A History of
R.G. LeTourneau's Earliest Scrapers:
Culminating in the 1922 Mountain Mover[1]

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Commemorating
the November 29, 2004,
Designation by the A.S.M.E.
of R.G. LeTourneau's Mountain Mover
at LeTourneau University, Longview, TX
as a Historic Mechanical Engineering Landmark

November 29, 2004

A PERSONAL INTRODUCTION

The present author's interest in R.G. LeTourneau is long-standing. My father, George Niemelä, Sr., was a mechanic, welder, heavy-equipment operator, and businessman. When the author was a boy, Dad worked for R.G.'s brothers-in-law (Howard and Buster Peterson) at Peterson Tractor, a Caterpillar dealership based in San Leandro, CA. He was a machinist/welder in the first crew of Peterson's Roller Exchange Shop.[2] In 1961 Dad opened an equipment rental yard in Stockton, CA. A Montgomery-Ward warehouse two blocks away once was R.G.'s second factory (built in 1930, expanded in 1934). Dad heard R.G. speak at San Francisco's Cow Palace and met him. A few months later Dad believed Christ's free offer of eternal life to him.

Dad and I enjoyed all aspects of heavy equipment together: operating, repairing, designing, improving, and considering the history of construction equipment. Despite knowing LeTourneau's contribution to equipment, "religious" books like *Mover of Men and Mountains* were at the bottom of my list. Finally, in the summer of 1972 I read it and reread it. The autobiography convinced me that R.G. enjoyed life—not in spite of being a Christian—but because Christ's free gift of eternal life to every believer can be a real motivation for a life of gratitude. As R.G. often said, "I am just a mechanic whom the Lord blessed." The Lord blessed him with eternal life and a purpose in life. R.G.'s book sparked in me a new interest in the Bible.

In October 1972, I believed Christ's free offer of eternal life. "Most Assuredly, I [Jesus] say to you, 'He who believes in Me has everlasting life.'" (John 6:47).[3] My life's work (Professor of New Testament Literature and Exegesis at Chafer Theological Seminary, Orange, CA) combines two passions, researching original-language texts of the Bible and explaining what texts mean.

Despite no longer moving dirt, fond memories remain of growing up on the seat of a tractor in the land where R.G. changed earthmoving. Several personal interests come together here, so this research project has been a hobby that has continued for over thirty years.

AN OVERVIEW OF THIS PAPER

The author plans to write a history of LeTourneau's California years (up to the 1948 sale of the Stockton factory). The present paper considers R.G.'s entry into a new field: designing tractor-drawn scrapers. The field itself was new, because the first scraper that required a tractor (not horses) only preceded the Mountain Mover by seven years. R.G. was not tradition-bound, so even his first machines were radical departures from all others. His early machines constitute an important chapter in any history of LeTourneau's California years (or of his entire career).

We both have a great debt to R.G. himself. In addition, his family and the University have been most helpful. We also wish to express appreciation to everyone cited in the bibliography. We are indebted to those whose writings preceded our own. Despite devoting more than thirty years to researching this topic, it is certain that others (some of whom have never gone into print) may have insights or possess evidence which may adjust some of our conclusions. We believe in open scholarship. Hence, endnotes document the evidence leading us to our positions. Thus, we welcome comments and corrections as a means of refining our thought.

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SIGNIFICANT DATES FOR LETOURNEAU'S MOUNTAIN MOVER

Timeline

1888 (November 30): Robert Gilmour LeTourneau born in Richland, Vermont.

1919 (early summer): R.G.'s first experience operating a Holt 75 with a Holt leveler.

1920: Two-man Holt 75 with Schmeiser drag scraper converted to one-man electric control.

1921: Two-man Holt 75 with Holt leveler converted to one-man electric control.

1921 (not before May): One-man electric controlled full-drag scraper built at Moss Avenue.

1922 (Spring): The Gondola, the first large semi-drag scraper controlled from tractor, built.

1922 (Late June): The Mountain Mover, a telescoping-bowl scraper, built.

1922 (July 13): Application (for patent 1,512,614) reached the U.S. Patent Office.

1922 (July 15): Stockton newspaper's photograph of Gondola building racetrack.

1922 (September 27): Application (for patent 1,470,853) reached the U.S. Patent Office.

1923 (October 16): Patent 1,470,853 granted, "Scraper [with telescoping bowl]."

1924 (October 21): Patent 1,512,614 granted, "Scraper and Spreader."

1922–26: Eph Hahn operated the Mountain-Mover for R.G.

1926: Andrew Maestretti bought Mountain Mover and quickly sold it to Eph Hahn.

(1922–44): Disc wheels replaced Mountain Mover's spoked front-wheels.

1943: Eph Hahn sold the Mountain Mover to his brother, Clarence.

1944: Clarence Hahn interview and current pictures of Mountain Mover appeared in *NOW*.

(1944–60): Height of the Mountain Mover lowered to enable transport under low bridges.

(1944–60): Telescopic feature disabled (due to D8's power), possibly when height reduced.

(1944–60): Hitch converted to gooseneck style for improving maneuverability.

(1944–60): Provision for removable transport dolly attached to Mountain Mover.

Early 1950s: Eph Hahn's son, Harold, bought the Mountain Mover, when Clarence retired.

Latter 1950s: Harold Hahn entered plumbing, basically idling the Mountain Mover.

1959–60: Mountain Mover photographed for *NOW* and *Mover of Men and Mountains*.

1967: R.G. and Harold Hahn photographed with Mountain Mover near Manteca, CA.

1969 (June 1): Robert Gilmour LeTourneau died in Longview, Texas.

1974 (September): Mountain Mover dismantled and transported to Longview.[4]*

1974–75: The Mountain Mover restored at LeTourneau University's ATP Building.[5]*

1975 (or early 1976): Mountain Mover placed in front of the Margaret Estes Library.[6]*

1989 (November 30): Mountain Mover placed in new R.G. LeTourneau Memorial Park.[7]*

2004 (November 29): Mountain Mover named a Historic Mechanical Engineering Landmark by the American Society of Mechanical Engineers.

Chronological Summary

The Date When the Mountain Mover was Built? R.G. fabricated it in late June of 1922. He drew up blueprints after (not before) building it.[8] Thus, the patent drawings came about after it was completed. Additional time is needed for the attorney to draft the application and for it to reach Washington DC on July 13th. A late June completion is reasonable.

Subsequent History of the Mountain Mover. Eph Hahn operated it for R.G. from 1922 to 1926, when he purchased the Mountain Mover.[9] Eph sold it to his brother Clarence (another former LeTourneau employee) in 1943.[10] At some point before the 1944 *NOW* article, disc wheels replaced the original spoked front-wheels.[11]* By then seven tractors had pulled the Mountain Mover.[12] The seventh, a Caterpillar D8, had tremendous power, so the owners disabled the (now unnecessary) bucket-telescoping mechanism.[13] Sometime between 1944 and 1960, the Hahn family lowered its overall height (allowing transport under low bridges).[14]* They also added a gooseneck hitch[15]* and a removable transport-dolly.[16]* Eph's son Harold bought the scraper around 1955 from his uncle Clarence.[17] Though basically idle in 1960,[18]* it occasionally moved dirt as late as 1967.[19] In September 1974, it was dismantled and trucked to LeTourneau University.[20] ATP Inc. started restoring it that year, apparently finishing in late 1975.[21] From 1976–89 the Mountain Mover was displayed in front of LeTourneau University's Margaret Estes Library. On R.G.'s 101st birthday (November 30, 1989), it reached its final resting spot, near the graves of Robert Gilmour and Evelyn LeTourneau. Finally, on November 29, 2004, the eve of R.G.'s 116th birthday, the American Society of Mechanical Engineers designated the Mountain Mover a Historic Mechanical Engineering Landmark.

BACKGROUND INFORMATION

R.G.'s 1928 cable-controlled scraper marks the beginning of R.G.'s twenty-five year use of cable control, an era of increased standardization of LeTourneau scrapers. Pre-1928 machines display much higher levels of experimentation. LeTourneau University owns two pre-1928 models (the 1922 Mountain Mover and a 1927 Gondola). Researchers have no trouble identifying the Mountain Mover correctly, but many treat the 1927 Gondola as if it were the 1922 Gondola. R.G. died five years before these scrapers reached Longview. Lacking his official pronouncement, posterity plays guessing games in identifying the 1927 Gondola. This paper seeks to clarify the relationship between the University's two California-built scrapers.

The year 1919 marks R.G.'s first encounter with scrapers. Interestingly, the same principles that guided LeTourneau in designing scrapers from the very start were the basis of an engineers' 1957 article on scraper theory: "What Contractors Need to Know on Economics of Scraper Design and Load."[22] Economical earthmoving requires cutting cycle-times and increasing payload. Long cycle-times combined with small payloads seemed wasteful to R.G.

R.G. and the Holt Leveler

LeTourneau's first scraper experience was with a Abraham Grunauer's Holt 75 crawler pulling a Holt leveler in 1919.[23] Such wheel-supported[24]* full-drag[25]* scrapers were then common in the Central Valley. One man operated the tractor and another ran the scraper, because conventional wisdom denied that one man could control both.[26] Holt Manufacturing

Company of Stockton, CA, designed both tractor and leveler as a matched-team. Such scrapers were small in relation to the tractor, but the heavy friction loads of a full-drag design kept his 23,000-pound Holt 75 from dragging more than three cubic yards (only 6,000 pounds payload).[27]

R.G.'s Electrified Schmeiser and Holt Scrapers

Few realize that R.G. electrified two scrapers (not just one) built by others: a Schmeiser (in 1920) and a Holt (in 1921). *Mover of Men and Mountains* (1960) mentions steps 1–2, and 5, but implies steps 3–4. He [1] rented a Schmeiser scraper, [2] electrified the Schmeiser, [3] rented a Holt scraper, [4] electrified the Holt, and finally [5] returned the electrified Holt scraper.

> [1] Ira Guy had an old *Schmeiser scraper* for rent [early 1920], and would let me pay off the rent in repair jobs for him [italics mine].[28]
>
> [2] Two weeks later [still in 1920, after he thought of electrifying the rented Schmeiser scraper], working nights with scant time out for eating or sleeping, I had the tractor rigged to generate electric power, and the scraper rigged to use it.[29]
>
> [5] . . . a big landleveling contract at Bellota came through [Spring 1922]. At once I hurried over to the Guy brothers to *rent the Holt scraper I had returned* while pulling stumps [winter 1921–22]. To my dismay, they had already leased it to Buck Maistretti [Andrew Maestretti], one of my competitors. Worse, Buck had gone off with my electrical system still attached to the scraper [italics mine].[30]

Some readers might dismiss the apparent discrepancy as a minor memory lapse as he wrote forty years later. Not so, a 1945 article reconciles the seeming difficulty:

> R.G.'s first effort to improve earthmoving tools was the installation of an electric motor on a Schmeizner [*sic*, should be Schmeiser] drag scraper in July '20.[31] [*] Next year [1921] he put an electric motor on a Holt scraper. In '22 he built a conventional drag scraper with a single electric motor to raise and lower the bowl as on a bulldozer.[32]

As background, compressed-air[33]* controlled the cutting edge on Schmeiser Giant[34]* scrapers, but each Holt scraper used ground-wheel drive in conjunction with a hand-wheel to move the blade.[35] (Holt did not use compressed-air control). This confines R.G.'s accounts of electrifying an air-powered Schmeiser to 1920. He converted a Holt leveler a year later.

