As Charles Dickens was touring America in 1842, he maintained a journal of his observations. Some Americans find these candid observations rather imperfect, and in at least one instance I am inclined to agree. When, early in his stay, Dickens rode a train from Boston to Lowell, Massachusetts, he was impressed not only with the speed of the locomotive but also by its apparent disregard for pedestrians and livestock along the wayside. “[The locomotive] rushes across the turnpike road, where there is no gate, no policeman, no signal: nothing but a rough wooden arch, on which is painted 'WHEN THE BELL RINGS, LOOK OUT FOR THE LOCOMOTIVE.'” If Dickens had not been traveling so fast and had he not been so intent on observing his fellow travelers, he might well have seen, on each side of this turnpike crossing, a slat-covered pit that extended under the tracks from shoulder to shoulder of the grade—in other words, a cattle guard.

Dickens was quite perceptive in noting details that distinguished the American character and experience from that of the British, but he missed two features of American railroading that certainly help to point up these distinctions. Both features—the cowcatcher and the cattle guard—reflect especially the openness of America, the notion of great spaces (even in the East) where livestock could roam, unrestrained by hedges, fences, or herders. In England these devices were not immediately necessary for early railroad use, because livestock did not normally have access to the tracks. The English locomotive, in fact, had a square front end, according to Clarence P. Hornung in
Wheels across America; thus, when the John Bull was imported into this country, it was fitted out with a cowcatcher. As soon as trains had begun to attain the exhilarating speed of twenty miles per hour, the cowcatcher did little to save the life of an animal in the path of the locomotive, but it did tend to move the carcass along and thus helped to prevent derailments, which commonly resulted from collisions between trains and livestock.

Isaac Drips is credited with inventing the cowcatcher, but we do not know who invented the railroad cattle guard. Although railroad buffs and historians, a diverse and dedicated lot, have explored many facets of American railroading, the cattle guard has attracted none of this effort. Even the Association of American Railroads and the Transportation Division of the Smithsonian Institution, with their extensive collections of documents, offer little to the researcher seeking the origins of the cattle guard. Despite these handicaps, the outlines of the development of the railroad cattle guard can be traced.

We know, for example, that the railroad cattle guard is an American invention. *The Oxford English Dictionary* lists the term “cattle guard” as of American origin, and Mitford Matthews includes it in his *Dictionary of Americanisms*. As documentation, both sources quote from legal testimony published in 1843: “The first cattle guards he saw were in one thousand eight hundred and thirty six.” We do not know where this 1836 cattle guard was seen. Nor do we know who devised and built it. We do know, however, that on 11 March 1837 Thomas J. West of Whitehall, Virginia, filed for the first United States patent (number 146) on a railroad cattle guard. A reproduction of this patent application is included in the Appendix.

Although it has been exciting to try to discover biographical data about West, the results have been inconclusive. What fame he had was apparently local, for his name does not appear in any of the standard biographical reference works. Mabel Apple Talley, of the Albemarle County Historical Society Library in Charlottesville, Virginia, has provided information about a West family (or families), probably of English ancestry, including a Thomas J. West, in the Albemarle County area during the late eighteenth and early nineteenth centuries. (1) A Thomas West is listed in a 29 August 1794 record as a witness to the marriage of James H. West and Susannah Harlow. (2) At least one Thomas West figures in two guardian bonds. On 4 September 1815 a Thomas West is listed as an orphan son of James H. West, with Robert Brooks named as guardian. On 8 April 1817 James West is listed as an orphan son of James H. West, with Thomas West named as guardian. Probably the orphaned Thomas West was a young nephew or cousin of the Thomas West who witnessed the marriage of James H. West. (3) The single reference to a Thomas J. West (who logically could have been either the younger or the older West) occurs when he marries Lucy Ann Randolph on 27 May 1820. (4)
Finally, a rather complicated indenture of 16 July 1823 lists Thomas West as the seller of a large number of household items (including “a negro woman slave named Aggy”) to Nathaniel Harlow, with West pledging $132.36 to Smith Massie.

The little existing evidence suggests that the West family was of English heritage. Most persons named West had their origins in Cornwall. This link to the West Country of England is important, because, as will be seen in chapter 6, the earliest forerunner of the cattle guard can be traced to the ancient flat stone stiles of that county. The flat stile and the railroad cattle guard patented by West share the concept of parallel bars spaced over a pit.

One cannot prove that there was any connection between the Cornish flat stile and the invention of the railroad cattle guard merely by establishing a link between Cornwall and Thomas J. West of Whitehall, Virginia. For one thing, there seems to be another White Hall in Frederick County, Virginia. Moreover, we do not know for certain that Thomas J. West actually invented the first railroad cattle guard (which was in use at least by 1836) or, indeed, that he invented one at all. We only know that he patented the first railroad cattle guard in 1837. Mrs. Talley reports that although some mention of a cattle guard has been passed down in the West family and another story in the area associates the invention of the cattle guard with a black man, no documentation exists for either of these local traditions. Miscegenation may be one reason for the difficulty in tracking down the history of Thomas J. West; someone in one of the West families in the area seems to have married a mulatto woman, probably in the late part of the nineteenth century. Even in today's more tolerant social atmosphere, that subject is not readily discussed.

It is possible that the railroad cattle guard was invented by a black, but it is highly unlikely that Thomas West was black, for the indenture of 1823 indicates that he himself was a slaveholder. Undoubtedly in 1837 a white man could have taken out a patent much more easily than a black man could have, so it is likely that if a black man had invented this particular cattle guard, West may have patented it, whether for selfish or altruistic reasons is not clear. More probably, however, West's patent was on a device of his own invention.

Because of the identical concepts underlying the Cornish flat stile and the first railroad (as well as the first highway) cattle guard, it is tempting to look for someone with a Cornish background when seeking the originator of the cattle guard. Whether or not Thomas J. West is that man is an apparently insoluble puzzle. Adding to the puzzle is the fact that hundreds of Cornish miners, who had walked across flat stiles on their way to work in the tin mines of Cornwall, were brought into Central City, Colorado, in the late nineteenth century to work the gold mines. As noted in chapter 3, the earliest known highway cattle guard was located at Barr Lake, Colorado, which is less than
fifty miles from Central City. This is but speculation, however. Undoubtedly the inventor of the first cattle guard—railroad or highway—will remain nameless. In any case, the cattle guard was in use remarkably soon after railroading itself began.

Two of the earliest railroad cattle guards in Canada were patented in 1856 and 1861. The first one, “a moving and self-acting cattle guard for railway purposes,” was patented on 6 February 1856 by D’arcy Porter of Hamilton, Ontario. The other, a “self-acting cattle guard,” was patented 14 February 1861 by James T. Forrest, a machinist from Wentworth County, Ontario. Porter’s mechanism was rather complicated, consisting of levers, posts, pulleys, weights, cranks, rollers, pickets, and a platform. When an animal stepped on the platform, it caused the platform to sink, in turn causing the levers to operate the cranks that turned the rollers, thereby raising the pickets to a vertical position to form a gate of sorts for stopping livestock. The posts, pulleys, and weights were used to prevent the platform from rising above the level of the tracks and thus getting hit by a train. Although Forrest’s cattle guard also involved moving parts, it was much simpler in design: it had a series of revolving bars which were shaped like four-pointed stars in cross section. When an animal stepped onto the grid, the bars would roll inward, causing the animal’s leg to be pinched so severely that it would at once back out.

Results of a preliminary survey made in the British Patent Office by a classification section examiner named Mrs. J. A. Sullivan suggest that no railroad cattle guards were patented in Britain until late in the nineteenth century.

