The Fresno Scraper

Invented in 1883

A National Historic Mechanical Engineering Landmark

Designated By

The American Society of Mechanical Engineers

October 13, 1991

Fresno, California

Background

For centuries, the soil of the earth has been moved by mankind for agriculture and construction. In some underdeveloped countries, it is still moved in baskets, carried on the head, or hung from a pole slung across the shoulders.

The earliest use of draft animals to pull the Slip/Scoop, (Figure 1) is attributed to Flemish Husbandry. The single handle was later replaced by two handles for better lateral control of scraping, sliding and dumping the load into a pile.

In the middle of the 1800's the Buckboard was developed in the Western United States. Essentially, it was a board which was horse drawn in an upright position to scrape and push the soil from a high spot into the low spots, smoothing and leveling the ground. The Buckboard was provided with a tail board upon which the driver stood until ready to dump the soil. Slip/Scoops and Buckboards were often used in combination to smooth and level piles of earth dumped by the Slip/Scoops. This was particularly true in the earliest agricultural development of the San Joaquin and Sacramento Valleys of California.

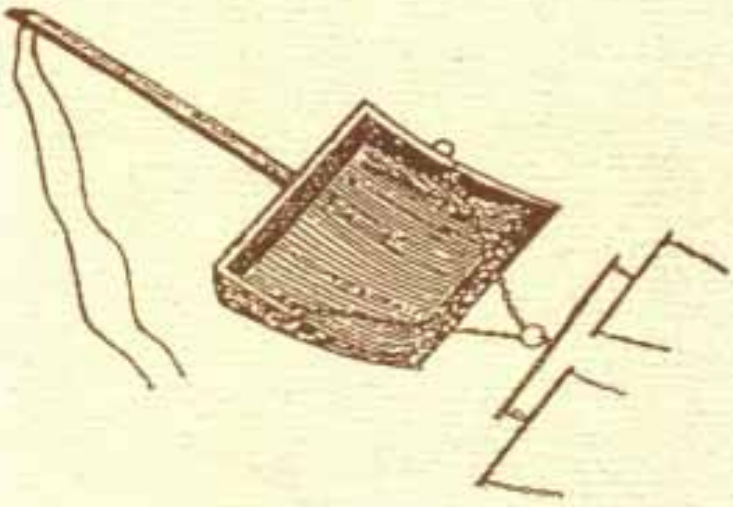


Figure 1 Slip/Scoop

Evolution

The history of the Fresno Scraper starts with James Porteous, born in Scotland in 1848. His father, William Porteous, was a wheelwright and blacksmith who built and repaired carriages, wagons and farm equipment. After learning his basic skills, James Porteous headed for Santa Barbara, California, in the company of friends. In 1877, he came to Fresno, (Photo 1) and established a wagon shop in the downtown area. He prospered, manufacturing buggies and heavy wagons.

Photo 1 James Porteous
(1848 – 1922)

Working with Fresno farmers, Porteous recognized the valley's dependence on irrigation. This necessitated more efficient means of constructing canals, ditches, borders, furrows, stock ponds, etc. In his efforts to better current methods used, James Porteous became an inventor, an entrepreneur and a manufacturer.

Porteous' first invention was to improve the Buckboard by overcoming major problems: (a) the tail board, rigidly secured to the Buckboard, would swing up into the air to dump the load, and (b) the pushing of the load against soil required considerable power. Porteous' answer to these problems was his first Buck Scraper, U.S. Patent 261, 759 issued July 25, 1882, (Figure 2).

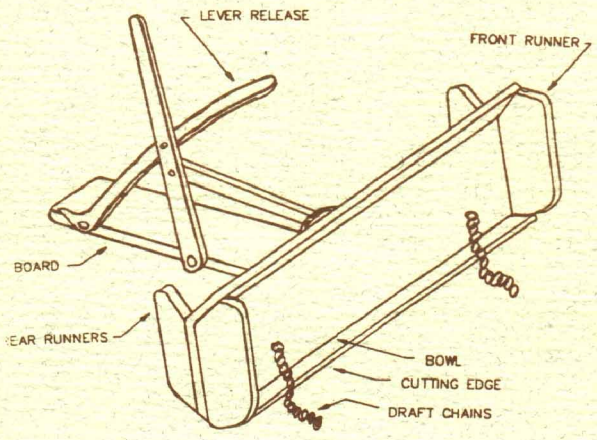


FIGURE 2 BUCK SCRAPER
PORTEOUS' FIRST PATENT

In this first invention, the tail board is hinged to the Buck Scraper. When the lever is moved to the rear, the soil pushed by the board is carried on the rear runners. When the lever is moved forward, the load is dumped so the front runners act as a gauge to grade the soil to a fixed depth. The disadvantages were: (a) much of the pushed soil fell off while tilting the board to the horizontal, and (b) the depth of grading was fixed.