R.G. already had a two-scraper operation when he modified the Schmeiser, "We were leveling land for irrigation and it soon became apparent that one man was doing a better job [than the two-man scraper screw], and before long I had the boys quarreling over which one would get to run the one-man outfit."[36] It is true that R.G. first mentions buying a second tractor in 1923. Even so, he may have already rented a second tractor and scraper. This offers an insight: Good cash-flow required busy tractors, but no one-man show could set grade-stakes, level land for fourteen-hour shifts, do repairs, design machines, build them, and bid on new jobs. R.G.'s brothers-in-law and Eph Hahn did much of the daily work, but how could one tractor generate sufficient revenue for wages, repairs, and buying steel for building new machines? A second rented tractor gave R.G. time and money to build new equipment.

In January 1920, he had purchased a well-worn 1915 Holt 75 and rented a Schmeiser scraper, "Then a contractor with new equipment dumped an old 1915 Holt tractor on the market cheap, and the $600 went for a down payment. Ira Guy had an old Schmeiser scraper for rent, and would let me pay off the rent in repair jobs for him."[37]* R.G. charged an hourly rate for

various kinds of tractor work, including land leveling. Working each tractor fourteen hours per day would help cash-flow. Unfortunately, ranchers provided scraper-operators only for ten-hour shifts,[38] precluding fourteen-hour days—dawn to dusk.

Eliminating the scraper operator would break the one-shift-per-day barrier. In 1920 R.G. electrified the Schmeiser scraper during two weeks of night work.[39] Meanwhile, it still moved dirt on the day-shift (as a two-man machine). This preserved cash-flow, ". . . to be sure no loss of time would be caused by my new contraption—for dollars were scarce and loomed big in those days—I let the regular operator continue to control the scraper by compressed air during his shift."[40] When electrified, it leveled land from dawn to dusk.[41] He left the air controls intact during conversion, "The air cylinder and the [electric] motor were interchangeable, and after his operator had put in a day's work with the former, he [R.G.] would switch over and put in his own time to test the efficiency of his new gear."[42]

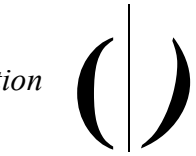
Unexpectedly, one tractor-and-scraper operator improved both quantities of dirt moved per hour and quality of leveling. Two reasons exist. First, a compressible medium (air power) no longer controlled the blade, so the cutting edge did not drift from its original setting.

> I'm not bragging when I say the results were astonishing, because I was among those most astonished. I have mentioned that when compressed air pushed the blade into the ground, the blade bounced when it encountered a resistance greater than its air pressure. I had accepted the uneven surface left behind as the normal behavior pattern of scrapers. But my rack and pinion gears just didn't have any bounce built into them. Whatever the blade hit, it cut through.[43]

Second, the tractor-operator did not need to second-guess the scraper-man's strategy or vice versa: ". . . one man could do a better job alone than two men because often one [on the tractor] would be planning to do it one way and the other [on the scraper] would be planning a different way." R.G. also says, "Synchronizing two minds was difficult, especially where they could communicate only by signs. In land leveling one has to see the humps and cut them off, see the hollows and fill them in, and for that one head is better than two."[44] R.G. could not persuade that rancher (probably: Roy Pike, El Solyo Ranch, Vernalis, CA)[45] to change the contract, giving half the scraper-operator's wages to him as a bonus.[46] However, other ranchers gladly paid a premium hourly rate, because he required fewer hours to complete the work.[47] Business seems to have gone well, because he also electrified another scraper (a Holt) the next year (1921).

LeTourneau's Full-Drag Scraper

One day, R.G. stopped modifying other people's scrapers. After his contract for Carlton Case ended, R.G. bought property at 122 Moss Avenue in May 1921.[48] A new contract at Bellota required another scraper,[49] but someone else had already rented the electrified Holt from the Guy Brothers.[50] He could not find one, so R.G. and his brother-in-law, Ray Peterson, built their own "full-drag" scraper in May or June.[51]* Brazing (acetylene welding), rather than riveting, cut deadweight and increased payload.[52] Tipping the blade transferred some payload onto the wheels, which also increased payload.[53]*

Traditional Vertical Blade Orientation  *R.G.'s Tipped Blade*

The Original Gondola (semi-drag)

Gondola is a term that raises controversy.

1. Two distinct designs (1922 and 1927) received the designation *Gondola*.
2. The *original* 1922 Gondola no longer exists.
3. The 1922 Gondola was built before mid-June 1922, not during July (as R.G. asserts).

These assertions differ with conventional wisdom. Therefore, this paper documents these points heavily. In the interest of accuracy, the author gave an earlier draft of this paper to:

1. three of R.G.'s sons: Richard, Roy, and Ben LeTourneau,
2. Dale Hardy of the R.G. LeTourneau Heritage Center,
3. Harold Hahn, who arranged for LeTourneau University to receive both his Mountain Mover and Andrew Maestretti's 1927 Gondola, and
4. Eric Orlemann, author of *LeTourneau Earthmovers*.

The author has also spoken with them afterwards concerning his perspective on the 1927 Gondola. They have not objected to his conclusions. The author accepts final responsibility for any errors that might remain. Some pertinent passages in *Mover of Men and Mountains* are subject to alternate interpretations.[54]

The Supposition that Only One Gondola ever Existed.

Many believe that R.G.'s 1922 Gondola was his only Gondola. This view derives from the fact that the same man who donated a Gondola about fifty years later to LeTourneau University is the one who bought the 1922 Gondola a few years after it was built.

> Buck Maistretti [Andrew Maestretti] came around [1924–25]. He had had so much success with my electrical system on the tractor and scraper he had rented from the Guy brothers that now he wanted to buy his own equipment. . . . He wanted the Gondola, already work-tested. I snapped him up so quick I forgot to ask if he had any money.[55]

This same Andrew Maestretti donated a "Gondola" to LeTourneau University in 1974, before dying in 1975.[56] If only one Gondola ever existed, the issue would be much simpler. This supposition underlies the common view that Maestretti only bought one LeTourneau designed *Gondola*.[57] On the surface, the assumption seems safe, since few have heard of a Gondola scraper other than the one that LeTourneau built in 1922. For example, note the following statement which assumes that the machine at LeTourneau University is the 1922 Gondola,

> Shortage of equipment in 1922 led R.G. LeTourneau to start building scrapers for his own use. After experimenting with a drag scraper, he built a pull-type on wheels with 6-yard capacity. Known as the "Gondola," it was significant. . . .
>
> The Gondola is preserved and is on display at LeTourneau University in Longview, Texas.[58]

Another author shows a picture of the 1922 Gondola. His 1974 book speaks LeTourneau possessing a seventy-four year old Gondola [1996 – 74 = 1922]. Legion are those who equate the 1927 Gondola at LeTourneau University with R.G.'s original 1922 Gondola.

> Long since retired and not easily recognized due to numerous re-builds, the Gondola is on display at LeTourneau University in Longview, Texas. The original lattice type frame has been replaced by a stronger draft frame and solid steel wheels have been fitted at some time during the machine's 74 years in existence [written in 1996].[59][*]

The above citation observes that the 1922 picture does not resemble the scraper now at LeTourneau University.[60]* If alleged rebuilding rendered the machine unrecognizable, very little remains of LeTourneau's engineering. What a shame that would be!

Fortunately, that is not the case. The University's Gondola actually does embody LeTourneau's ideas, because it is a 1927 LeTourneau design. Quite frankly, it is more satisfying to see a later LeTourneau Gondola evidencing his handiwork than to see a 1922 machine that suffered at the hands of a later repairman who supposedly undid all of R.G.'s design work.

Establishing that Maestretti Also Purchased a 1927 Gondola.

In February 1927, R.G. entered a six-month employment contract with Henry Kaiser and sold his patents and factory equipment to him.[61] In March, he built a factory at Kaiser's Livermore, CA, location to make tracked-telescopic scrapers.[62] After the contract ended, R.G. restarted his own company. One journal reported in October 1928, "R. G. LeTourneau, of Stockton, is now putting some husky equipment for caterpillars[©] on the market. Mr. LeTourneau completed his contract with the Kaiser Paving Company a year ago and has been back at the Stockton plant for the past year developing a line of heavy grading machinery."[63]* R.G. still subcontracted for Kaiser and they remained friends.[64] Selling his early patents to Kaiser yielded working capital, so he started bidding for larger contracts. As a result, R.G. needed a greater variety of machines and more of them. Both the construction and manufacturing ends of his business grew. In the mid-1930s (after Kaiser ceased building equipment), R.G. bought back the patents and re-introduced telescopic scrapers.[65]*

Meanwhile, a 1927 Kaiser job near San Francisco required a new scraper. It needed (1) to load in shorter loading-distance the telescopics and (2) to have wheels that tracked within the scraper's cut.[66] A June 1927 article hints at the new machine, "Practically all dirt moved was handled by the Kaiser-LeTourneau earth movers [at Colma, CA]. Only one of the electric earth movers remains, and it is expected *a new type* will be tried out there in the near future [emphasis mine]."[67] The new machine was LeTourneau's first non-telescopic design since the 1922 Gondola. Appropriately, this non-telescopic machine received its forebear's name: "The second unit [produced by Kaiser] is termed *the 'Gondola' earth mover*. This is a type of Fresno, non-telescoping, but capable of lifting eight tons of earth and delivering same. . . . [emphasis mine]").[68] Another 1927 journal mentions a Kaiser-LeTourneau Gondola, a LeTourneau-designed machine built in Kaiser's factory, "Additional equipment is being prepared to ship to the job and the contract will soon be well under way with three Kaiser-LeTourneau earth movers, one Kaiser-LeTourneau electric blade, one Kaiser-LeTourneau electric scarifier, and one *Kaiser-LeTourneau gondola* [emphasis mine]."[69] The 1927 Gondola (containing no ideas covered by patents sold to Kaiser). Thus, after leaving Kaiser's employ, the LeTourneau-designed 1927 Gondola served as R.G.'s starting point for his improved 1928 cable-controlled scraper.[70]*

The preceding establishes that two LeTourneau-designed models were designated *Gondola*. Did Andrew Maestretti ever buy a 1927 Gondola? Yes, Kaiser Paving Company sold a "Gondolo Scraper" (e.g., Gondola) to Andrew Maestretti on October 29, 1929.[71]

Western Construction News shows Maestretti's "LeTourneau" Gondola (built in Kaiser's factory) working in 1930.[72]* That picture bears an uncanny resemblance to the machine at LeTourneau University. Close examination of the machine in Longview shows signs of post-manufacture enlargement and slight alternation. Tractor-size increased dramatically in the 1930s, so contractors enlarged their older scrapers. The scraper that Andrew Maestretti donated to LeTourneau University was one of his (slightly enlarged) 1927 Gondola scrapers,[73] not the 1922 Gondola. The 1922 and 1927 versions are quite distinct.

This is a sufficient case for dating the Gondola in 1927, but not the whole picture. Not only did R.G. design more than one Gondola, but the 1922 Gondola no longer exists. If so, the 1922 Gondola could not be at LeTourneau University. Before going into evidence that the 1922 machine no longer exists, please note what this would imply: The Mountain Mover (not the Gondola) would be the oldest surviving LeTourneau scraper.

Evidence that the 1922 Gondola No Longer Exists.

Five lines of evidence lead to this conclusion. The first line is suggestive, but the others are more definitive.