In the United States, as well as in England and Europe, travel by steam locomotive began in the early 1830s. The first regularly scheduled service by steam-powered trains in this country, the forerunner of today’s 190,000 miles of track, was provided in 1831 by the South Carolina Canal and Railroad Company. (This line also gave us our first derailment and our first locomotive explosion, which occurred when the engineer sat on the steam escape valve in order to stop its annoying hiss.) By 1835 over two hundred charters had been granted for railroad operation on about 1,000 miles of track in eleven states. Some fifteen years later, track mileage had increased to 7,400, of which 6,671 miles were along the seaboard. There was no track west of the Mississippi at this time.

In the 1830s, railroad builders were competing with canal promoters for superiority of transportation. Many of the latter considered the steam locomotive an impractical but dangerous toy that would succumb, if to nothing else, to the wrath of farmers who would “destroy the tracks . . . as soon as they discovered that their cows would no longer give milk nor would their hens let down eggs when the smoke-belching, ugly black monster came chugging
A railroad cattle guard patented in 1896 by Charles V. Compton, New Albany, Indiana. Livestock stepping on the ends of the grid would cause it to rise up. (Photo from *U.S. Patent Gazette*)

A railroad cattle guard patented in 1892 by John J. Callaghan and Albro R. Horn, Stevens' Point, Wisconsin. (Photo from *U.S. Patent Gazette*)

Buda Oscillating Cattle Guard, as pictured in *Railway and Engineering Review* (31 December 1904)
through," as Madeline Sadler Waggoner puts it in *The Long Haul West*.

Some cows did stop giving milk, but the cause was considerably more
drastic than mere noise and smoke. Collisions between trains and livestock
were a serious problem, and the cowcatcher was far from being totally effec-
tive in preventing derailments. Besides posing a threat to the physical safety of
passengers, employees, and equipment, livestock on the right of way also
posed an economic threat to the railroads. Farmers usually sued if trains
killed their animals, and the juries, invariably made up of the farmers' peers,
not those of the railroad magnate, tended to support the plaintiffs. Joseph A.
Noble, who spent half of the twentieth century as an employee of the Atchi-
son, Topeka, and Santa Fe Railroad, attests to this tendency:

> Of course, in spite of all the precautions to prevent accidents,
now and then a cow got on the track and was struck by a train. The
owner immediately demanded payment for this "fine animal which
probably would have won a prize at the next stock show." The mat-
ter was usually settled on the basis of whether it could be shown that
the cow, heedless of the cuts and scratches inflicted by the barbed
wire, had ruthlessly torn down the well-maintained right-of-way
fence, or whether the section foreman had neglected it to such an
extent that, when the cow rubbed against a post, the fence fell down
and the animal just walked over it. I believe in most cases tried be-
fore a jury, Justice prevailed and the railroad paid off.

Although materials were expensive in the 1830s, fencing the right of way was
the most effective way to keep animals off the track. Grade crossings, how-
ever, could not be fenced, and, as Charles Dickens noted, many crossings did
not have gates or watchmen. Thus, livestock that was either straying or grazi-
ing on the open range could rather easily mount the tracks. Actually, neither
gates nor watchmen, despite their undoubted effectiveness, would have been
a practical solution for warding off livestock. Posting a twenty-four-hour
watch at every grade crossing would have been prohibitively expensive for a
railroad company, not to mention the problems of weather and darkness.
Gates have proven, in this century especially, to be a better solution, particu-
larly the type of automatic gates found on British and European railways.
These gates close across the tracks when no trains are near, then, upon the ap-
proach of a train, they swing through a 90° angle to block off the highway
completely. In the 1830s such automatic gates were not available, while the
existing manually operated gates suffered from two disadvantages: they were
bothersome to the traveler, and consequently they were often left open.

Thus, by at least 1836, responding to safety and economic pressures,
some unknown innovator—possibly a railroad employee, a farmer, or a pas-
senger—had created the first cattle guard ever used in conjunction with me-
chanically powered transportation. As railroading progressed, and especially
as the western cattle ranges began to be organized into fenced ranches in the late 1800s, cattle guards became more and more important. Literally hundreds of designs were patented, although not nearly that many were successfully marketed. Journals such as Engineering News, Railway and Engineering Review, and Scientific American kept their readers posted on innovations by carrying notices and descriptions of newly invented guards.

A good way to gain an understanding of the railroad cattle guard is to examine a few of the track manuals current at the turn of the century. Railroad historians have particularly recommended three of these manuals: Notes on Track, by W. M. Camp; volume 3 of The Science of Railways, by Marshall M. Kirkman; and Railway and Track Work, by E. E. Russell Tratman. In addition, retired railroad workers have suggested two other manuals: The Trackman’s Helper, by J. Kindelan, used by the Kansas-Missouri-Texas line in the early 1900s; and The Road-Master’s Assistant and Section-Master’s Guide, by William S. Huntington, revised by Charles Latimer, which is the earliest of all these particular manuals. Camp and Tratman give the most attention to cattle guards; Kindelan and Huntington, the least.

Huntington seemed to know of only two types of guards, the more effective of which he considered to be the open pit, devoid even of cross sleepers. More troublesome to use was the wooden-slat guard placed over a shallow pit. Cattle often became trapped in this type of guard. Then a passing train would kill the cattle and simultaneously be derailed. Apparently, when Huntington first published his manual (1871), surface railroad cattle guards were not yet widely used or even available. His final comment on the subject suggests that the railroad cattle guards of the time were more often than not ramshackle affairs, “cobbled up on ties and fence-posts. . . . Nothing gives our railroads a more poverty stricken, slovenly appearance than a shabby and unsafe manner of building cattle-guards and culverts.”

In his manual, Kindelan states that steel surface guards, which were rapidly growing in favor with railroad men, were much better than open-pit guards. His manual also explained why such a boom in the promotion of surface cattle guards occurred: “It is just what the railroads need at the present time, and . . . if the proper kind is offered railroad companies would purchase them and put them in.” In other words, in the 1880s and 1890s the market in railroad cattle guards was there, waiting to be exploited. The advantages of the steel surface guard, in Kindelan’s opinion, were many: it did not require a deep pit, it did not trap cattle, it was not expensive, it was easy to install, and it did not weaken the track.

Kirkman devotes only these three paragraphs to the cattle guard:

[Cattle] guards should be placed at all farm and public road crossings where there is no protection by gates or otherwise; to prevent cattle running along the track, a fence should be built from the
right of way fence on both sides of the opening to as near the rail as practicable. There are various forms of cattle guards. One plan in particular commends itself, being effective and cheap. It is a space of not less than six feet stretching the entire width of the track parallel to the road, laid with two and one-half by four inch oak pieces laid across the ties parallel to the rails, cut to a sharp edge on the upper face, spaced with two-inch spacing blocks, and spiked down to the ties. The most effective plan, however, is to build a pit the entire width of the road about six feet wide, and of sufficient depth to enable a cow to drop entirely clear of the trains. This, however, is too expensive, requiring the building of retaining walls and bridged for the rails only. This style of a cattle guard is perfectly effective.

Cattle guards are the means of continuing fences across railroad tracks without interfering with the passage of trains. They form a very considerable portion of the expenses of a road, and therefore it is desirable to obtain a device as simple as possible, and yet it must effectually exclude all stock from the enclosure. A framed pit sufficiently wide for the connecting fences to afford proper clearance for the cars, and with stringers for the rails to rest on, was, until recent years, the form in most general use. The danger of stringers spreading and the disastrous effect of a derailment at these pits led to the addition of ties and guard timbers; these additions permitted a much shallower pit. As cattle, sheep and goats learned to walk these ties or guard timbers, it became necessary to have them chamfered.

Many other forms of stock guards, principally surface guards intended to do away with the pit entirely, have been suggested and patented.