Porteous' second invention was his Dirt Scraper, U.S. Patent 275, 075 issued April 3, 1883, (Figure 3).

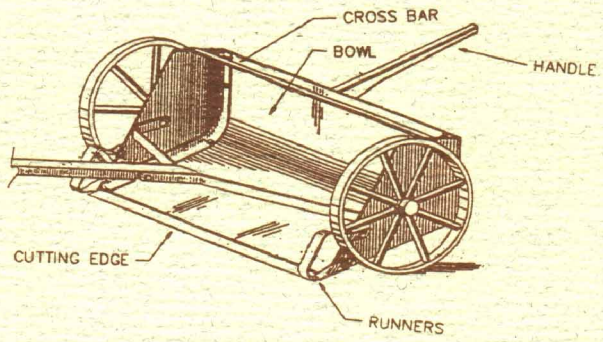


FIGURE 3 DIRT SCRAPER
PORTEOUS' SECOND PATENT

This second Porteous patent relates to "means for limiting the rotation of the scraper bowl to dump the load to a controlled depth" when the handle is pushed up. The cross bar may be adjusted forward or back on the bowl side plates to vary the limit position of the bowl as it strikes the tongue. The side runners or shoes raise the cutting edge above the ground. The three principal problems with this invention were: (a) the high rolling resistance of the iron wheels in the soft or sandy soils, (b) the tendency of the scraper to overrun the horses on firm down slopes, and (c) the short runners sinking into soft or sandy soils.

William Deidrick of Selma, California, was awarded U.S. Patent 275, 893 issued April 17, 1883, (Figure 4), to overcome the problems of Porteous' second invention.

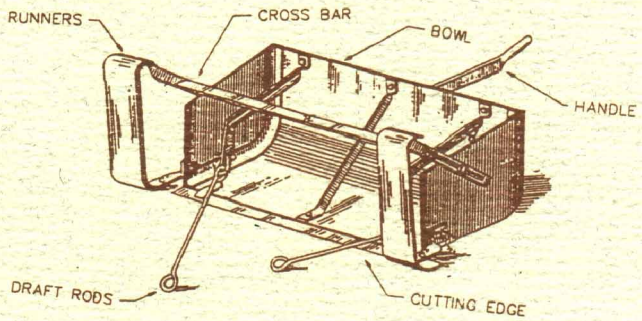


FIGURE 4 DIRT SCRAPER
DEIDRICK PATENT

Deidrick eliminated the wheels by utilizing long, flat, adjustable runners while retaining the bowl, handle and cross bar of Porteous' second patent. Whenever the cross bar position is changed, however, the runners need to be adjusted so that they run flat on the ground, otherwise they would drag on the front or rear tip ends. This adjustment required lifting the bowl up into the desired dump position and using wrenches to adjust both the cross bar and the runners. Nevertheless, the long runners were an important step in the evolution of the Fresno Scraper.

Meanwhile, Porteous made his third invention, U.S. Patent 289,134 issued November 27, 1883, (Figure 5).

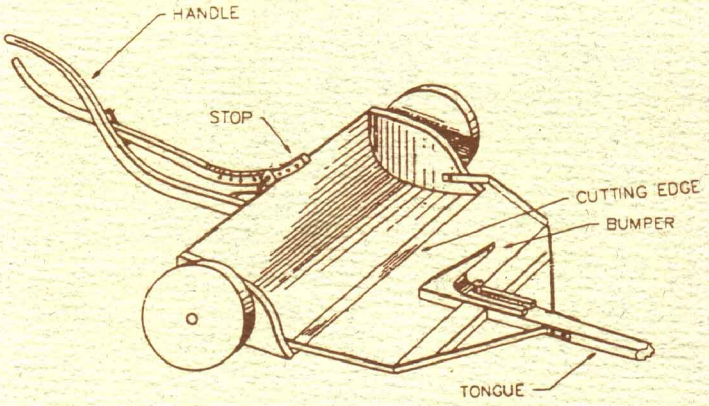


FIGURE 5 DIRT SCRAPER
PORTEOUS' THIRD PATENT

In this third patent, Porteous retained the general features of his second scraper, but substituted the cross bar with a more complicated means on the handle and tongue to adjust the thickness of the dump.

Another approach to an adjustable means to vary the dump and use of curved runners was invented by Frank Dusy and Abijab McCall, also of Selma, California, U.S. Patent 320,055 issued June 16, 1885, (Figure 6).