First. R.G. said something about the Mountain Mover in 1959 to prove that the Gondola was a good design. The form of his argument suggests that the Gondola no longer existed.

> When the prototype of the now famous Carryall was nearly completed [the Gondola], a man I knew [Damon Throop] who was building the best drag scraper then came along and looked my new machine over and said, '"If it were different, I would say more power to you, but I built one just like it and I know it won't work." I might say that very scraper [the Gondola] moved hundreds of thousands of yards of dirt, probably millions, with only one man driving the tractor and operating the scraper. In fact, the next one I built a few months later [the Mountain Mover] is still in existence and has the original electric motors still on it in running shape.[74]

Why would he say, in effect, "The proof that the Gondola was a good design is that the Mountain Mover is still in operable condition?" The problem is that the success of the Mountain Mover (Experiment $x + 1$) does not prove that the Gondola (Experiment $x + 0$) was a success. Why would R.G. use the thirty-seven-year existence of the Mountain Mover as proof that the Gondola was a good machine? Why did he not speak of the thirty-seven-year existence of the Gondola? Maybe, it no longer existed.[75]

Second. Harley Murray, a long-time manufacturer of heavy-equipment-hauling trailers and a contract heavy-hauler, dealt with LeTourneau in Stockton, CA. Murray transported the 20,000 pound[76] Mountain Mover to its various jobs for the Hahn family.[77] A photo of the Mountain Mover annotated by Harley Murray calls the Mountain Mover LeTourneau's second scraper. He also says that a tunnel accident destroyed the first scraper (the Gondola).[78]* As a machinery mover, he would know of various heavy-hauling accidents in California's Central Valley.

Third. On March 7, 1975, Medora Johnson, who was Director of the San Joaquin County [California] Historical Museum, mentioned a prior communication from Stjernstrom,[79]

> . . . we are assured that it [the machine at the San Joaquin County Historical Museum] was the first five slip telescopic scraper and therefore No. 3. *You have stated that No. 1 [Gondola] was scrapped*, and if you [LeTourneau University] have No. 2 [Mountain Mover], ours [the tracked telescopic] would be the third model in the succession of improvement [emphasis mine].[80]

She wrongly identifies her museum's telescopic scraper as the immediate successor to the Mountain Mover.[81] However, her statements are still important. She defines "No. 1" as the Gondola. If "No. 2" meant the Gondola, then "No. 1" would speak of LeTourneau's 1922 full-drag scraper. "Ours" would mean that her museum owned the Mountain Mover. Clearly, she identifies her museum's machine as a "five slip telescopic" [the Mountain Mover was a "two slip telescopic." However, if "No. 2" is the Mountain Mover, then "ours" would be a five-bucket telescopic and "No. 1" would be the Gondola. This is her meaning.

Mrs. Johnson's misidentification of her museum's tracked telescopic as "No. 3" (rather than as "No. 5" or "No. 6") does not affect the present argument. She did not claim first-hand knowledge of the Gondola's fate, but credits Nels Stjernstrom for this information. Conceivably, R.G., Andrew Maestretti, or Harold Hahn told Stjernstrom about the Gondola's demise.

Fourth. Lloyd Molby worked for LeTourneau before starting his own company. His firm, ATP Inc. (**A**nswer **t**o **P**rayer), restored the two old California-built scrapers displayed at LeTourneau University. One ATP Inc. status report says, "35. Restore R.G. LeTourneau 1922 model 'Mountain Mover' Scraper. In Process. (LeTourneau College Project)."[82] The "Project Backlog" report for November 1, 1974, says, "1. Complete projects in process. 2. Restore R.G. LeTourneau 1927 Model Scraper. (LeTourneau College Project). . . ."[83] This is consistent with Kaiser manufacturing Gondola scrapers in 1927 and selling one to Maestretti in 1929.

Fifth. Not only did Harold Hahn arrange to transfer the Mountain Mover to the LeTourneau Foundation, but made arrangements on behalf of Andrew Maestretti. Harold is emphatic that Andrew Maestretti's machine is more recent than the Mountain Mover[84] and that more than one 1927 Gondola scraper existed.[85] R.G. only built one 1922 Gondola, but a number of the 1927 Kaiser-LeTourneau Gondola scrapers existed. Furthermore, Andy Maestretti owned more than one 1927 machine, so it is reasonable to conclude that he donated such a machine to the University.

Summary. R.G. seems to imply that the 1922 Gondola no longer existed by 1959. Harley Murray, a Stockton heavy-hauler and manufacturer of heavy-hauling trailers, indicates that the Gondola was destroyed in a tunnel accident. This agrees with Nels Stjernstrom telling Medora Johnson that it was scrapped. Finally, Lloyd Molby reported that he restored a 1922 scraper (Mountain Mover) and a 1927 scraper (Gondola) for display at LeTourneau University.

Evidence links Andrew Maestretti with LeTourneau-designed Gondola scrapers of both 1922 and 1927. The LeTourneau University Gondola looks like Andrew Maestretti's machine pictured in 1930. The original Gondola no longer exists. LeTourneau University has a 1927 LeTourneau-designed Gondola fabricated in the factory R.G. built for Kaiser.

The Original Gondola Was Built before June 1922

Preliminary Summary of the Chronological Problem. The dates advocated in this paper reflect the author's approach to a problem contained within the following propositions.

1. R.G. says that in 1922 he did not draw blueprints before building machines.
2. The Mountain Mover's patent drawings reached the Patent Office on July 13, 1922.
3. Time needed for drafting the patent application, dates the Mountain Mover's completion in late June.
4. R.G.'s small crew needed at least two weeks to build the Mountain Mover (start in mid-June).
5. Stockton's first heat-wave in 1922 was the last half of June, with both early June and July being milder.
6. The Gondola started working at the fair prior to mid-June.
7. R.G. said that Damon Throop came "one scorchingly hot July day" and saw him finishing the Gondola.

If Damon Throop met R.G. during the heat wave, he would have seen him building the Mountain Mover. The days when R.G. built the Gondola were cooler. The date that the patent application reached Washington DC and Stockton's temperatures for 1922 are public record. In addition, contemporary newspaper articles exist. *Mover of Men and Mountains* contains R.G.'s recollections of these events after four decades. The present author continues to be amazed by the high level of accuracy maintained by R.G. after all of those years, but occasionally minor discrepancies do emerge. The present author accepts the first six propositions (above) at face value. However, the day that Mr. Throop came may have seemed *scorchingly hot* because it followed a cool spell, but it was only warm and it was not July. The present author takes R.G.'s statements seriously. Primary evidence require a minor adjustment in proposition 7.

Analysis of the Chronological Problems. *Mover of Men and Mountains* dates the completion of the original Gondola in July 1922,[86]* but a photo published on July 15, 1922, shows it working.[87]* This precludes a late-July date. Actually, the best date for the Gondola's completion is before June 1922.[88]* R.G.'s "Personal Data Sheet," late-dates several events in this period,[89] so precise dates require documentation beyond his recollections several decades later.

Newspaper accounts confirm what *Mover of Men and Mountains* says about building the racetrack[90] and exhibiting the Gondola at the fair.[91] However, they provide some additional details. Ira Guy won an earthmoving contract at the San Joaquin County Fair in late May 1922.[92] Three tractors moved dirt on the project.[93] The contract included building the half-mile horse-racing track.[94] Three articles connect LeTourneau with Ira Guy's 10,000 yard job. One shows the Gondola working on the racetrack and mentions three tractors working since early June.[95]* The second describes the Gondola.

> Two "75" Caterpillars, operated by Guy Brothers and R. G. Le Tourneau, are being used to haul the dirt. One of these tractors that has been recently invented and manufactured by Mr. Le Tourneau, and because of its radical departure from the old methods of operation is attracting a good deal of attention. It is claimed that there is no other scraper like it. The scraper blade is twelve feet long and five feet wide, and carries from eight to ten yards of dirt at one hauling. The driver operates the entire outfit from controls attached to the tractor. Two independently controlled motors are attached to the tractor, one for lowering the bucket and the other for dumping the dirt. They are controlled by a foot lever in front of the driver.
>
> Mr. LeTourneau, formerly an automobile dealer of Stockton, has patented the scraper[96] and expects to manufacture them. He has been using the electric controlled device for sometime [sic, some time] and claims it is a great improvement over the old system.[97]

The third article mentions that R.G. exhibited the scraper at the fair, "R.G. Le Tourneau, a local contractor, has his new type land leveler on display. The huge leveler was only recently designed by Mr. Le Tourneau and was first used to any great extent in leveling off the fair grounds preparatory to making the last building improvements."[98] Observe that this citation does not merely connect the Gondola with the horse racing track, but with preparing the ground for new buildings at the fair. This is extremely important, because an earlier newspaper article indicates that the contractor who erected those buildings started work on June 14, while Ira Guy and R.G. continued leveling.

> The grounds this morning were teaming with activity. Three huge tractors were busy leveling the site for the barns and crews of men were busy preparing for the laying of the foundations of the [con]struction activity, which is not only confined to the new buildings, the race-horses quartered on the grounds were being worked out and the usual routine was under way.
>
> . . . The contract for the bulk of the work [of erecting buildings] has been awarded to Ubel and Vantil of Ripon and their crews began work this morning.[99]

Since the Gondola prepared the site "preparatory of the last building improvements," it necessarily existed prior to June 14, when the building contractor started laying foundations. One article cited above said that the Gondola "was only recently designed by Mr. Le Tourneau and was *first used to any great extent* in leveling off the fair grounds preparatory to making the last building improvements [emphasis mine]." The natural reading of it "being first used to any great extent" at the fairgrounds is that R.G. had used it on some small jobs before using it at the fair. The Gondola probably was built no later than May 1922 (presumably, Ira Guy based his bid for work at the fair, in part, upon knowing about the efficiency of the Gondola).

After discussing the scraper known as the Gondola, R.G. said, "the next one [the Mountain Mover] I built a few months later."[100] Public records show that his first patent application on the Mountain Mover reached the patent office on July 13, 1922.[101]* This suggests a date for the Gondola no later than May 1922. It was only after operating the Gondola for a few months that he perceived its shortcomings. That ultimately led to the telescoping Mountain Mover.

The issue of patents raises another chronological matter. R.G. says,

> As has already been mentioned, it was as a free exhibitor at the fair [in August 1922] that I came in for the deflating remarks of Mr. Harris of the Harris Harvester Works.
>
> Mr. Harris was right, of course, but before I could act on his well-meant remarks, I heard some comments that sent me off on another track
>
> Carlton Case [R.G.'s attorney],[102] more than a little impressed by my demonstrations, suggested, "Better protect yourself with some patents on that machine. It might be worth something."[103]

From the citation, it appears that Mr. Harris made these comments before R.G. spoke with Carlton Case. However, R.G.'s first patent application on the Mountain Mover had already reached the patent office on July 13. Therefore, the conversation with Mr. Case necessarily occurred no less than two months before the discussion with Mr. Harris.

The timeline sets forth the chronology accepted by the present author. R.G.'s discussions with Damon Throop and Carlton Case occurred earlier than he remembered (four decades later).

