Steam was often applied to the scoops themselves to keep the mechanisms from freezing.

Pan areas were constantly wet, slippery, and covered with moss and debris. Steady leakage or splashing of water could undermine the trackbed, and Belgian blocks and similar paving materials were typically installed to protect the understructure and guide the water to drains which were installed throughout the pan area. Tunnels of up to 4 feet in diameter crossed under the trackbed at intervals, to collect the water and provide access for the water supply and steam piping. In some cases the captured water was reused. Periodic cleaning out of these tunnels was difficult and messy.

"Track troughs in service will be marked: At entrance—By day: White target. —By night: Lunar white light. At exit—By day: Yellow target. —By night: Yellow light. At middle —Same as at entrance. Out of service—By day and night, all yellow targets and yellow lights.

"Enginemen must be notified when tank troughs are out of service. Care must be used to prevent unnecessary overflow of tank. When passing over tank troughs, the use of poker or scraper and the shaking of grates is prohibited."—Pennsylvania Railroad, "Rules for Conducting Transportation," September 1951.

Railroads maintained elaborate rules to avoid problems at these installations. Pan locations typically were identified in employee timetables, along with specific guidance as to which locomotive would take on water in what order and for how many seconds, speed reductions, and the responsibilities of engineer and fireman. Notwithstanding, on occasion a detached locomotive was known to back up for a second runby to get an adequate drink —a dangerous practice at best! Each scooping might pick up several thousand gallons, enough to help replenish but not completely fill the tender. Many pan locations had standpipes just down the line in case the train did not scoop enough water.

BOB LONG COLLECTION, COURTESY OF ALFRED H. ELDREDGE JR.

At Ancora, N.J., on the PRSL, a K4 approaches the "lift-scoop" signal at the end of the pan. Ladder is for oil-lamp maintenance.

Upon approaching a track pan, the engineer would advise the fireman to get into position at the control valve, which was located above the water leg on the front of the tender, behind the engineer. The engineer would then issue the drop-scoop order, often verbally and with a body signal as well as a toot on the whistle, and repeat the gesture to have it raised. Notwithstanding the inclined ramps at the pan's end, failure to raise the scoop in time was to be avoided, as damage was possible.

The scoop control on the PRR tenders featured a single valve, with a lock to prevent it from being moved accidentally. The NYC control mechanism involved a control operated by the fireman on the left side of the tender, and two cut-out cocks, one operated by the fireman, the other by the engineer.

Which brings us back to the accident at Lydick on the NYC in 1945, recounted at the beginning of our story. The Interstate Commerce Commission investigated, and found that a design weakness in the NYC scoop control had allowed the scoop to hang down after scooping water. Passing over two grade crossings, the scoop caught several timbers, which then tripped a switch, derailing the freight into the path of the *Commodore Vanderbilt.* The Central was ordered to redesign the control system [see "The Culprit Was a Water Scoop," July 1979 Trains].

Track pans and water scoops, like much of this century's railroading technology, were an outgrowth of the Industrial Revolution, embodying systems and structures that today seem crude and unsophisticated. Considerable skill and empirical knowledge went into these practices, however, and they served a bygone era well.

Track pans today are gone and largely forgotten. New York Central removed its last pans at Lawton, Mich., and Avery, Mich., in 1954, and the Pennsy's at Hawstone, Pa., saw service through 1956, nearly the end of steam on that mighty line. In England, where it all began, the last steam locomotive to scoop water was the *Flying Scotsman,* on May 1, 1968. For an additional decade, pans were used on England's East Coast Main Line by Deltic diesels to take on water for their steam generators for passenger-car heating!

Young Tommy Taber's overwhelming curiosity caused him to creep up to the track pan to see what happened when the scoop dropped. He got a blinding drenching that he never forgot! Decades later, Thomas Townsend Taber was a noted railroad author and historian, and in 1960 he sent off to England an article entitled "An Elegy on Railway Water Troughs in the USA," in which he recounted this youthful experience.

More than 30 years later, when a section of discarded track pan had been found buried at the bottom of an embankment in the Alleghenies, a copy of Taber's story was chanced upon by another author, in a dusty box in the archives of the Railroad Museum of Pennsylvania. The faded manuscript began:

"The useful 'water trough,' or 'track pan,' as it is known in the United States, has vanished from our petroleum-worshipping country, for it preceded the steam locomotive into oblivion—unwept, unhonored, and unsung."

Well, not quite. **I**

JAMES ALEXANDER JR. is the associate editor of Milepost, *the Journal of the Friends of the Railroad Museum of Pennsylvania in Strasburg. This is his first* TRAINS *byline. An exhibit showing an actual PRR track pan and scoops has been set up at the museum. Questions on the subject may be directed to the author at the museum, P.O. Box 125, Strasburg, PA 17579.*