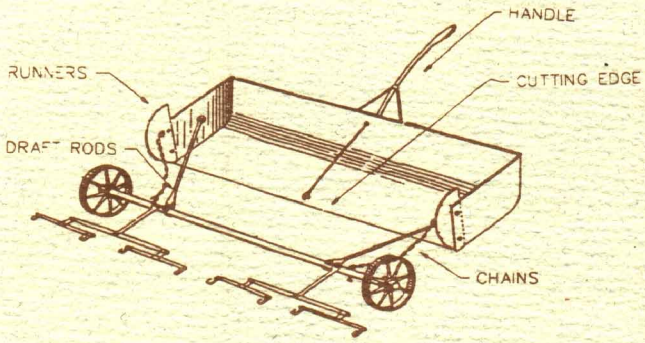


FIGURE 6 DIRT SCRAPER
DUSY AND MCCALL PATENT

Dusy and McCall used chains to control and adjust the dump by selecting the desired link to connect to hooks on each end of the draft axle. The circular arc runners to gauge the dump depth, while good in principle, were ineffective due to being so narrow as to slice through the soft, sandy soils.

James Porteous bought the rights to the Deidrick patent by assignment dated January 31,1889, and the Dusy and McCall patent by assignment, dated February 7, 1896. Using some of the features of these patents, along with his own ideas, Porteous perfected the scraper which became known as the "Fresno Scraper" (Figure 7), and commonly known as a "Fresno."

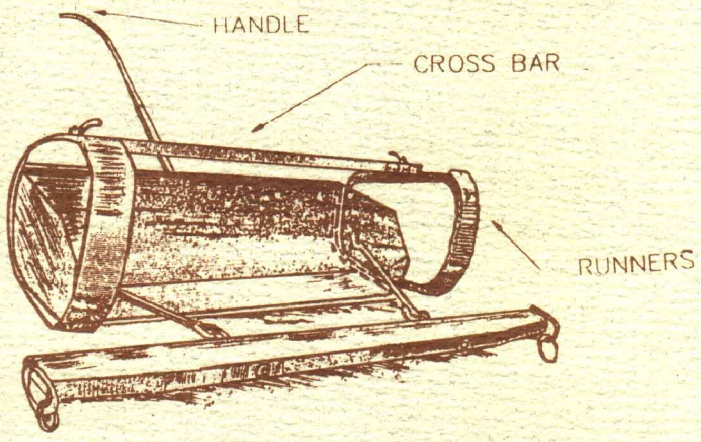


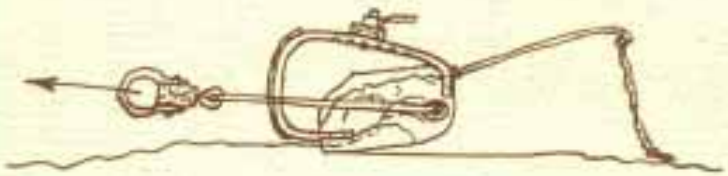
FIGURE 7 FRESNO SCRAPER
MANUFACTURED BY FRESNO
AGRICULTURAL WORKS

The front cover photograph shows a "Fresno" constructing a canal with a four horse team and one man.

The three modes of operation of the Fresno Scraper are illustrated by Figure 8.

FRESNO SCRAPER

(a) Scraping to Load Bowl



(b) Sliding Load

(c) Dumping Load and Grading to Desired Thickness

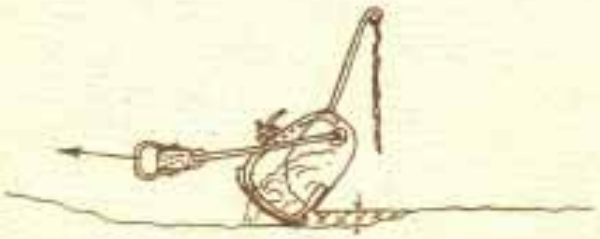


FIGURE 8 FRESNO SCRAPER

MODES OF OPERATION

During the scraping mode, (a) the operator raises the handle slightly to engage the cutting edge and scrape a load of soil into the bowl. In the (b) mode, the operator depresses the handle slightly to raise the cutting edge above the ground, thus allowing the bowl to slide on its bottom. In the (c) mode, the operator raises the handle so that the cutting edge engages the ground causing the bowl to rotate forward until the cross bar contacts the draft rods. This discharges the load and grades it to the desired thickness. The cross bar position is adjusted by loosening the single wing nuts on the "J" bolts and then tightening the "J" bolts locked in the selected notch on the runner support. After returning empty to the cut, the operator pulls on the rope to return the scraper to the scraping position.

Fresno Scrapers were manufactured at Porteous' Fresno Agricultural Works in Fresno, built in the middle 1880's, (Photo 2).