The first paragraph refers to the two types of cattle guard that Huntington described—a grid of wooden panels, and an open pit—and Kirkman seems to favor the latter despite its greater expense. Several important points are raised in the second paragraph. First is the notion that railroad cattle guards are considered primarily as an extension of the fence, whereas automotive cattle guards are thought of primarily as gates (although both types serve both functions). Second, Kirkman emphasizes the economic importance of the cattle guard. He then points out some of the disadvantages of the pit cattle guard, which have led to its being replaced by surface guards, but he no more than mentions these replacements, even though at least 173 railroad cattle guards had been patented by 1902, the date of Kirkman's revised edition. Obviously his sympathies lay with the pit guard.

Both Tratman and Camp, in concurrence with the editors of Engineering News, disagreed with Kirkman about the desirability of the pit cattle guard. Tratman devoted nearly six pages to the cattle guard; Camp, over
nine; and both authors went into much greater detail concerning the construction and use of each type of cattle guard. Both pointed out that cattle guards were being used not only at grade crossings but also at approaches to bridges, tunnels, and deep cuts—any place, in other words, where it was important to keep the track clear of trespassing animals.

Tratman discusses the difficulty of making an effective cattle guard, primarily because cattle are persistent in their attempts to evade constraints:

> It is not as easy to turn cattle as might be supposed, and very generally they will become accustomed to the guards and find a way to cross them. If straying along the road they will sometimes spend considerable time in trying the guards, either from a desire to wander or to reach a tempting patch of grass or hay. Hungry cattle are especially venturesome. Some cattle are inveterate wanderers, and will cross almost any form of guard, even as others are inveterate fence breakers or jumpers. If being driven they will often either run blindly into or over the guard, and the length of the guard should be sufficient to deter them from jumping. Hogs and sheep are difficult to stop, and are very persistent in their attempts to reach forbidden ground.

He also noted that a standing cow, if struck by a train, would probably be thrown clear of the track, but if the cow were lying down when struck, the train would usually be derailed. Camp emphatically stated that the only sure way of keeping the track clear of livestock was with pits:

> It is safe to say that the open pit properly constructed will stop stock. There are, of course, those who will declare they have seen some old cow do the tight-rope act and walk the rail over the pit, but such exhibitions may properly be considered unusual and of infrequent occurrence; and no doubt room could be found for all such rare animals in menageries, where they could make their living easier than by picking it along the track.

Camp was just as emphatic, however, in condemning the use of the pit cattle guard. Both he and Tratman pointed out problems of maintenance: the track could heave or settle, resulting in an uneven riding spot on the rails; frost and rain could damage the pit; timbers could rot or burn. The most serious objection, however, was safety. A derailed wheel or truck would invariably drop into the pit and cause a wreck. Moreover, persons who walked along the tracks at night, whether trainmen or members of the public, often fell into these pits, and if the stringers holding the rails had been joined together with a switch rod, the chances of a broken neck were considerable. The Chicago Times for 14 May 1881, for example, carried a story about a man who had suffered a fatal accident when he fell into an open-pit cattle guard at night. According to railroad law, the railroads were not liable for damages if
a trespassing pedestrian accidentally fell into a pit cattle guard. Charles A. Dana once recalled that during the Civil War, trains were sabotaged by placing ties in cattle guards so that the engine would strike them and then run down an embankment.

Camp further pointed out that a shallow pit was even worse than a deep one (he recommended that a pit be ten feet long, ten feet wide, and three to six feet deep). A shallow pit posed the same maintenance problems as a deep one, yet it would not turn stock as effectively. If the pit were too shallow, animals could walk across it, and if they slipped on a deeper one, they would become stranded and cause a derailment. Both Tratman and Camp discouraged the use of the open-pit cattle guard, although Camp was the more vehement: “Thus it seems almost criminal to place open pits in the track and their use ought to be illegal.”

Camp mentioned only one railroad that was still using a form of the pit cattle guard in 1904, the Florida East Coast Railway. The design of these guards on that railroad featured eight-by-eight-inch ties laid on corner (presenting a diamond shape when viewed from the side) so that they offered no footing to livestock. These ties were strong enough to hold up any derailed trucks. In Florida there was no danger that a track would heave due to freezing ground, but because of the damp climate, maintaining good pit drainage could be troublesome.

Pits were used on a railroad that ran through Parker and Palo Pinto counties in Texas, according to Tracy King of Roby, Texas, who saw them on his grandfather’s farm around 1900. Pit cattle guards were also used around 1891 by the Baltimore & Ohio Railroad near Rittman, Ohio, according to Marcus Lind of Salem, Oregon: “My late father, 1881–1968, used to tell how, as a boy, he would crawl down into the cattle guard, which evidently was in the form of a pit, when the train went over. He spoke of the terrific noise it made, which I can very well believe. And Father was hard of hearing all the time I knew him.”

Pit cattle guards were no doubt used at one time or another by many other railroads, but by 1900 pits were rapidly being supplanted by surface cattle guards. There was an overwhelming variety of surface guards from which a roadmaster could select a design he deemed appropriate for his railroad. Over the years, some 409 railroad cattle guards have been patented, at least 290 of them by 1910. There are two major reasons for this onslaught of cattle-guard designs. First, cattle guards had a significant, if sometimes indirect, economic impact on railroads. If an inventor built a better cattle guard, the railroad companies beat a path to his door, bringing with them fistfuls of dollars. Second, the problem with all these inventions was that none, with the exception of the pit, was totally effective. As Camp put it, “The two essential conditions of a perfect cattle guard—a structure which will safely carry the
wheels of a derailed truck and which will form an impassable barrier to stock without entrapping the animals to the peril of trains—are incompatible with each other.” Tratman was more prosaic, but no less demanding in his specifications:

Besides being effective in turning cattle, the guard should meet the following requirements: 1, Reasonable in first cost and maintenance expense; 2, Permit of proper maintenance of track; 3, Not liable to cause derailment or wreck a derailed train; 4, Not liable to become loose or to be caught by low-hung brake rigging, etc.; 5, Easily and safely passed by employees; 6, Not liable to trap or throw cattle attempting to pass; 7, Not noisy or rattling under the trains.

Both authors agreed that it was more difficult to turn livestock than many persons might suppose, and they both agreed that surface cattle guards were ineffective because they were not made long enough. Camp notes:

Horses will clear an 8-ft. guard at a single jump, and by stepping as far as possible with their front feet cattle will leap the rest of the way over a guard 10 ft. long. If cattle guards were made 15 or 20 ft. long, measured with the track, and well flanked by side fence, there would be but very few animals better domesticated than the Texas steer or the southern “razorback” hog that would attempt to clamber over them.

He added that the Chesapeake & Ohio Railroad preferred twelve-foot guards to eight-foot ones, while the Nashville, Chattanooga, & St. Louis line got good results from a sixteen-foot guard made by placing two eight-foot sections end to end.

With few exceptions, railroad cattle guards relied either on insecure footing or on the potential to cause pain as the deterring factor in their various designs. Those few exceptions were guards constructed on a principle of novelty. Of over 400 guards, probably fewer than two dozen ever achieved much commercial success. Here are descriptions of some of the more widely used, and some of the more novel, railroad cattle guards.

The simplest cattle guard, and one of the most widely used, was made of wooden slats. It was cheap to build, easy to repair, and uncomplicated in design—a series of wooden arris bars, roughly four to six inches wide at the base and eight feet long, running parallel to the track and spaced so that hooves could not slip between them. The bars could be spiked directly to the ties, or they could be bolted, with spacing blocks, into sections that could be placed onto the ties and could more easily be removed for repairs. The slats were usually made of oak or hard pine. They were also usually kept freshly white-washed on the theory that paint would be more effective in deterring livestock than would natural wood; paint also helped to preserve the wood. Some
guards were painted black; others had black slats and white slats alternating. The Wabash Railroad coated its cattle guards with hot tar, and the Chicago Terminal Transfer Railroad used white glue and whitewash for a coating that would last up to a full year between repaintings. Among other railroads, the Canadian Pacific, the Missouri Pacific, the Union Pacific, the Northern Pacific, and the Wabash all used the wooden-slat cattle guard at one time or another.