April? May?	*Late June*	*After July 4*	*July 13*	*July 15*
Gondola built	Mountain Mover built	Mailed patent application	Application reached Patent office	Picture of Gondola working

The Gondola's Design Advances

The Gondola's primary advance was that dirt flowed from the cutting edge onto a large floor (the large floor is what makes it a semi-drag scraper).[104]* R.G. asserts that the Gondola was a pioneer for large semi-drag scrapers, "I made the first large scraper with a carrying bottom in it. . . ."[105] Raising the cutting edge lifted a load of dirt. The Gondola embodied the semi-drag design,[106] where wheels support most of the load. A lower proportion of the dirt tumbled in front of the cutting edge during travel to the discharge area. Transferring weight to the wheels in the Gondola's semi-drag design enabled moving six yards of dirt behind a Holt 75 in a higher gear than was possible with earlier scrapers.[107]* It greatly increased hourly yardage.

However, R.G. soon saw a problem with the Gondola. Although its design enabled moving larger loads than ever before, the ease with which his tractor loaded and hauled it suggested the need to enlarge it. Unfortunately, the efficiency curve was against him. Minute yardage increases required major additions of tractive effort.

> I wanted to double the size of my scraper, and it was already as big as it could get. It was a cumbersome 12 feet wide and carried eight tons. The first couple of tons could be scraped up easily. The next two tons had to force the first two up and back. The last ton had to force seven inert tons aside to make room for itself, but after that the loading could become difficult. It would take as much power to squeeze in one more ton as was needed to load the first eight. In short, I could pick up eight tons with 75 horsepower, but would need 150 horsepower to scrape up nine tons, all of which did not strike me as being very practical.[108]

R.G.'s application for patent 1,470,853 also describes this problem faced by conventional forms of the semi-drag scraper, such as the Gondola.

> The scraping and carrying capacity of an ordinary scoop is governed by its width rather than its depth or fore and aft length, since the resistance of the dirt against being piled up and moved bodily backward as it is being scraped is so great as to cause a tractor to become stalled before a scoop of any great depth may be filled.
>
> This might of course be overcome by increasing the width of the scoop, or using a tractor having a horse-power sufficient to overcome any such resistance. To overly increase the width of the scoop, however not only makes an unwieldy device, but a very heavy one, since it must be heavily braced to prevent lateral sag. To use a tractor of size having reserve power sufficient to overcome the above noted dirt resistance when necessary necessitates an expenditure for such a machine which would not be warranted and would increase the cost of the land levelling [sic] operations to an excessive degree.[109][*]

Basically, the tractive effort required for the cutting edge shearing the dirt is a constant. However, the process of filling a deep and high scraper bowl from the bottom (where the cutting edge is) requires incoming material to displace previously loaded material.[110] Entering dirt curls upward at the back of the bowl and falls on top of the incoming dirt (like a rolling snowball). Instead of snow, a growing dirt-ball rolls within the bowl (rolling on the incoming dirt). The Gondola's bowl was too large for his Holt 75, so the dirt-ball eventually stopped rolling. The dirt-ball acted like a dam, stopping the flow of dirt into the bowl. That was R.G.'s problem.

Widening the scraper would allow his tractor to roll more yards into the bowl's dirt-ball, but the Gondola's 12' width already created transport problems. Making the bowl taller or deeper (front to back) would not let him increase the yardage of the dirt-ball. Buying a new 4000 Series Holt 75 to replace his 1915 Holt 75 (60–75) would only help slightly. What a dilemma!

THE MOUNTAIN MOVER

R.G. hoped for a modest increase. Astonishingly, a way to double the payload came in a flash, "Curiously enough, while drinking out of one of those telescoping aluminum cups, I found what I was after. Remember how the sections nested one inside the other when the cup was collapsed? In that condition only the bottom section held water, but when the next section was raised it held twice as much."[111]

R.G. no longer needed to contemplate making the scraper wider. The tractive requirements for loading the inner bucket resembled those for the Gondola. As it filled, the operator slid it rearward.[112]* Then, he loaded the remaining (empty) bucket. Of course, the loaded Mountain Mover weighed more than the loaded Gondola, raising rolling resistance. Available tractive power, especially after R.G. bought his "brand new super-Holt," a 4000 Series Holt 75,[113]* was more than adequate.[114] Specifically, after filling the Mountain Mover's buckets, he dragged four more yards to the discharge area with the cutting edge on the ground.[115]* The design was successful. The Mountain Mover surpassed the Gondola, a remarkable machine in its own right.

> The total load able to be scraped at one operation is therefore nearly, if not fully, twice as great as could be successfully or economically scraped into a single scoop the size of the inner scoop used, which itself is as large as could be successfully or economically employed in the ordinary type of scraper.[116]

The Mountain Mover embodies LeTourneau's very first patents: 1,470,853 and 1,512,614, the first ones of 298.[117] It is the oldest surviving LeTourneau scraper. The Mountain Mover embodies the key advances of all of his earlier scrapers, as well as some new ones:

1. Electric power (continuing an earlier LeTourneau advance),
2. Brazed (gas welding) construction (continuing an earlier LeTourneau advance),
3. Semi-drag design (continuing from the Gondola),
4. Telescopic scraper design (new feature covered by patent 1,470,853).

In addition, some features of the Mountain Mover continue in later machines:

1. Electric controlled scrapers (pre-1928 and post-1947; electric wheels after 1958).
2. Electric-arc welding superceded brazing,
3. The semi-drag design prevailed until 1932 (the year of apron-equipped carryalls).
4. Telescopic scrapers regularly appeared in the LeTourneau line, even in the 1960s.

The Mountain Mover was the next-to-the-last machine aimed narrowly at land leveling for irrigation.[118]* These ranches were on relatively flat land with few rocks. Both the tiller-wheeled Holt 75 and the Mountain Mover required a wide turning-radius, suited for preparing fields for irrigation.[119] Road construction required a smaller turning radius. Furthermore, highway-construction soil-conditions included ripped rock, so later scrapers used strong box-beam frames.

Some writers date the Mountain Mover in early 1923.[120] However, such a date does not square with R.G.'s July 13, 1922, patent application. Fabrication preceded this date (when the application arrived at the U.S. Patent Office in Washington, DC). After fabrication, R.G. would have seen his patent attorney, who drew up the application and mailed it. Thus, the Mountain Mover must be dated in the latter part of June 1922.

Persons Involved in Building the Mountain Mover

R.G. LeTourneau was his firm's chief engineer for almost fifty years. The company was quite small in 1922. His only employees then were two of his brothers-in-law (Ray and Howard Peterson) and Eph Hahn.[121] R.G. was the main designer, but Ray had an important design role.

Historical Significance of the Mountain Mover

Mountain Mover is the oldest surviving LeTourneau machine.[122] Its advances let it move more dirt than any existing scraper. Although the Mountain Mover never left the farm, R.G. started introducing new designs for heavy construction work. Succeeding machines applied features drawn from the Mountain Mover. R.G.'s accomplishments in heavy construction came, because he never rested on his laurels. Each new machine advanced over its predecessors. Although crawlers with scrapers travel much slower than dump trucks,[123] one man could scrape, transport, and spread the dirt in thin layers (required for compaction).

Scrapers Versus Power Shovels. A power shovel operation required several dump trucks plus spreading equipment. Scraper popular came at the expense of small shovels. R.G.'s business soared, while Bucyrus-Erie, exemplifies plummeting sales of shovels. B-E's manufacturing sales dropped from $19,894,000 (1929) to $3,239,000 (1933).[124] Of course, the depression had cut deeply into orders for large stripping shovels. Even though public works spending increased, manufacturers of small shovels saw that market evaporate. Even a major company like Bucyrus-Erie could not ignore LeTourneau's small company. It established a New-Products Committee headed by three vice-presidents (William Bager, Dan Eells, and William Morison) and the General Sales Manager, Peter Birkhead. In turn, the committee appointed a sales engineer, W.K. Fawcett, as its executive secretary and field investigator.[125] In 1934, just twelve years after the Mountain Mover, his report, "Heavy Earth Moving Equipment Such as Le Tourneau and Others,"[126] showed that scrapers were hurting smaller shovel sales.

> One of the Company's West Coast customers had promised to buy a 1½ cu. yd. Bucyrus-Erie shovel, provided he was low bidder on a certain highway contract. When the award went to another, the Bucyrus-Erie representative attempted to sell the successful bidder a shovel for the job. The contractor was not interested. According to his calculations, the use of a 1½ cu. yd. shovel and auxiliary equipment (five trucks and a bulldozer) would have required a capital investment of $54,000, and the average cost for digging, transporting, and grading would have been 20.1 cents per cubic yard (including interest, depreciation, operation, and maintenance). By contrast, he estimated that he could accomplish the same work for 10.5 cents per cubic yard with a tractor-scraper combination costing only $12,500, a savings of 77 per cent in capital outlay and 48 per cent in net cost per yard of earth moved.
>
> Bucyrus-Erie's field representatives had been reporting similar experiences with increasing frequency and forcefulness, especially from the area west of the Rocky Mountains where a former garage operator and excavating contractor R. G. Le Tourneau, of Stockton, California, was sweeping the market with a new "carry-all" scraper of his own design and manufacture.
>
> Such was the demand for the new cost-saving devices that, even in 1934, a year of severe depression, Le Tourneau's plant at Stockton was reported to be working twenty-four hours a day and to be so far behind in deliveries that management was hesitant to accept any further orders.[127]

As a result Peter Birkhead traveled to Stockton to ask LeTourneau to license B-E to manufacture and sell his scrapers east of the Rockies.[128] As he headed west, LeTourneau announced plans to locate near Caterpillar, in Peoria, IL. Having failed to align with LeTourneau, B-E hired some California scraper men, R.W. Moon and T.R. Paulsen, in August 1935 to establish a tractor-equipment division.[129] In 1936 Bucyrus-Erie signed an agreement with International Harvester. International dealers sold B-E dozers and scrapers as attachments for their tractors. Sales of the Tractor Equipment division went from $113,000 (1936) to $1,088,000 (1939).[130] Such sales were 9% of the manufacturing sales volume for the whole company in 1939,[131] cushioning the blow inflicted by scrapers against small power shovels. International bought this B-E division in May 1953.[132]

The Cost-Effectiveness of Scrapers and Dozers forced old-line companies to build them. R.G. said, "But to get back to the weak confounding the mighty, in spite of my limited education, I became, with the help of the Lord, what is known in the heavy-duty equipment field as an industrialist. Among my competitors are such giants as Caterpillar, General Motors, International Harvester, Allis Chalmers, and some eight others [including (Clark) Michigan, M-R-S, Westinghouse Air Brake, and Wooldridge], all big corporations with high powered executive staffs and engineering departments."[133] Many of R.G.'s innovations became universal.

Scrapers had a dramatic impact upon the cost of excavation. Amazingly, the 1926–56 indices of highway bid prices shows that excavation costs per cubic yard of dirt was no higher in 1956 than it had been in 1926.[134] Despite inflation, the average bid-price for excavating a mile of highway (standardized at 17,491 cu. yds. of common excavation). Amazingly, the Excavation Index for the fourth quarter of 1955 was 100% of 1926 levels (despite inflation). Thus, after factoring inflation, excavation costs actually decreased. Contrarily, the paving index was 162% and structures were 234% as high as 1926. Selby concludes, ". . . while the decline in all costs was a function of the Great Depression, excavation costs did not show a typical rise during the recovery period [whereas all other factors rose steeply during recovery times]. The continuing low cost of excavation was a function of technology, not economics [such as price deflation]."[135]

Use of LeTourneau Equipment in World War II. Selby also draws an interesting conclusion from the fact that the same Army Corps of Engineers who supervised a number of civil works projects in the 1930s ordered construction equipment during World War II.