PHOTO 2 FRESNO AGRICULTURAL WORKS IN THE 1880'S

"Fresnos" were sold throughout the West and when their reputation for efficiency, reliability and ease of operation was established, they were shipped to practically every state as well as South America, India, The Orient, South Africa, Australia and Europe. The "Fresno" played a vital role in the construction of the Panama Canal.

Excerpts of 1888-89 sales literature for two types of service are shown in Figure 9, giving sizes and prices.

FRESNO
LEVELING and DITCHING
SCRAPER

This Scraper is made more expressly for ranch work, and is the best Scraper on earth for leveling or ditching, the result of seven years experience in the center of irrigation. It will scatter, the dirt in layers from one to twelve inches deep, and will follow up any bank the horses can climb without losing any dirt, and is so thoroughly balanced that a boy can work it. It is made mostly of boiler iron, with solid steel bottom, all parts interchangeable. It is so well proportioned and strong that it will stop any team attached to it without breaking.

Price, 4-horse $37.00
" 2 or 3 horse $32.00
" 2-horse $28.00

FIGURE 9, FIRST AD FOR SCRAPER

Historical Significance

The Fresno Scraper transformed the back-breaking labor of land leveling, ditch digging and road and railroad building. It helped to change the way that earth could be scraped, moved, dumped and leveled. The "Fresno" and its variants made possible the early-day irrigation canals, ditches and level fields in the Central Valley of California, as well as the construction of dams, roads and railroad right-of-ways. It indeed was the forerunner and provided the basis for the development of the modern day earth-moving scraper.

Present day scrapers are built to scrape up to 30 cubic yards and to carry such loads at speeds up to 30 mph.

The advent of the tractor in the 1910-20's, displaced the horses and mules, and provided mechanical and hydraulic control means to aid the operator. Laser beam controlled scrapers have also reduced surveying and operator skill requirements for land leveling for agricultural and construction.

The wording of the landmark plaque follows:

A National Historic Mechanical Engineering Landmark

THE FRESNO SCRAPER

1883

The Fresno Scraper established the basis for the modern earthmoving scraper, being able to scrape and move a load of soil, then discharge it at a controlled depth.

James Porteous, inventor-entrepreneur, founded the Fresno Agricultural Works. The Fresno Scraper evolved from his patents and those he acquired from W. Deidrick, F. Dusy, and A. McCall.

Between 1884 and the advent of tractor-drawn scrapers in the 1910's, thousands of "Fresnos" were used in agriculture for canals, ditches, and land leveling; in road and railroad grading; and in general construction not only in California, but throughout the U.S., and in many foreign countries, and on the Panama Canal.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

1991

THE ASME HISTORY AND HERITAGE RECOGNITION PROGRAM

The ASME History and Heritage Recognition Program began in 1971 as part of the Society's effort to note, document and acknowledge mechanical engineering achievements of particular significance.

The National History and Heritage Committee includes mechanical engineers, historians of technology and the immediate past curator of Mechanical and Civil Engineering of The Smithsonian Institution.

An ASME Landmark represents a step in the evolution of mechanical engineering and reflects its influence on society, here and abroad. This landmark is one of many throughout the world that are part of our engineering technical heritage.

The Fresno Scraper is the 10lst National Landmark to be designated by ASME. In addition, 34 international, and 12 regional Historic Mechanical Engineering Landmarks, three collections and five heritage sites have been recognized.

This History and Heritage Committee is part of the ASME Coucil on Public Affairs and Board on Public Information. For more information contact the Public Information Department, American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017, phone 212-705-7740.

OWNER OF THIS LANDMARK

California Agricultural Museum
1121 S. Chance Avenue
Fresno, CA 93744
Alvin Quist, President and Director
Allan Clark, Vice President

DONATED BY

John and Keri
Bourzac
8271 N. Marion
Clovis, CA 93612

ACKNOWLEDGEMENTS

The ASME Santa Clara Valley Section and the Fresno-Madera Group gratefully acknowledge the efforts of all who cooperated for the designation of the Fresno Scraper; particularly the Fresno City and County Historical Society, the California Agricultural Museum, Kearney Mansion, California State University-Fresno Mechanical and Industrial Engineering Department, FMS Manufacturing Company, and James Porteous Jr. The front cover photograph is courtesy of San Joaquin County Historical Museum. The inner photographs are courtesy of The Fresno Historical Society Archives.

REFERENCES

Fresno County Historical Society, "James Porteous – Fresno's Forgotten Inventor," Winter 1981, by Maria Ortiz.

Western Construction Magazine, "How the Scraper Began," August 1963.

Valley Magazine, "The Story of James Porteous," August 1981, by Maria Ortiz.

Tools of the Earthmover, pages 77 – 80, by J.S. Allhands, Sam Houston College Press, 1951.