Insecure footing was the principle behind most wooden-slat cattle guards, but the potential for pain was incorporated in the guards used by some railroads. The Louisville & Nashville, for example, used twists of thickset buckthorn ribbon wire between and parallel to each slat. This variation was particularly effective against range cattle, as was the Kennedy Cattle Guard, made of slats and strips of barbed wire, which was used by the Oregon Railway & Navigation Line. The Western Pacific Railway used the same guard with eight-inch spacing, so that a horse could get its foot out without damage. Camp described a barbed-wire guard designed by a Rock Island Roadmaster, J. D. Sullivan:

The strands of barbed wire in each section of the guard are stretched over a frame made of two strips running parallel with the rails, with four cross pieces of wood of triangular section, covered with sheet metal. The ends of the section are held together by bolts and the barbed wires are woven back and forth from end to end of the section, on lines parallel with the track. This guard is used on parts of the road in Indian Territory and northern Texas, where the cattle are hard to hold and where other forms of surface guard have failed.

Camp also noted that when a dragging brake beam had caught in one of these interlaces of barbed wire, it created an appearance that would frighten anything, man or beast.

The National Surface Guard Company made two types of cattle guard. The first used flat metal slats, which were serrated and barbed, set on edge, and fitted into slotted cross pieces of triangular sections at the ends and in the middle. Alternate slats were two and one-half and three and one-half inches deep and were spaced from two and three-quarters to three and three-quarters inches apart. Each section (it took four to make a complete unit—two between the rails and one on each side) weighed 140 pounds. In an attempt to deter smaller animals, such as the practically unstoppable razorback hog of the southern states, the serrated slats were furnished with barbs punched out on the sides. The other type of guard made by National had slats of angle iron, with the angle on top, like an inverted V. A complete unit was nine feet long and ten feet wide, and it weighed about four hundred pounds.
National Surface Guards were used quite extensively, thanks in part to the endorsement they received from the New England Road Masters' Association.

In the original Kalamazoo Guard, triangular slats alternated with rows of triangular teeth that were punched up out of the flat strips of plate between the ridges. An animal's hoof would slip down off the ridges onto the teeth, but a person who fell across the guard would be held off the teeth by the slats. This guard was nine feet long and weighed 375 pounds. It was approved by the Western Railroad Association. What is today known as the Kalamazoo Guard was originally manufactured under the name of Perfect Steel Surface Cattle Guard. It was made of sheet metal and looked somewhat like a series of low shed roofs with peaks about ten inches apart and eaves about five inches lower than the peaks. The peaks reached just below the level of the rails. The advertising copy of the 1907 edition of Railway, Mining, Municipal and Contractor's Supplier Catalogue describes this guard:

An effective stock turner for any section of country. Renders crossing physically impossible and does not punish the animals. At initial step they slide toe first against slot at base and cannot advance, but are free to withdraw without slightest injury. Made in three sections only, ready-to-place. Offers no catching points for dragging chains. Is readily removable during track overhauling. Chokes weed growth. Has a solid anchorage in track; can not rattle to pieces. After assembling, guards are dipped in an asphaltum bath to fill all crevices and cover all surfaces with a thick tenacious coat. Is proof against corrosion. Is self-cleansing of snow and rubbish by draught. Prevents personal injury from accidental falling. Length 9 ft. Weight 475 lbs. Prices on application.

This guard does indeed sound perfect, but, like all the others, it was not. The Union Pacific Railroad is currently having some trouble with this type of guard in Wyoming, a problem that will be discussed later.

The Bush Surface Cattle Guard, promoted as the "common sense steel guard," had seven slats of inverted T-irons, two inches apart and held in slotted triangular pressed-steel cross pieces. The slats were held at different heights. This guard was made in four interchangeable nine-foot-long sections and weighed about 475 pounds. Each slat could support a center load of 1,800 pounds. The complete guard sold for $20 plus the cost of delivery.

The Bartlett Cattle Guard was used on the Great Northern Railroad during the 1920s. This guard consisted of thirty-two separate pieces of heavy sheet metal, spiked in four rows onto eight adjacent ties. These triangular metal sheets sloped forward like the prow of a a ship. An animal could put its foot down between the rows formed by the sections but could not step forward; it could only pull up its hoof and draw it backward.

The Merrill-Stevens Guard had T-iron slats, one and one-fourth by one
and one-fourth inches, set aslant of and parallel to the rails. The slats were set diagonally in the end cross pieces and were level with the top of the rail. Thus it relied on insecure footing to turn cattle.

The Standard Company made two cattle guards. One used slats of Z-bar, set at an angle in order to offer an upturned corner for insecure footing. The other had slats of angle bar, one leg of which was much longer than the other. Both guards were spaced by supporting rods that passed through holes in the slats, and both were nailed onto the ties. The ends of the slats were beveled in order to prevent dragging brake lines from catching on the guard.

The Cook Cattle Guard was made of four interchangeable sections, each of which had nine serrated slats fastened to metal channel section cross pieces which were nailed to the ties. The serrated teeth were staggered, thereby presenting an uneven appearance and unstable footing for cattle. Each section was spiked to the end ties only; thus the guard vibrated under the weight of an animal, an added deterrent. This guard operated on the principle of pain, but the teeth did not cause serious injury. The guard was available with an auxiliary hog slat which went between the regular slats. This slab was shorter, and its teeth were like saw teeth. It could also be fitted with rows of link-belt chain stretched parallel with the rail over suitable cross pieces, placed at appropriate intervals. By 1904 some thirty-five thousand Cook Guards were being used.

The Sheffield Car Company of Three Rivers, Michigan, a subsidiary of Fairbanks-Morse, produced a cattle guard that was made by punching out rows of triangular teeth, each tooth with a three-inch base and spaced three inches apart, in a flat steel plate twenty-six inches wide and eight feet long, or slightly longer. This guard had several advantages besides its forbidding appearance. It could be fastened to ties without any special preparation. No pit was needed, and no dragging brake gear could catch on it and tear it out. The soft steel teeth, if bent accidentally, could easily be straightened with a spike hammer. This guard was widely used throughout the country; the Santa Fe was one of its chief customers.

The Walhaupter and the Positive cattle guards were similar to each other. Both were made of buckled plate, with folds that ran crosswise of the track and reached to the bottom of the ties, the pitch of the folds or corrugations corresponding in length to the spacing between the ties. The folds were shaped like ratchet teeth, and when in place on the track, they presented an inclined surface that ran from an upper corner of one tie to a lower corner of the next tie. When an animal stepped on one of these guards, its hoof would slide into the fold and strike the ridge or upper corner of the next fold; thus its leg would be obstructed just above the ankle and the animal would not be able to move forward. It could, however, back out unharmed.

The Trackman’s Cattle Guard worked similarly, but the folded metal
was made in separate pieces, each of which was spiked to a different tie. The advantage of this design was that ties could be easily removed for replacement, the track could be lined or surfaced without dismantling the guard, and the entire guard did not have to be replaced if part of it got damaged.

The Columbian Guard consisted of steel angle irons, one and one-half by one and one-half inches, laid parallel in order to form inverted-V slats. An eight-foot section of this guard weighed about 320 pounds.

The Wallace Surface Cattle Guard Manufacturing Company of Monroe, Arkansas, made a guard composed of a longitudinal triangular-shaped wooden strip spiked to the tie, over which was placed a covering of galvanized steel which sloped on each side to the tie into a deep V-shaped box. One of these boxes was laid between each two ties, with the top an inch or two higher than the level of the bottom face of the ties. An animal attempting to walk over the guard would have its feet pinched into the tight, converging sides of the box.