> These great projects, although sponsored by the government were contracted by private construction firms. This fact makes it possible to reconcile the enormous amount of government building programs and the relatively small increase in equipment sales in this sector by the LeTourneau company. . . .[136] It was the civilian contractors who were, for the most part, purchasing LeTourneau machinery, and it was from them that the Engineers were learning about the new tools and methods. When the time came for massive government equipment purchases, the Engineers turned to the same manufacturers who had been successfully supplying the civilians. . . .[137]

The Engineers found that LeTourneau met their needs, as evidenced by their volume of purchases. ". . . Gen. Wheeler said that of $357,546,000 worth of equipment delivered to the Corps of Engineers up to V-J day, LeTourneau had furnished 75,000 pieces, including 8,648 scrapers, of a value of $102,000,000."[138]

> Company records show that of the 75,000 pieces of equipment, 35,682 were Power Control Units, but that together both branches of the service [Army Engineers and Seabees] bought 15,159 dozers, 10,783 Carryall Scrapers, 1,947 cranes, 1,366 rooters, 1,735 sheep's foot rollers, 2,169 Tournapulls, and 121 trailers for carrying heavy equipment. In dollars, the war-time total came to $99,000,000.[139]

R.G. says,

> . . . it was our organization that built over fifty percent of the earthmoving equipment in combat. According to reports, what with the building of highways like the Alcan and the Ledo Road in Burma, the building of airports and artillery emplacements all over the world, and the plowing away of rubble in demolished cities, more earth had to be moved during World War II than during all the combined wars of history.[140]

Moving the earth has been a national priority both in war and in peace. LeTourneau's ideas have allowed our country to undertake huge projects swiftly and economically. His company went from a shoestring operation to one that employed thousands, because it offered cost-effective ways of undertaking huge projects (both in wartime and in peace).

Mechanical Engineering Concepts Unique to the Mountain Mover

The Mountain Mover embodies LeTourneau's very first patents: 1,470,853 and 1,512,614. These are the first of his 298 patents.[141]

1. Electric power (continuing an earlier LeTourneau advance),
2. Single-man operation (continuing an earlier LeTourneau advance),
3. Brazed (gas welding) construction (continuing an earlier LeTourneau advance),
4. Semi-drag design (continuing from the Gondola),
5. Telescopic scraper design (new feature covered by patent 1,470,853).

In addition, some features of the Mountain Mover continue in later machines:

1. Electric controlled scrapers (pre–1928 and post–1947; electric wheels after 1958).
2. Electric-arc welding superceded brazing,
4. The semi-drag design prevailed until 1932 (the year of apron-equipped carryalls).
5. Telescopic scrapers regularly appeared in the LeTourneau line, even in the 1960s.

With the Mountain Mover, one man could move about four times as much dirt the same tractor as other contemporary scrapers (requiring two men). Although this machine is narrowly suited for agricultural earthmoving, it was the prototype for all large scrapers (of any brand).

Significance to the World and to Mechanical Engineering.

Stockton was home to Holt and LeTourneau, San Leandro was Best's hometown, and Fresno (home of the Fresno scraper). Holt and Best merged in 1925 to form Caterpillar tractor. Both one-man scrapers and the crawler tractors that pulled them originated in California.

> The scraper was definitely a Western development. In fact, the area marked off by Stockton, San Leandro, and Fresno, Calif., was the main cradle and suffered the sharpest birth pangs. The famous Fresno drag scraper got its start here and quickly spread throughout the country. . . .
>
> A big reason why the West was the center of activity in scraper development was the need for machines to level land for irrigation in California's Central Valley. . . . Highway and dam building added a powerful stimulant in the 1920's and 30's.[142]

The article's first five (of six) pages briefly describe a series of key historical contributions of various western companies including LeTourneau.[143] The final page devotes itself to: "A revolution named LeTourneau."[144] The final page quotes 1929–31 *Western Construction News* articles. A few excerpts show that R.G. always demanded performance, "Bob Mann, Holt's office manager [in Stockton] in the 1920's reported the 'Bob used to come into the Holt factory complaining that our tractors weren't rugged enough to take care of overloading. I would plead with him to go around such obstacles as stumps and stones now and then instead of charging like a bull at a red cape.'"[145] The article also says, "Following is a quote from the April 1930 issue of *Western Construction News*, which would not seem out of date, if it appeared in the current issue [August 1963]: '. . . LeTourneau has specialized in the last few years in grading equipment of unusual size and type, and bid this contract at a very low price in order to demonstrate the efficiency and speed of his equipment—both of which he satisfactorily accomplished.'"[146]

What was California like in the years before this man-in-a-hurry started moving dirt? In the late 1800s, non-irrigated wheat was the Central Valley's major crop. The Bonanza Wheat era[147] created demand for combined harvesters. Holt Historian, Reynold Wik, says,

> A time capsule found in an iron column in a Holt factory building constructed in 1899 reveals that Holt first produced 13 combines in 1886, 134 machines in 1892, 61 in 1896, and 128 in 1899 for a total of 1,072 combines before 1900. By 1900, the sales of combines by the Holt Manufacturing Company (including the companies Holt purchased in the 1890s) were greater than those of all competing firms, and by 1916 some 6,000 Holt combines harvested an estimated 90 percent of the grain on the Pacific Coast.[148]

Although the Bonanza Wheat farms pioneered large-scale Central Valley agriculture, the aftermath hindered the expansion of irrigation. Specifically, large landowners could not afford irrigation works. Dry-land farming yielded low profits per acre, precluding capital improvements to their huge tracts. On the other hand, small landowners needed the higher profits per acre that irrigation would yield. Bonanza growers prevented irrigation canals from crossing their fields. (Dams are suited to hilly areas, while irrigable land is in the valleys. Thus, widespread irrigation could not occur without canals crossing wheat lands). Continuation of this wheat era would have hindered irrigation[149] and development of efficient land leveling equipment.

The 1887 Wright Act changed the rules for forming irrigation districts and taxing those lands. Such districts (with authority to tax all lands within their borders) formed all over the state. More and more acres came under irrigation.[150] The payment of irrigation taxes gave an incentive to benefit from the tax (by irrigating). However, large landowners could not immediately afford irrigation canals and extensive land leveling for all of their lands, so they gradually put land under irrigation.

This monumental task brought large crawler tractors[151] into service pulling the largest possible land levelers. The process of bringing fields under irrigation had started before R.G. entered the picture in 1919. He made several important advances in scraper-design prior to building the Mountain Mover. However, the Mountain Mover's use of a telescopic semi-drag bucket enabled it to move more dirt than any earlier scraper (including those he had built). This scraper and those which followed enabled quicker and cheaper land leveling, which accelerated California's change-over to irrigated land. Some 1930 testimonials to R.G.'s scrapers follow.

> In various agricultural sections tributary to Stockton, notably Union Island and West Stanislaus Irrigation districts, a veritable transformation is taking place. Vast areas of comparatively unproductive land are being prepared for intensive farming by leveling and subsequent irrigation. Proper watering of big-money crops is made possible by quick, cheap and efficient land leveling.
>
> "One of the main reasons more land has not been leveled for irrigation before," points out Alfred Ferguson, who has 1100 acres of high-producing land on Clifton Court, "is because it is only very recently that power scrapers have been developed which were superior to mules and old type scrapers.
>
> "With a Stockton-built machine, such as the seven-yard Le Tourneau scraper which I recently used in leveling 300 acres, it is possible to get grading work well and quickly done without the use of teams or much man labor."[152]

LeTourneau's Transition to Heavy Construction. He applied the lessons learned in building the Mountain Mover to a different field, when he entered heavy construction in 1926.[153] His five-bucket tracked-telescopic scraper impressed Henry Kaiser[154] and a California Division of Highways engineer.[155] Publicity generated by influential people, by trade magazines, and by R.G.'s successful completion of contracts generated much business. Large scrapers often worked more cheaply than fleets of dump trucks loaded by power shovels. Low cost earthmoving encouraged additional public works projects, even before the Depression. Then, the government increased public works projects to hire many newly unemployed workers. The new 1930 Stockton factory enabled filling more equipment orders. It expanded in 1934. Factories opened in Peoria, IL (1935), and Toccoa, GA (1938). Pre-war expansion enabled LeTourneau to meet the military's initial needs for earthmoving equipment to win World War II. Two other factories were needed during the war (Vicksburg, MS, and Rydalmere, Australia). The same types of equipment worked on such projects as the Interstate Highway System.

The efficiencies the Mountain Mover introduced not only worked in California's irrigated farmland, but applied to public works, the military in World War II, and post-war expansion. Efficient scrapers helped keep 1956 earthmoving prices at 1926 levels, while other aspects of construction saw major price-inflation. Economical earthmoving has encouraged great improvements in the infrastructure for close to a century. An efficient infrastructure is essential to the modern economy. Although earthmoving may seem mundane, the Mountain Mover's descendants have indeed shaped the modern world (pardon the pun).

100-Word Summary of the Mountain Mover's Contribution.

Mountain Mover, the oldest surviving LeTourneau scraper, underlies his later scrapers and all others. Its telescopic bowl (a LeTourneau exclusive) minimized loading effort, doubling payload without widening the machine. Wheel-supported payload enabled large scrapers. Brazing (gas welding) lessened deadweight. Electricity let one operator do the work of two. The efficient Mountain Mover remained competitive over four decades. At retirement it still leveled fields efficiently. Later models of R.G.'s scrapers lowered earthmoving costs further. By replacing many power shovels, they converted many projects from expensive "wishful thinking" to practical and cost-effective. National defense and our infrastructure benefit from Mountain Mover's descendants.

How Unique Is the Mountain Mover?

The Mountain Mover is the oldest surviving LeTourneau scraper. LeTourneau University's 1927 Gondola is the third oldest. The San Joaquin County (California) Historical Museum has the second oldest surviving machine, a five-bucket telescopic scraper. (R.G. built two in the winter of 1925–26, selling the surviving one to Ernie Rider).[156]* The same museum also owns a Highboy (a 1930 design) as does Ed Akin of Placerville, CA.[157]* Akin also owns two lowboy scrapers (1931 design). The Antique Mechanics Club at University of California Davis also owns a different version of the lowboy.

All these machines are significant, but the Mountain Mover pioneered the concept of a telescopic scraper. It was the prototype for what followed. Its claim to fame is not greater efficiency than later surviving LeTourneau machines of the 1920s and 1930s. Clearly, his later machines were better adapted to the needs of general contractors. Rather, the Mountain Mover's contribution was to prove once-and-for-all the benefit of letting wheels carry payload, not just the weight of the machine. Welding allows eliminating unnecessary weight. Bowl design (in this case, a telescopic bowl) enabled loading more dirt for the same tractive effort. One man could operate both the tractor and the scraper. The Mountain Mover marked a departure from all competitive scrapers. In time, other scraper builders began implementing R.G.'s innovations.

Conclusion

It has truly been a privilege for this son of a Stockton, CA, dirt mover to honor another Stockton dirt mover who testified about Jesus Christ's free gift of eternal life for everyone who believes in Christ. That testimony played an important role in my father and I both coming to believe in Christ for eternal life. Both R.G. and my parents are now with the Lord. As one who believes the Lord's promise to resurrect all who believe that He gives eternal life all believers and will resurrect them (John 11:25–27), I know that all believers will be with Him for all eternity. Furthermore, as one whose life's work is to study and teach the New Testament in the original language, I anticipate sitting at the feet of Christ, my Savior, and learning from Him. It will also be a privilege to see my mother and my two favorite earthmoving contractors as well.

The author is working on a full-length book about R.G.'s California years. The working plan to integrate a history of his various construction jobs with the machines that he designed to resolve specific problems. The aim is to produce a tight chronology that is heavily documented and contains many pictures. Please contact the author at the address listed on page 1 of this paper.

ENDNOTES

Notes for pages 1–3

***** Asterisks indicate notes which refer to equipment pictures. Most picture citations are in published sources.

[1] This is a revision of a paper submitted to the American Society of Mechanical Engineers: "Nomination of R.G. LeTourneau's Mountain Mover for ASME Historic Mechanical Engineering Landmark."

[2] Eileen Grafton, *Peterson Tractor Company: The First Sixty Years* (San Leandro, CA: Peterson Tractor, 1998), 152, shows my father working in the roller exchange shop (the man closest to the right side of the picture).

[3] *New King James Version* (Nashville: Nelson, 1982).

[4*] "[Mountain Mover Arrives at LeTourneau University]," *NOW* 28 (October 1974): [1]. This supplied title serves bibliographic identification purposes for an untitled article. The upper picture shows six people standing in the scraper bowl. Charles Able, "Dirt Mover Is Located," *Longview [TX] Morning Journal* (February 22, 1976): 3-A, said, "It [the Mountain Mover] was shipped to Longview in two pieces and reassembled at the ATP plant."

[5*] The ATP Building no longer exists, but "Campus Map," LeTourneau University, November 2001, labeled it as building 36 (near the southeast corner of campus. Four pictures depict the sections of the Mountain Mover's frame after arrival in Longview. "[Mountain Mover in Pieces near ATP Building]," four pictures: A–D, [about 1975]. In addition, "[Mountain Mover Arrives at LeTourneau University]," shows its scraper bowl.

[6*] The Mountain Mover was placed in front of the Margaret Estes Library. "Campus Map," LeTourneau University, has a "13," designating the "Jeannette S. Belcher Memorial Tower/ Belcher Mall," where the machines were located after February 1976. Able, "Dirt Mover Is Located," 3-A, says about the pictured Mountain Mover, "The scrapers [the 1922 Mountain Mover and the 1927 Gondola] . . . will soon be on permanent display on the college campus. ¶"Although no specific site for their retirement has been selected, Dr. Joe Winniger, LeTourneau College spokesman, said of the old, 'They are here to stay.'" For 10+ years the scrapers rested near the library.

[7*] "Campus Map [of LeTourneau University]" uses numbers 17–18 for this area. The November 30, 1989, Founder's Day ceremony was R.G.'s 101st birthday. Philip G. Gowenlock, *The LeTourneau Legend*, ed. Kerrie L. Gowenlock (Paddington, Queensland, Australia: Paddington, 1996), 286–87; Philip G. Gowenlock, *The LeTourneau Archive,* ed. Kerrie L. Gowenlock (Paddington, Queensland, Australia: Paddington, 1998), 2 and 74; and Eric C. Orlemann, *LeTourneau Earthmovers*, ed. Kris Palmer (St. Paul, MN: MBI, 2001), 13, depict memorial site scenes.

[8] R.G. LeTourneau, *Mover of Men and Mountains* (Englewood Cliffs, NJ: Prentice-Hall, 1960; reprint, Chicago: Moody, 1967, 1973), 121, describes the design of another scraper built the same year, "We squatted down in the dust of the driveway and began to draw up some plans." Another indication of the lack of early blueprints comes from *Mover of Men and Mountains*, 37, "Mindful of the old German's warning that an unfinished machine never works, I started construction on the [Gondola] scraper that night, not even delaying to draw up plans."

[9] "Grandpappy Never Quit," *NOW* 9 (October 20, 1944), 4, "Ephraim Hahn was a born land leveler. He knew his tools and thought that the Mountain Mover was exactly AAA1. In fact, he thought so much of the Mountain Mover that in '26 he bought it from R.G." Harold Hahn, Ephraim's son, in a telephone interview, February 8, 2004, indicated that for some reason, R.G. was hesitant to sell the Mountain Mover to Eph (maybe wanting to keep a good operator). R.G. sold it to Andrew Maestretti, from whom Ephraim soon bought it.

[10] "Grandpappy Never Quit," 4–5.

[11*] Cf. the picture and caption to that effect in Grandpappy Never Quit," 4–5.

[12] Ibid., 5.

[13] "Harold Hahn interview," February 8, 2004, said that a D8 did not require the telescopic feature. The telescopic feature let a Holt 75 load twice the dirt that it could with the Gondola. R.G. struggled under a Holt 75's tractive limits, never imagining that a D8-sized tractor would economically eliminate the need for the telescoping feature. R.G. LeTourneau, Stockton, CA, Patent 1,470,853, United States Patent Office, "Scraper," filed by Percy Webster, October 16, 1923, 1, "To use a tractor of size having reserve power sufficient to overcome the above noted dirt resistance when necessary necessitates *an expenditure for such a machine which would not be warranted and would increase the cost of the land levelling* [*sic*] *operations to an excessive degree* [emphasis mine]."

[14*] Cf. the 1944 pictures in "Grandpappy Never Quit," 1, 4–5, against those of 1960. Cf. the picture on the second picture-page following *Mover of Men and Mountains*, 122. "Harold Hahn interview," February 8, 2004, says that low bridges in the Manteca-Linden area (near Stockton) made transport difficult. Height was reduced to 11 feet.

[15*] The 1944 pictures in "Grandpappy Never Quit," 1, 4–5, lack a gooseneck, but the one in "R.G. Retraces Steps of Early Days in Stockton, Calif.," *NOW* 14 (December 15, 1960): [3], has a gooseneck hitch. Harold Hahn, "telephone interview," by John Niemelä, February 8, 2004, dates the gooseneck at about the same time as lowering its height. The gooseneck improved maneuverability. "[Mountain Mover in Pieces near ATP Building: picture D]," shows the gooseneck, so it went to Longview, but was never reattached.

[16*] Compare the 1944 rear pictures of the Mountain Mover "Grandpappy Never Quit," 1, 4–5; Gowenlock, *The LeTourneau Archive*, 68, with the 1994 picture in Gowenlock, *LeTourneau Archive*, 74; and "[Mountain Mover Arrives]," [1]. Recent pictures show two vertical channels (6" × 6") braced by triangular steel plates. Harold Hahn, "telephone interview," by Dale Hardy, February 10 and 17, 2004, described their use. Harley Murray was hired to transport it between jobs. He hoisted the machine's rear, attached a dolly into the channels, put the front wheels onto a trailer, and towed it.

[17] Harold Hahn, "telephone interview," February 8, 2004. He became a plumbing contractor.

[18*] "R.G. Retraces Steps of Early Days in Stockton, Calif.," *NOW* 14 (December 15, 1960): [3], "With Eph Hahn, an operator for him in the early days, R.G. examines the Mountain Mover that he built in 1922. This Scraper has been in use until a few years ago when Eph Hahn ceased land levelling [sic] contracting." That photo's date differs from the one appearing on the second picture-page following *Mover of Men and Mountains*, 122. A harrow (or disk) exposed bare dirt in the *NOW* picture's foreground, whereas *Mover of Men and Mountains* shows mowed field-grass in the foreground. The same orchard is the background for both pictures, but the camera angle changed. Both show dry field-grass that grew around the Mountain Mover. It had stood there for a period of time.

[19] R.G. LeTourneau, "New Machine Dramatizes Progress," *NOW* 21 (August 1967): 1.

[20] "[Mountain Mover Arrives at LeTourneau University]," *NOW* 28 (October 1974): [1], dates the Mountain Mover's arrival in Longview as September. That fall Roy and Ben LeTourneau sent a truck from Florida to California to retrieve the Mountain Mover. Two trips were necessary ("Harold Hahn telephone interview," February 10, 2004, by Dale Hardy).

[21] Ambiguity arises because [Lloyd Molby], ATP Inc., "ATP Inc. Projects: Nov. 1, 1974–Nov. 1, 1975," [November(?) 1975], [1], lists the two scrapers as projects #13 and #14 for 1975 without indicating completion:

"13. Do restoration work on 1922 LeTourneau Scraper [Mountain Mover]. (LeTourneau College Project)
14. Do restoration work on 1927 LeTourneau [Gondola] Scraper. (LeTourneau College Project)"

No scrapers are mentioned in [Lloyd Molby], ATP Inc., "Project Status," March 13, 1976, [1]. Restoration ended before March 13, 1976; and, probably, before November 1, 1975. A more exact date has been elusive. N.B.: His first citation refers to one scraper as a 1922 model, but the other as a 1927 machine. The present author agrees.

[22] Dan Heiple, "What Contractors Need to Know on Economics of Scraper Design and Load," *Roads and Streets* 100 (August 1957): 98–104.

[23] *Mover of Men and Mountains*, 94–96. The correct spelling of this employer's name is Abraham Grunauer.

[24*] Small mule-powered levelers (such as Fresno scrapers) often lacked wheels. By contrast large wheel-supported scrapers were what the large Holt and Best crawler tractors pulled. Wheel-support lowers friction, enabling "large" scrapers (c. three cu. yds.). Holt levelers appear in Randy Leffingwell, *Caterpillar Dozers and Tractors* (Ann Arbor, MI: Lowe & Hould, 1997; reprint, Osceola, WI: Motorbooks International, 1994), 60; and Caterpillar Tractor Company, *Fifty Years on Tracks* (Peoria, IL: Caterpillar Tractor, 1954), 31.

[25*] A full-drag scraper has a blade with side-wings, but a dirt-carrying floor may be (1) minimal (under Schmeiser designs, cf. patent 1,150,459) or (2) absent (under Holt designs). Retaining the load to the discharge point requires dragging the cutting edge on the ground surface. (Cf. *Mover of Men and Mountains*, the first unnumbered "picture page" after page 122). The scraper body lacks a floor. Simply raising the cutting edge dumps the load. LeTourneau, "New Machine Dramatizes," 1, says, "It [a Holt full-drag scraper] was known as a scraper because it was just a straight up and down blade with wings on each end, but no bottom in it. To let the dirt out, we just raised the blade like a bulldozer."

Side-wings reduce load-losses past the cutting-edge's ends. Importantly the tractor's hitch and the scraper's wheels support the cutting edge. Assume a setting in which the cutting edge barely contacts the dirt (not quite digging). Going over a bump raises the cutting edge, but less than the bump's original height. Each succeeding pass reduces the height of bumps.

[26] R.G. LeTourneau, "R.G. Talks about the Joy of Accomplishment Makes Play out of Work." *NOW* 17 (April 1963): [1–2], 221, "One evening I joined the gang and proposed my new scheme of putting an electric generator on the tractor[,] belted to the flywheel, and let the tractor operator kick a switch with his foot and one man could operate both the tractor and the scraper. But I couldn't sell the idea at all. They said, 'Oh, no, each man has his hands full. That won't work.'" In note 35 R.G. describes a successful operator of a Holt leveler as a *contortionist*. Similarly, Leffingwell, *Caterpillar*, 57, hints at the problems faced in steering a Holt 75 (using both steering clutches and a steering wheel). R.G. knew that simple controls were essential for any one-man tractor and scraper.

[27] A crawler in low gear should move a load of about 80% of its weight. A 23,000 pound crawler should pull more than a 5,000 pound wheel-mounted scraper (cf. note 34) with 6,000 pounds of tumbling dirt.

[28] *Mover of Men and Mountains*, 110.