The Climax Stock Guard Company of Chicago made a metal guard without slats. An inverted V-shaped strip of expanded metal was placed on each tie, its edges projecting beyond the tie so as to hit the leg of any animal that tried to step between the ties. This guard had the advantage of not having to be removed in order for section hands to go about their normal work of lining, surfacing, and ballasting.

Climax also produced an unusual railroad cattle guard made of blocks of vitrified shale clay. These blocks were twenty-four inches long, eight and one-half inches wide, and four and one-half inches high. Each block was formed of two longitudinal triangular ridges molded into shells one and one-fourth inches thick and joined at the base. A complete cattle guard was composed of forty blocks weighing thirty-three pounds each and arranged on five ties in two-foot rows. It was held in place by a two-inch wooden cleat fastened around the guard, and end blocks were slotted and beveled to accommodate spikes.

Another unusual railroad cattle guard used clay sewer-pipe tiles. A series of ten pipes, eighteen inches in length, was buried vertically between each of four successive ties. The tiles were set on a bed of gravel in order to ensure proper drainage, and they reached just to the top of the rails. The ties were capped with a triangular wooden piece so that they afforded no footing. One of the major attractions of this guard was its cost: forty tiles at fifteen cents each, and almost no maintenance. According to its promoters, only in snow did this guard require attention, and then it could be dipped out with a light scoop. The idea for this guard was patented by Kellogg, Baker, and Stearnes of Garden Grove, Iowa, in 1889. They could not manufacture and ship this kind of cattle guard, but they did sell to railroads the right to install it.
Within two years the Rock Island, the Keokuk & Western, and the Chicago, Burlington, & Quincy were among the railroads using this guard.

Still another unusual cattle guard was made by the Buda Foundry and Manufacturing Company of Chicago. It was called the Oscillating Cattle Guard, and it did just that when stepped on, for its panels of triangular-shaped wooden slats were suspended by chains from each of its four corners. The chains were attached to arched brackets that spanned the space between two ties. The guard was nine feet long and eight feet wide. Its slats were spaced three-quarters of an inch apart and were spiked to wooden bolsters in three sections. The section between the rails had ten slats, and the two outer sections had three slats each. Two cross bars hung below the track rail between two adjacent ties near the end of the guards, and the chains from the brackets were attached to the crossbars at that point. In addition to its cattle-turning advantages, this guard did not have to be removed for snow plows, and all or part of it could be easily removed for track work by simply removing the cotter pins that held the guard sections to the cross bars.

The Conical-Roller Cattle Guard was another movable guard. It was made of four sections, each twenty-four inches long and each composed of about twenty wooden cylinders that were three inches in diameter at one end and four inches at the other. The cylinders were held in a frame of steel side and end pieces. The rollers rotated on metal rods and were installed with the large and small ends alternating. If an animal attempted to cross the guard, the rolling bars discouraged it from doing so.

In 1903 William H. McLaren of Highgate, Canada, patented what could best be termed a liquid cattle guard. His invention consisted of four shallow metal pans, two of which were to be placed between the rails and one on the outside of each rail. These pans were supposed to contain water and a second (unspecified) liquid of a lower specific gravity that would float on the water. This second liquid was also to possess a highly reflective surface and have a bad taste so that cattle would not drink it.

Finally, there were some mechanical cattle guards on the market—which may or may not have actually been used by railroads—that could be termed “trip and flip” cattle guards. These guards usually had loose trip boards (connected by transverse rods to several prongs) which would, when stepped on, spring the prongs into the air and form a sort of fence, much like the workings of the Canadian cattle guard discussed above. Others would, when tripped, hammer an animal’s leg, as a piano hammer strikes a string. None of these devices seems to have been very practical, but that did not stop inventors from trying. Camp put it best: “Cattle guards are as numerous as Yankee ingenuity has been able to devise, but only a comparatively small number of the inventions in this line have succeeded in being put to use.”

Today Yankee ingenuity has created a world of miniature railroads, cor-
A "trip and flip" railroad cattle guard patented in 1909 by Robert B. Walker, Strathcona, Alberta, Canada. (Photo from U.S. Patent Gazette)

A Kalamazoo-type cattle guard near Craig, Colorado

A railroad cattle guard patented in 1914 by Eugene Cook, Niles, Michigan. This cattle guard is the type described by A. F. Young and Jesse Jordan. (Photo from U.S. Patent Gazette)
rect in every detail, including cattle guards. The 1980 edition of *Walthers HO Railroad Catalog and Craft Train Reference Manual* is 425 pages long, and it carries the product lines of some two hundred and fifty manufacturers. On page 390, among a number of accessories (such as an oil can, a fire-alarm box, and a set of track tools) produced by the Sequoia Company, is a miniature railroad cattle guard, one which appears to be patterned after the National Surface Guard Company's metal cattle guard. Six pages later, a model of the widely used wooden arris-board railroad cattle guard is offered for sale by the Kadee Company.

Kalamazoo, Michigan, seems to have been a hotbed of railroad-cattle-guard activity around the turn of the century. Many of the cattle guards listed above were manufactured there by the Kalamazoo Steel Cattle Guard Company, the Bush Surface Cattle Guard Company, and the Merrill-Stevens Manufacturing Company (which also made the Cook Cattle Guard). In addition, the Kalamazoo Railroad Velocipede and Car Company manufactured a cattle guard made of woven steel wire.

A result of the invention of barbed wire was increased pressure to fence railroad right of ways, and a result of this pressure was the formation of fencing companies, one of the largest of which was the Western Fence Company. Between May and October of 1880, its first year in business, Western Fence had built literally hundreds of miles of railroad fences, along with numerous gates and cattle guards. This Chicago-based company furnished all materials for fences, wings, gates, and cattle guards. They built pit cattle guards with wooden slats spaced over the pit, according to an advertisement in Poor's *Manual of Railroads* (1890). During the first ten years of its existence, the Western Fence Company built an average of one thousand miles of fence per year and, presumably, hundreds of cattle guards as well.

A decision handed down by the Iowa Supreme Court in 1885 typifies the economic pressure that was being put on railroads to continue their search for an effective, durable cattle guard. The Rock Island passed through land owned by a farmer named Miller. The railroad had constructed a crossing for Miller and had properly installed fences, gates, wings, and cattle guards. When a gate was left open, however, some cattle got through the lane fence (which was in poor repair) and were killed by a train. The Rock Island used as its defense the claim that Miller had not requested that the fence and the cattle guard be repaired. The court decided in favor of Miller anyway, and the railroad had to pay him double the value of his cattle.

In fact, by the late 1800s the legal requirements and ramifications of railroad fencing had become so complex and pervasive that a book of more than 550 pages was devoted exclusively to the subject. A look into this book, *The Law of Railroad Fences*, by W. W. Thornton (1892), and into some other pertinent legal records, reveals much about the use of railroad cattle
guards at a time just prior to the introduction of the automobile, and thus just prior to the time when the railroad cattle guard would have served as either the conscious or the subconscious model for the automotive cattle guard.

From a legal standpoint, the term “cattle guard” is used interchangeably with “cattle pit.” Both terms refer to some sort of structure that, according to Thornton, “will prevent animals from going over the right of way upon . . . inclosed land; and [a cattle guard] must extend quite across the right of way, or wing fences must be built from it to the fences along the outer edge of the right of way.” Most states in 1892 had laws governing a railroad’s obligation to fence its right of way, but the legal requirements concerning cattle guards varied from state to state. Some state laws explicitly required cattle guards; in other states the obligation to build them was implicitly contained in the laws requiring the construction of fences. Also, under certain circumstances, a railroad was allowed to forego the building of fences and cattle guards.