[29] *Mover of Men and Mountains*, 112.

[30] *Mover of Men and Mountains*, 119. *Mover of Men and Mountains*, 117–18, mentions pulling stumps in the winter. California's rainy season is winter–spring. Clay must be leveled in the dry season. R.G. sought winter contracts in arid places with well-drained soils. Peat soil predominates in the San Joaquin-Sacramento delta, a triangle between Stockton, Sacramento, and Antioch. Adobe clay is what Stockton and Sacramento have. Grape and almond areas (like Lodi and Manteca) are sandy. Knowing local soil-types and historic rainfall-figures assists in dating R.G.'s early small jobs (that rarely appear in newspapers). Norman B. Rohrer, *The Remarkable Story of Mom LeTourneau* (Wheaton, IL: Tyndale House, 1985), 53, says, "R.G. tried to get jobs working in sandy ground in the winter time and adobe soils in the summer. Winter's moisture made the adobe impossible to maneuver with his tractor and graders." Sandy areas put R.G. further from his wife and Stockton's adobe, so she would certainly remember which jobs were in summer and which were in winter.

[31*] R.G. LeTourneau, "Personal Data Sheet (1918–1962)," [1], has an earlier date for electrifying the Schmeiser, "Bought first Holt tractor — January 1920 ¶Elsolio Ranch [*sic*, El Solyo], motor on Schmeizner [*sic*, Schmeiser] — until July, 1921." Other Schmeiser scrapers appear in J. L. Allhands, *Tools of the Earthmover Yesterday and Today: Preserved in Pictures* (Huntsville, TX: Sam Houston College Press, 1951), 124–25; Gowenlock, *LeTourneau Legend*, 2–3; and Leffingwell, *Caterpillar Dozers*, 136.

[32] "Buttons Halt Perspiration," *NOW* 10 (July 27, 1945): 4.

[33*] A smaller Schmeiser scraper (lacking air power) appears in *Mover of Men and Mountains*, first unnumbered "picture page" after page 122. For an air-powered Schmeiser, cf. Gowenlock, *LeTourneau Legend*, 1.

[34*] Allhands, *Tools of the Earth Mover*, 123, describes Schmeiser's most popular models, "Giant leveler, twelve feet, $1,450 at factory, weight 5000 pounds, and a capacity of between 4 and 4½ cubic yards. Junior leveler, ten foot, $1,275 at factory, capacity between 2 and 3½ cubic yards. Junior A leveler, $1,125 at factory, weight 3880 pounds, capacity 1 cubic yard." Schmeiser scrapers used patent 1,150,459 (Applied for patent on March 9, 1914; awarded on August 17, 1915). The patent drawings depict a smaller machine, lacking air-power. Stockton's soil conditions prevented R.G.'s tractor from moving more than three yards with a 4½ yard capacity Schmeiser Giant.

[35] See pictures mentioned in note 24. An article compiled from R.G.'s notes, "Power Transmission and Control," *NOW* 3 (January 1, 1949): n.p., describes the Holt design, "Next stage brought a similar machine [to the air-operated Schmeiser] with a leather belt running from a live axle, keyed to the wheels, to a pulley shaft with gearing on it. Tightening the belt by hand would raise the blade, which could then be held up by a foot brake, and when released would go down by gravity. This system often lacked the power that was often necessary to force the blade into hard ground. To help (?) the operator, this rig was furnished with a large hand wheel, to augment the action of the belt. Two hands and two feet were not enough to deal with the wheel, brake and lever at the same time, and one had to be a contortionist to achieve success." The "(?)" may be a proofreader's note that ended up in print.

[36] R.G. LeTourneau, "The Joy of Accomplishment," 221.

[37*] *Mover of Men and Mountains*, 110. This tractor appears in Gowenlock, *LeTourneau Legend*, 2–5, but the scrapers pictured on those pages date from 1921–22.

[38] *Mover of Men and Mountains*, 111. Also R.G. LeTourneau, "Education Plus Experience Make the Successful Inventor," *NOW* 9 (August 25, 1944): 5, "The company was glad to have the tractor work as many hours as possible, but was not willing to furnish a scraper man for the extra 3 or 4 hours of daylight."

[39] *Mover of Men and Mountains*, 112.

[40] LeTourneau, "Education Plus Experience," 5. He also left the Holt scraper's original controls intact in 1921. *Mover of Men and Mountains*, 119, gives this sequence: (1) Guy brothers leased the Holt leveler, (2) R.G. asked to rent it again, (3) but it was already rented, (4) they suggested that R.G. modify Maestretti's tractor. Now, if the scraper would only work electrically, the Guy brothers would need to do step 4 before Maestretti would have rented it again (Step 1). Thus, R.G. left the original controls intact, when he electrified each machine.

[41] *Mover of Men and Mountains*, 111, says that his desire to work from dawn to dusk prompted the change.

[42] "Power Transmission," n.p.

[43] *Mover of Men and Mountains*, 112.

[44] LeTourneau, "Education Plus Experience," 4.

[45] Roy Pike established El Solyo Ranch (taken from Spanish *sollo*, pronounced properly as *soy-yō*, meaning *sturgeon* or *pike*). He intended to name this impressive ranch after his last name retranslated into Spanish. R.G.'s statement probably refers to Pike, because LeTourneau, "Personal Data Sheet," [1]] speaks of electrifying the Schmeiser at El Solyo. Presumably, R.G. spoke to Mr. Pike, not a foreman, about contract terms.

[46] *Mover of Men and Mountains*, 113.

[47] *Mover of Men and Mountains*, 113–14, says that he raised his rate from $7.50 to $8.00 per hour.

[48] *Mover of Men and Mountains*, 116–17.

[49] *Mover of Men and Mountains*, 121.

[50] *Mover of Men and Mountains*, 119. Maestretti is the proper spelling of his name.

[51*] *Mover of Men and Mountains*, 121–22. Pictures appear in Gowenlock, *LeTourneau Legend*, 2–3; "Earthmoving: From Rubbing to Rubber," *NOW* 10 (December 14, 1925): 3; and "Scrapers from '22 to '44," *NOW* 8 (January 7, 1944): 3. He built it soon after buying the Moss Avenue property (May 1921). Cf. notes 48–49.

[52] *Mover of Men and Mountains*, 124, says that brazing cut Gondola's weight (ditto for the full-drag scraper). "Thanks to its all-welded construction, it was freed at last of the massive cast iron frames used on other machines. When loaded, its weight was almost all pay load; when empty the tractor pulling it didn't know it was there." Raymond J. Sacks, *Theory and Practice of Arc Welding* (New York: Van Nostrand, 1943), 4–5, describes equipment that built the Alaska Highway, "This equipment had to meet several requirements. Irregularly shaped parts and movable members had to be immensely strong, yet light so that economical motive power could be employed. Relatively low first cost was important, but most important was the need for strength, rigidity and light weight.

"The design of an earth-moving unit, fabricated entirely by the welded method from 'mill run' steel plates and shapes, brought about a reduction in weight of the total earth-moving machine from 15% to 20% over the older conventional method of manufacturing. This was due to the fundamental reduction in weight made possible by the welded joint, which fuses the edges of the parts instead of the heavy reinforcing sections involved in the other common methods of joining such parts."

[53*] LeTourneau, "New Machine Dramatizes," 1, says, "So I built my first scraper [the full-drag] somewhat conventionally, but I tipped the blade backward considerably so I could carry about five yards instead of three. . . ." Cf. Gowenlock, *LeTourneau Legend*, 2–3. Unfortunately, the caption in Orlemann, *LeTourneau Earthmovers*, 12, says, "Full-Drag Scraper," since the *dumped* bowl *resembles* a full-drag. In all fairness, the print from which this picture derived had an old notation, "Full Drag Scraper," on it.

(The following shows that it does not depict the full-drag). Cf. the picture "Original Gondola Dumping," for identification of key locations (A–E) on it. An electric motor drives a cross-shaft (A) with pinion gears at each end. These pinions contact a pair of rack gears, raising and lowering the cutting edge. Another electric motor drives a winch (B) for dumping the bowl. The cable pulley is just below the highest point of the scraper. The cable attaches to the bowl (C). A full-drag scraper would not have a dumping mechanism, but only a way to hoist the blade.

The cutting edge is raised (approximately 4"), so daylight and shadows appear under cutting edge (D). Two narrow steel uprights (E) rise to an angle-iron cross-beam. If the uprights were vertical, the bowl would be in the digging position. Instead, it is fully dumped. This is the Gondola, not the full-drag. Cf. Gowenlock, *LeTourneau Legend*, 2–5, to compare and contrast the full-drag with the Gondola.

[54] R.G.'s recall of events is remarkable, but primary evidence clarifies any ambiguous wording. The present author has examined primary evidence concerning LeTourneau's California years for three decades.

[55] *Mover of Men and Mountains*, 133.

[56] Known records do not call the donated machine *Gondola*. This Livermore-built scraper does not resemble R.G.'s Stockton-build machines (A list of early Stockton scrapers appears in Gowenlock, *LeTourneau Legend*, 34).

People still identify it as the 1922 Gondola, because the same man who donated this machine bought the 1922 Gondola. They surmise that it was so drastically modified that it no longer looks like R.G.'s design.

The actual solution may initially seem unlikely, but the following provable assertions establish this view:

1. R.G. produced two distinct scraper models that went by the name Gondola,
2. He designed the second for Kaiser, so *Mover of Men and Mountains* does not mention it,
3. Maestretti not only bought the 1922 Gondola, but at least two 1927 Gondola scrapers. Cf. note 57.

[57] "Ancient History Anyone?" *The Co-Operator* (January–February 1966): 7, says, "Three of these [1927 Gondola scrapers] were owned by 'Buck' Maestretti of Stockton, Calif." The article pictures one of them, which is the same design as LeTourneau University's 1927 Gondola. Harold Hahn, interview by John Niemelä, July 19, 2004, remembers that "Andy" Maestretti and his brother, "Smoke," operated a pair of 1927 Gondola scrapers. S.J. Sanders, "Construction Review: Highway Grading," *Western Construction News* (May 25, 1930): 262–63, says that Maestretti owned two LeTourneau seven-yard scrapers, picturing one of them, a 1927 Gondola.

[58] Keith Haddock, *Giant Earthmovers: An Illustrated History* (Osceola, WI: MBI, 1998), 59.

[59*] Gowenlock, *LeTourneau Legend*, 4. A picture of the 1927 Gondola at LeTourneau University appears in Philip G. Gowenlock, *The LeTourneau Archive,* ed. Kerrie L. Gowenlock (Paddington, Queensland, Australia: Paddington, 1998), 2. A picture of the 1922 Gondola appears in Gowenlock, *LeTourneau Legend*, 4–5.

[60*] Compare the picture in Gowenlock, *LeTourneau Legend*, 4–5.

[61] *Mover of Men and Mountains*, 149. The six-month contract with Kaiser ended in August 1927. Then R.G. and Evelyn attended Biola in downtown Los Angeles (the acrostic title: **B**ible **I**nstitute **o**f **L**os **A**ngeles; now called Biola University, La Mirada, CA). Regular classes started September 12, 1927; evening classes on September 19.

[62] *Mover of Men and Mountains*, 138, 148–50. Cf. note 68.

[63*] "New Equipment and Trade Notes," *Western Construction News* 3 (October 25, 1928): 676. *Mover of Men and Mountains*, 152, says that R.G. built hopper wagons in Stockton for Kaiser's Fresno rail-yard job. Cf. the hopper wagons under construction the first "picture page" after page 122 in *Mover of Men and Mountains*.