For the most part, railroad companies were required to fence both in rural and in urban areas, except where fences would interfere with the rights of the public or with the ability of the railroad to conduct its normal business. Thus, towns with numerous street crossings, alleyways, and railroad service areas tended to have less fencing (and fewer cattle guards) than did the countryside. Railroads were not forced to fence depot areas, sidings and switch areas, coal yards, or freight yards. Part of this exception to the normal fencing requirement resulted from court decisions that allowed the company a reasonable freedom in conducting its business, and part came from considerations of safety. Decisions from Indiana courts express these concepts quite clearly:

To have securely fenced [the right of way] at that place . . . would have required a cattle-guard near the south end of the bridge and another at or near the switch. The evidence . . . shows without conflict that a cattle-guard near the switch would have greatly endangered the lives of . . . employees in operating . . . trains. It is well settled law that a railroad company is not required to fence its road where such fence interferes with its own rights in operating its road or transacting its business, nor where the rights of the public in travelling or doing business with the company are interfered with.

An 1891 Montana statute concerning fences and cattle guards can also be considered typical:

Railroad corporations must make and maintain a good and legal fence on both sides of their track and property, and maintain, at all crossings, cattle guards over which cattle or other domestic animals cannot pass. In case they do not make and maintain such fence and guards, if their engines or cars shall kill or maim any cattle or other domestic animals upon their line of road, they must pay
to the owner of such cattle or other domestic animals, in all cases, a fair market price for the same, unless it occurs through the neglect or fault of the owner of the animal so killed or maimed; provided, that nothing herein shall be construed so as to prevent any person or persons from recovering damages from any railroad corporation for its negligent killing or injury to any cattle, or other domestic animals, at spurs, sidings, Y's, crossings, and turntables.

This statement of law is supplemented by three pages of commentary, cross references, and applications. Two years later, Montana passed legislation mandating, in grazing country only, the construction of crossings through railroad fences at intervals of at most four miles. These openings had to be no less than sixty feet wide and had to have a cattle guard on each side. Other states in range country had similar laws.

Where a company was required to fence, the laws could be quite strict. Not only did cattle guards have to be installed; they also had to have been installed by railroad personnel (not the farmer whose land was crossed by the railroad), and they had to have been installed in appropriate places. A Texas decision, for instance, declared that the farmer was not responsible for building cattle guards to protect his crops because “it is a work requiring skill and experience, beyond ordinary labor, such as a farmer is not supposed to have, nor is it supposed that he has such knowledge of the business to choose a competent and skillful person to prepare them for him.” Although some farmers might not have liked the implication, contained in the foregoing decision, that they were incompetent, all of them were undoubtedly happy that the responsibility for cattle guards was placed upon the railroads. Concerning installation at proper places, decisions from many courts required that cattle guards be placed precisely on the margin of the highway at a grade crossing. Even an unintentional error of five feet in constructing the cattle guard could be cause for holding the railroad liable for livestock that might be struck at that crossing.

In addition to paying costs for livestock killed or injured by passing trains, railroads sometimes were also liable to pay for damage done to crops by livestock that had strayed through right-of-way fences. Only if cattle were unlawfully on the highway or if they were in an area where the railroad was not legally bound to fence was the company not liable for crop damages.

Not all decisions went against the railroads, however. Companies were not required to go beyond what was reasonable in constructing and installing cattle guards. In New York in 1860, for example, the railroad was held liable for damages only until fences, gates, and cattle guards had been constructed. Farmers could not legally allow their stock onto the right of way, unless they had permission to do so, nor could anyone except railroad employees legally walk along the tracks other than at public crossings.
Moreover, unusual circumstances, such as a heavy snow, could alter the liability status of a railroad. Snow was a problem for railroads particularly in Canada and the northern United States, and many of the cattle guards used in those areas were removable. They would be put in place in the spring, when livestock was turned out to pasture, then taken up in winter, when most animals had been moved to winter quarters and when snow plows were needed on the tracks. Only fairly recently did the Canadian Pacific reach an agreement with some of the cities along its route in Alberta whereby it was allowed to cease altogether the installation and maintenance of cattle guards.

Finally, railroads were not held accountable for animals that were especially difficult to keep behind fences: “The company is bound to put in guards that will turn ordinary stock; and if it does, and stock leap over them, the company is not liable.” In a New York decision, the owner of a cow that had crossed a cattle guard during a snow storm could not collect damages because the animal was illegally running loose already.

Present-day fence laws are not in all cases identical to those of ninety years ago, and livestock owners are now more likely to be responsible for keeping their animals fenced in than are grain farmers (or railroads) to keep that same stock fenced out. This generalization, however, does not hold true in all states, particularly those, such as Wyoming, that have large areas of open range. Although most western railroads had their right of ways fenced by 1900, the Northern Pacific in Montana had, in the early decades of this century, fenced only those portions of its line where concentrations of cattle were especially heavy. A fifteen-mile stretch of fence (with cattle guards) might be followed, for example, by a fifty-mile stretch of unfenced track.

As Joseph Noble noted in his book, rarely if ever did a train seem to strike a scrub animal, or even an ordinary one. Several correspondents have mentioned that only purebreds seem to have been drawn, seemingly irresistibly, into the paths of trains. Joel F. Overholser, publisher of the Fort Benton (Montana) River Press suggested a survey “on whether any railroad ever hit any but pedigreed stock. The quality slaughtered by the Great Northern trains from 1887 until Jim Hill fenced his line was substantial—the few items on claims I’ve run across indicate that the quality was excellent!” Other people have also alluded to James Hill as someone who had to pay for the carcasses of many purebred animals. Thus it is somewhat ironic that Hill did indeed believe in upgrading the quality of livestock, as this quotation from the 15 June 1916 Breeder’s Gazette indicates: “One of the chief factors in the success of the late James J. Hill as the builder of a great railway system was his active, personal interest in promoting improved methods of farming and the breeding of better livestock in the territory depending upon and supporting his lines.” Perhaps Hill decided that as long as he had to pay for top-quality
livestock when his trains hit any, he might as well do what he could to see that what was hit was indeed of top quality.

Most of the material referred to thus far comes from around the turn of the century. Although railroads continued to use cattle guards extensively for the first few decades of the twentieth century, during the past thirty years or so the use of cattle guards on railroads has greatly decreased, a circumstance noted in the 1978 edition of *Track Cyclopedia*: “Cattle guards are rapidly disappearing in this country, even though their use is required by law in some states. The guards are very costly to maintain and claims paid for livestock may be less than the maintenance cost.”

The American Railway Engineering Association developed four criteria for stock guards. These have not been changed since before 1962, and they are essentially the same as the criteria developed as early as 1915:

1. A stock guard should be so constructed as to avoid projecting surfaces liable to be caught by loose or dragging portions of equipment.
2. It should be effective against all livestock, have no parts which would catch or hold animals or unnecessarily endanger employees who pass over it in the discharge of their duties.
3. It should be reasonable in first cost, durable and easily applied and removed, so as to permit repairs to track at minimum expense.
4. It should not rattle during passage of trains.

Many correspondents have provided copies of the cattle-guard standards used by various railroads, almost none of which have been updated since the 1920s. The most recent patent for a railroad cattle guard I have been able to locate was issued in 1934. Likewise, during the 1930s, such journals as *Railway Age* ceased to publish articles about cattle guards. One man who worked thirty-four years for the Delaware & Hudson cannot remember ever having seen a cattle guard in place on that line, according to D. E. Hoadley; and Bill Armstrong of the Chicago & North Western Railway said that cattle guards were removed when new track was installed and were simply not put back, as was the case with the Katy in 1943 on its Kansas City Division. On the Central Vermont Railroad, natural forces were responsible for the removal of cattle guards; in the late 1930s a hurricane washed out most of them, and they were never replaced. In short, the use of railroad cattle guards appears to have been on the decline for several decades.

Interesting things have happened to some of the old cattle guards after they have been removed. The Santa Fe branch that runs through the Kansas Flint Hills near my hometown of Cassoday tore out all its old Sheffield Guards during the early 1970s, at the same time that it was tearing down many of the stockyards along that route. (Cattle shipping on the railroad in this particular
area effectively ended in the 1960s, when trucks took over.) Some of these old 
guards are still to be found in the gravel along the right of way on the north 
edge of town, where they were discarded after having been ripped out. I sal-
vaged one in 1978 for my personal collection of cattle guards. Another dona-
tion to this collection came from Jesse Jordan, curator of the Western Trails 
Museum in Clinton, Oklahoma, who sent me a piece of a Rock Island cattle 
guard installed there in 1901. He had gone out to take photographs for me of 
some of these old guards, which are now being used as braces for fence posts, 
and on his way he stumbled over a broken piece in the grass, which he tagged 
and mailed to me. Other correspondents have told about placing sections of 
old railroad cattle guards in their local historical museums.

Sometimes, old cattle guards are put to further service. On the F. B. 
McCann ranch at Culbertson, Montana, for instance, the windbreaks around 
the stock watering tanks are nothing more than sections of old wooden North-
ern Pacific cattle guards. These guards are ten feet long, and the slats have 
been cut into a triangular shape.

The cattle guard sent to me by Jesse Jordan was one patented in 1915 by 
Eugene Cook of Niles, Michigan. It came in eight-foot strips of U-shaped iron 
bar approximately three inches by three inches. The open sides were notched 
to form a saw-toothed edge. When in use as cattle guards, five of these strips 
were nailed outside each rail, and ten strips were fastened between the rails. 
A. F. Young of Riley, Kansas, a long-time employee (now retired) of the Rock 
Island, used these metal strips for right-of-way posts soon after the Rock 
Island discontinued using them as cattle guards around 1930: “It was the first 
metal post I ever saw used. Sure different than the posts used now.” Young 
thought that the Rock Island cattle guards worked well and were attractive; 
the biggest problem encountered was when a dragging brake beam would 
hook the end of a guard and tear it loose. It was usually easy, however, to nail 
down the loose end and get the guard back into working order. In the late 
1970s Larry Greer discovered some of these Cook Cattle Guards, discarded 
from the old St. Louis and San Francisco Railroad, being used as fence posts 
along Kansas Highway 254 between El Dorado and Wichita. Because of the 
toothlike appearance of the punched-out serrations, Greer says, these posts 
are often called “gator posts.”

As of 1981 apparently only one supply company, the Tamper Division of 
the Camon Railgroup of West Columbia, South Carolina, was offering rail-
road cattle guards for sale. In 1969 Tamper bought the Kalamazoo Railway 
Products Division, thus adding the Kalamazoo Perfect Steel Cattle Guard to 
its line of products. This guard was being built at least as early as the turn of 
the century. According to the specification sheet from Tamper, the design 
has not been changed since 1929. Each unit of the Kalamazoo Perfect Guard 
is eight feet eight inches long, and it is available in widths of seventeen,
twenty-two, thirty-four, thirty-six, and forty-six inches. In 1978 Tamper sold fifty-five units; in 1979 that figure dropped to seventeen; in 1980 it rose to twenty-seven. Although sale of the guards is obviously not a major factor in Tamper's balance sheet, the company does intend to continue to manufacture and sell them as long as there is any demand at all, according to Richard Teeter, public information director for Tamper.

Overall the use of railroad cattle guards may be declining, but some railroads are actually having to increase their installations of cattle guards, particularly in the northern plains, where new branch lines are being laid into coal-producing areas. The Burlington Northern, for example, recently built a 116-mile line into the Powder River Basin of Wyoming, a line requiring new cattle guards all along the right of way. Rather than buying commercially produced guards, Burlington Northern has developed standard plans (revised and updated in 1975) for a single-track and a double-track railroad cattle guard, as well as for an automotive cattle guard to be used at grade crossings. These guards are then constructed locally as needed. Some are made by large manufacturing companies, others by small-town welders. As far as Burlington Northern is concerned, according to W. A. McKenzie, director of information services, the future of cattle guards will remain vital as long as open-range conditions exist in the West.

A cattle-guard controversy of sorts between southern Wyoming ranchers and the Union Pacific developed early in 1980, according to a story by Ron Franck in the *Laramie Boomerang* (24 February 1980). Trains on the Coal-mont Route between Laramie, Wyoming, and Walden, Colorado, had run on an unfenced track through open-range country for years without doing much damage to stock, but recently, because of the boom in Wyoming coal, more and faster trains have been traveling the route, and more animals have been hit and killed. According to one rancher, "Up until just a couple years ago we never lost any livestock to the trains. What few trains did go through here went pretty slow. Now, though, since they started hauling coal from Walden, there are about four trains a day going through, and they go a lot faster. With a heavy load of coal, they can't stop when they want to. And I think the engineers have come to feel that, what if they do hit a horse or cow? The railroad will pay for it. One of those fellows told me it costs the railroad about $10,000 every time they have to stop a train. Maybe they just think it's cheaper to go ahead and hit the animals." Fence law in Wyoming places responsibility for fencing, not on the owners of the livestock, but on landowners who want to keep livestock off their property. Thus, in the 1980s, just as in the 1880s, the Union Pacific must either fence its Wyoming right of way or continue to pay claims for damage to livestock.

Along with fencing goes the cattle guard, but even that is causing trouble for the Union Pacific, which, according to railroad spokesman Barry Combs,
uses the new model Kalamazoo Cattle Guard. This guard is made of thin strips of sheet metal bent into the shape of a rooftop and laid over the cross ties. Between the cross-ties no support is provided for the edges of these sheet-metal strips, and the weight of a horse or cow can cause the animal's hoof to slip down between the metal strips. When this happens, especially with horses, the Kalamazoo Guard becomes, according to Wyoming rancher Richard Smith, "a trap; the animal gets its foot down in it and it can't get out without badly injuring itself and often breaking its leg." Smith lost a horse when it caught a hind foot, broke an ankle, severed some arteries, and stripped the leg to the bone. Not all ranchers have lodged complaints against the Kalamazoo Guards, according to Combs; but where discontent exists, the Kalamazooos are being replaced with the old-style guards made of wooden slats. In other instances, the railroad guards are apparently being augmented by putting automotive guards on the approach roads that cross the railroad tracks. Warren Godfrey of Madison, Kansas, received a contract from the Union Pacific in the summer of 1980 to make nearly one hundred guards to be placed on roads crossing Union Pacific tracks in Wyoming and Colorado.

Godfrey figures in another contemporary story about railroad cattle guards. The need for railroad cattle guards in the present day can arise not only in the open range of Wyoming but also in the small-farm region of eastern Kansas. Around 1978 a spur was run from the Missouri Pacific near Westphalia to the construction site of the Wolf Creek Nuclear Power Plant near Burlington. This seven-mile spur, built by Kansas Gas and Electric Company (K G & E), angles through more than three dozen fence lines. Although the Missouri Pacific had used wooden-slat cattle guards in its Kansas operations during the teens, apparently no one who was connected with the Wolf Creek spur was aware that railroad cattle guards could still be purchased, for K G & E commissioned an original design. The utility company purportedly spent around forty thousand dollars building and installing these sheet-metal guards, and all for naught.

The guard itself offered no footing for livestock, and it was formidable in appearance, but animals could (and did) step between the sections of the guard at will. Proper installation required that the crossties be placed more closely together than usual and that no ballast be put between them, thus creating at least the semblance of a pit. Unfortunately these instructions did not reach Kansas, and the guard sections were simply placed on ties in their normal positions. The problem was solved only by scrapping the sheet-metal guards and replacing them with ones made of pipe, which Godfrey designed and built.

Paul Longrigg has developed an unusual way for railroads to use cattle guards. Longrigg, an electrical engineer, applied some of his expertise in radar and laser technology to the invention of an effective warning device to
be used at highway-railroad grade crossings. The result was a system that included, among many complicated and sophisticated mechanical devices, bar-grid cattle guards forty feet long embedded in the highway about 850 feet from the railroad tracks. The grid of the cattle guard serves as a tactile warning to drivers, much as a series of asphalt ridges is sometimes used to warn drivers that they are approaching a detour. Moreover, alternate bars of the grid are capable of automatic vertical displacement if a train is on the tracks or approaching the crossing when the car first hits the cattle guard. The result is an even rougher tactile warning to the driver. The cattle-guard part of the system is intended to be used on those crossings where auditory and visual warning devices would not be effective. Potential problems with the cattle guard include freezing weather or dirt and dust that could clog the actuating mechanisms.

J. G. Côté, a retired official of Canadian National Railways, provided an interesting account of what can happen when cattle evade a cattle guard and get onto the right of way. Usually an animal, when struck by a train, is killed at once and causes only limited damage to the engine (except in the case of derailment), but Côté was not in a regular train when this incident occurred.
The once that cattle did get away from a farmer's field, through a cattle guard, and onto the track happened on the Edmonton, Dunvegan & British Columbia Railway (now the Northern Alberta Railway) on which my father, in 1921, as Member of the (provincial) Legislature for Athabaska/Grouard, had rented or chartered a Packard inspection automobile on steel wheels (flanged) for use on that railway. He was to tour his constituency, and decided to take my mother and myself, a mere lad of 12 years. A derailment of the switch engine at Smith, Alberta, delayed us (the west switch was blocked) until 10 P.M. or so, and past midnight we hit a herd of cows on the track on a curve, as our headlights didn't show them up in time! We spent the next several hours until dawn trying (the conductor and driver and my father) to raise the wheels off the mooing cow under it. I had the trainman's lantern and with my mother went back to flag the following freight. When it came, the engine pulled the Packard off the cow with a chain; and we proceeded Westward.

More often than not, such accidents were fatal for livestock, but sometimes the cattle guards themselves could be equally dangerous. One of the most unusual cattle-guard fatalities I have learned of occurred in the 1930s on Wayne Rogler's ranch just north of Matfield Green, Kansas. The Santa Fe used the Sheffield Guard (a piece of sheet metal with three-inch triangular teeth punched out and pointing nearly straight up) on both sides of the private crossing between Rogler's ranch pens and a pasture on the west side of the tracks. While some cattle were being driven across, one especially wild cow ignored the jagged teeth of the guards and ran across a double section of them. A couple of the ranch hands opened a gate alongside the tracks and went in after her, but when she came out, she ignored the gate and again ran across the guard. Because the cow was hot and excited, Rogler cut her off into a side pen while sorting the rest of the herd. He said that she immediately went to a corner and lay down, and when he noticed her a few minutes later, she was lying on her side. When the hands had finished with the other cattle about twenty minutes later, they went to get the troublesome cow and found her on her back with her feet in the air, dead. Rogler thinks that the guard hurt her feet so much that she was trying to take all the pressure off them she could and that while she was on her back, her lungs must have collapsed. The heat and her nervous state may also have contributed to her death. Whatever the exact cause, it is the only instance that I am aware of where just running over a cattle guard caused an animal to die.

As noted earlier, many cattle guards are based on the principle that cattle are frightened by the prospect of insecure footing. Occasionally, however, a cow comes along that proves to be an exception to the rule. Dallas Perry of Kimball, Nebraska, tells the following story about a man named Shirl, a
clever cow, and the triangular-shaped wooden cattle guards used in Kimball near the turn of the century:

Shirl was town raised and remembered only the cattle guards at railroad crossings. Said his family had a cow that solved the problem of walking over them. Shirl thinks she went straight across, instead of at an angle, which might have helped a little. She would spread her feet out, and turn them enough to keep the clove of each hoof from slipping down on the upper edges of the triangular shaped timbers. It might have been fairly easy to so maneuver the front feet, but must have needed a heap of practice with the rear ones. Perhaps she watched humans sidle or "toes-out" their way across the three-sided planking. In any event that must have been one smart bovine; which may be the reason no iron horse ever caught up with her. I have to believe Shirl. He isn't the malarkey type of person.

A cow in eastern Kansas was equally adept at evading cattle guards, but once she had some trouble with a bridge trestle, James Kiser recalls. Kiser, who now lives in Chanute, Kansas, worked for the Katy for over fifty years before his retirement in 1960. One night in the 1920s he and a section crew were on a handcar heading north of Burlington when they hit a cow, and the handcar ran right up her back. The cow had gotten past a cattle guard and was crossing a bridge when she had slipped through the timbers and got stuck, her feet dangling through the ties of the trestle. Kiser and his men got the car off the cow, then took some poles and ties and pried her up a little at a time, blocking and getting a new hold, until she was raised up high enough to be able to get her feet on the ties. Kiser said she then hurried on across the bridge, never missing a tie: obviously it was not her first time to cross that bridge. A few weeks later, Kiser happened to be in town talking with the farmer who owned the cow. The farmer was mystified by what had seemed to be (and in fact were) cogwheel marks on the cow's back, but when Kiser told him about the bridge incident, the farmer refused to believe him.

Most of the material in this chapter has dealt with the use of cattle guards by railroads in the United States, with some reference to Canadian and British guards. I do not know to what extent railroad cattle guards are found in other parts of the world, although I have learned that they are found in countries as far apart and diverse as Argentina and India. In addition, I was fortunate enough to receive from B. Gallagher of the British Railways Board a survey history of the use of cattle guards on British railroads, with which this chapter will end.

According to terms of the 1845 Railways Clauses Consolidation Act, British Rails is required to keep all "cattle" (a term that includes all domestic farm animals) off the railway. In practical terms this means that nearly ten million dollars must be spent annually for fencing, crossing keepers (i.e., men
hired to open and close gates), automatic antitrespass gates (gates that raise and lower or swing open and shut automatically), and cattle guards. The typical cattle guard used on British railway lines is made of wooden arris bars (i.e., triangular-shaped slats, with the pointed side angled up at a slant) spaced about two inches or so apart. These slats are fixed on timbers and are spiked to the ties on either side of a crossing.

Since 1910, when many of the railways, particularly in southeastern England, were electrified on the conductor rail system, antitrespass guards have been used in conjunction with cattle guards, especially at busy crossings. Even in the middle of cities such as Canterbury, one finds such a system of dual protection, although cattle guards used within a city are aimed primarily at discouraging trespass by humans, not by animals.

Beginning in 1955, many crossing barriers that had formerly been controlled by hand were converted to lightweight automatic barriers. Ten years later the railroads were allowed to install automatic half-barriers (i.e., single arms that raise and lower, covering, as do most American barriers, only one lane of traffic). In 1979 further measures were taken to replace many of the antitrespass guards with automatic single-lane barrier arms. As a consequence, many of the British crossings that are not now equipped with cattle guards soon will be.

The British are currently experimenting with potential replacements for the wooden-slat railroad cattle guards. One alternative is a “Bomac concrete slab panel,” which wedges against the rails and can be lifted out more easily than wooden guards can be removed, thus enabling normal maintenance operations to be carried out more smoothly than is currently possible. Wooden guards are often damaged while being removed and then must be repaired or replaced, at not insignificant cost. Another alternative is a concrete guard
made in a honeycomb pattern, which can also be relatively easily lifted out and replaced.

In drawing conclusions from this survey of British use, it would seem that the railroad cattle guard, despite the late start it got in Britain, is now probably being used more widely there than in this country. Even here, however, the cattle guard will not disappear from railroad crossings for many years, if indeed it ever does.