[64] *Mover of Men and Mountains*, 150, 158, 160.

[65*] Gowenlock: *LeTourneau Legend*, 52, depicts the first production model, the eighteen yard U–18 of 1936. He built many telescopic scrapers, including some of his huge electric-wheeled machines of the 1960s. Cf. ibid., 248–62; Orlemann, *LeTourneau Earthmovers*, 106–13.

[66] "Unique Earth Mover in Use on Peninsula Highway," *California Highways* 4 (February 1927): 10.

[67] S.J. Sanders, "Construction Review: Highway Grading," *Western Construction News* 2 (June 25, 1927): 59.

[68] Roy Fellom, "Kaiser Paving Company Operates Large Industry at Livermore," *Pacific Street and Road Builder* 26? (June?/July? [1927]), 21. The photocopied article lacks both date and volume number. This is the June or July issue, because the plant was open seven weeks. Factory construction began in March 1927 (completed in early April?). "To Build Road Machinery," *Livermore [CA] Herald* (March 11, 1927): 2, says, "The Kaiser Paving Company is preparing for a new activity at its Livermore plant, a building is being planned as a factory to build road machinery. The project is being moved here from Stockton, where the machinery is now being manufactured."

[69] Sanders (1927), "Construction Review," 59.

[70*] Compare the cable-controlled scraper in Gowenlock, *LeTourneau Legend*, 16, with the 1927 Gondola at LeTourneau University. (Gowenlock, *LeTourneau Archive*, 2). The frame of the 1927 machine differed from R.G.'s earlier designs; the 1928 machine improved this new design. The two main innovations of the cable-controlled scraper over the 1927 Gondola were the patented cable control and an ejector (which dumped even sticky loads). It is important to note that the 1928 cable-controlled scraper did not infringe on any patents sold to Kaiser and that the points where it resembles the 1927 Gondola were not patentable features on either machine.

[71] Kaiser Paving Company, "[Bill of Sale]," to Andrew Maestretti, October 29, 1929, in Henry J. Kaiser Papers, Series 16: First Addition to the Henry J. Kaiser Papers, 1914–1968, Carton 297: Kaiser Paving Company. University of California, Berkeley. Bancroft Library.

[72*] S.J. Sanders, "Construction Review," 262–63, depicts the machine and has a short article about the job.

[73] *Mover of Men and Mountains*, 133, indicates that Maestretti bought the original 1922 Gondola.

[74] R.G. LeTourneau, "New Logging Machine," *NOW* 13 (March 15, 1959): [1–2], 186. A discussion of Damon Throop appears in note 86. Note 88 works with the difficulties of dating the visit by Mr. Throop.

[75] By itself, this argument is less than probative. However, it is suggestive, pointing to R.G. knowing that the Gondola no longer existed. Cf. the other (stronger) arguments.

[76] Thurston Walker, "Mr. R. G.'s #2 Electric Scraper," to Richard LeTourneau. September 24, 1969, [1], mentions the Mountain Mover's weight and his discussions with Harley Murray about shipment to Texas. As a heavy-hauler who transported it around San Joaquin County, Harley Murray would know its weight.

[77] Harold Hahn, telephone interview by Dale Hardy, February 10, 2004.

[78*] [Harley Murray], "Annotated Photograph of Mountain Mover," [no date]. Perhaps, other evidence will surface. It demise seems to be prior to 1959, because R.G., "New Logging Machine," [1] mentioned the Mountain Mover (as still existing). Unless the Gondola no longer existed, the expectation is that he would mention it.

[79] Nels Stjernstrom was R.G.'s personal assistant during the last five years of his life. Cf. Nels Stjernstrom, "Epilogue to 1967 Edition," 277–83, in R.G. LeTourneau, *Mover of Men and Mountains* (Chicago: Moody, 1967, 1973). Cf. also Nels Stjernstrom, "In Memoriam," 285–90, in R.G. LeTourneau, *Mover of Men and Mountains* (Chicago: Moody, 1973). Observe that neither of these addenda appear in the original (1960) edition.

[80] Medora Johnson, to Nels Stjernstrom, March 7, 1975.

[81] Medora Johnson incorrectly inferred from *Mover of Men and Mountains*, 132, that her museum's machine was the self-propelled scraper after being fitted with non-powered crawler tracks. She did not realize that R.G. built cable-operated five-bucket telescopics before building rack-and-pinion controlled five-bucket telescopics. His first patent application pertaining to a cable-operated five-bucket telescopic-scraper mechanism was on January 12, 1924 (for patent 1,530,779). He applied for a patent on the rack-and-pinion type of five-bucket telescopic scraper on December 25, 1925 (for patent 1,598,864). He seems to have built two machines on the first patent. The San Joaquin County Historical Museum's scraper embodies the second of these patents. At least one intervening design and, probably, at least two intervening machines separate that machine from the Mountain Mover.

[82] [Lloyd Molby], ATP Inc., "ATP, Inc. Projects: January 1974–October 31, 1974," [November(?) 1974], 1–4, lists thirty-seven projects (apparently arranged chronologically, by starting date) for the first ten months of 1974. As the thirty-fifth of thirty-seven projects, the Mountain Mover project was apparently in the early stages.

[83] [Lloyd Molby], ATP Inc., "Project Backlog," (November 1, 1974), [1]. Ten projects (2, 18–19, 23–24, 27, 32, 34–36) were ahead of the 1927 scraper. Also, Charles Able, "Dirt Mover Is Located," says, ". . . Molby says he is amazed at the vast strides in improving the machine [the 1927 Gondola versus the 1922 Mountain Mover]."

[84] "Harold Hahn interview," February 8, 2004.

[85] "Hahn interview," July 19, 2004. Specifically, he recalled jobs on which both "Andy" and "Smoke" Maestretti operated a pair of the 1927 Gondola scrapers.

[86*] *Mover of Men and Mountains*, 123, "The machine [the Gondola] was nearing completion when, one scorchingly hot July day, Mr. [Damon R.] Throop, a former designer and maker of scrapers, came out to see what I was doing." Just for the record, Throop had designed various products for Schmeiser, before leaving that company. He applied in 1918 for patent 1,330,359, a large scraper, while working for Schmeiser in Davis, CA. He moved to Stockton, where he designed and built small scrapers for wheel tractors. He lived in Stockton, when he applied for patent 1,806,959 and when J.M. Conley assigned patent 1,438,362 to him (1922). A Fordson pulling a Throop leveler appears in H.C. Shaw Company's ad in *Stockton Daily Evening Record* (June 24, 1922): 11. (Notes 87–89 show that Throop probably came on a cooler day (not a hot one) to see R.G. finishing the Gondola.

[87*] A picture of the Gondola appears in "This Year's Fair Building Program Now Under Way," *Stockton Daily Evening Record* (July 15, 1922), 13. The accompanying article says, "Two Caterpillar tractors and a scraper have been at work since the first part of June building up the new half-mile track, and part of the time there have been three tractors on the job. It will be completed in another week." Notes 92–93, 95 (below) show that the job went beyond the racetrack. R.G. subcontracted under Ira Guy's contract (awarded May 24, 1922). A June 14 article speaks of three tractors working. R.G. may worked on this job from late May to late July. The fair opened in late August, but R.G., "Personal Data," dates the job in September. His 1922 dates are less precise than for other years.

[88*] *Mover of Men and Mountains*, 123, dates its completion in July 1922, but two items point to an earlier date: (1) A picture of the Gondola appears on July 15, 1922, in "Fair Building Program," 13, in regard to various capital improvements at the fair (the horseracing track was one aspect of R.G.'s subcontract to Ira Guy's earthmoving contract). Cf. also *Stockton Daily Evening Record* (August 26, 1922): 14, which mentions that LeTourneau exhibited it at the fair. (2) R.G. first applied for a patent on the Mountain Mover on July 13, 1922.

Perhaps, June's unusually warm weather seemed like July. Having lived from 1961–73 in Stockton, the present author remembers a few times that June was unseasonably hot (resembling July or August). 1922 was such a year. The July 8, 1922, *Stockton Daily Evening Record*," entitled an article: "Hot Weather Has Been Aid to Most Crops," 11. It says, "No serious damage was reported as a result of the warm weather the last half of June." R.G. recalled meeting Throop on a hot day. The day he started building the Gondola was also hot, "I was leveling land for an irrigation project in Central California when one blistering hot afternoon an idea for a new scraper hit me like a sunstroke. Mindful of the old German's warning that an unfinished machine never works, I started construction on the scraper that night, not even delaying to draw up plans."

Chronology for this part of 1922 is difficult. The Mountain Mover must have been built in late June. Specifically, R.G.'s first patent application was July 13, 1922. Mail from Stockton to Washington DC would take four days by train. The lawyer needed to ask R.G. about his idea, write up the patent in legal language, prepare drawings, and get R.G.'s witnessed signatures. Prior to seeing the lawyer, R.G. actually built the Mountain Mover. This seems to require a late-June completion. It seems that it much hotter when he built the Mountain Mover, than for the Gondola. Fresno records [similar to Stockton] show only one day from June 15th and 30th being less than 90°. About half of the days were 100° or higher, one was 110°, while the warmest day from June 7–14 was 82°. Late June 1922 interspersed days of July-like heat with less oppressive temperatures. R.G. linked the Gondola with a July heat-wave, but the Mountain Mover was built in the June heat wave, not the Gondola. Did Throop come on a hot day (seeing the Mountain Mover) or a cooler one (seeing the Gondola)? Apparently, Throop came on a cooler day.

[89] LeTourneau, "Personal Data," [1], dates San Joaquin County fair's racetrack job as September 1922. However, as notes 87–88 (above) indicate, the Gondola was operating prior to July 15, 1922. Furthermore, the fair started in late August, so the preparatory earthmoving could not extend into September. R.G.'s chronology errs here.

[90] *Mover of Men and Mountains*, 125.

[91] *Mover of Men and Mountains*, 37–38, 125.

[92] Two articles show that Ira Guy won a contract at the fair: (1) "High Bids Are Submitted for Fair Buildings," *Stockton Daily Evening Record* (May 23, 1922): 14, "Ira D. Gun [*sic*, should be Guy] bid $3376.65 for grading for the horse barns." (2) "$58,000 Contract Let for Work at Fair Grounds," *Stockton Daily Evening Record* (May 24, 1922): 4, "Ira D. Gray [*sic*, should be Guy] was awarded the $3376.65 contract for grading the ground on the site of the proposed horse barns." These show that Ira D. Guy was the bidder, even if the *Record* misspells his name twice. Three factors show that this is Ira Guy: (1) Ira is not a common name, (2) misspelling the name twice argues for sloppy typesetting or for a reporter's carelessness, (3) the man is a contractor with whom R.G. affiliated. *Mover of Men and Mountains*, 92–132, uses Ira Guy's name often, showing that they did associate at this time.

[93] The article, "Construction Started Today on Three Fair Ground Betterments," *Stockton Daily Evening Record* (June 14, 1922): 14, does not say that the contract includes putting a half-mile track inside the one-mile track, but mentions the existing track and three tractors, "For several days three tractors have been raising and leveling the site for the horse barns. In preparing the site it has been necessary to move about 10,000 yards of dirt. The site selected for the horse barns is the northwest corner of the 40-acre tract recently deeded to the association by the state and adjoins the southwest corner of the original fair grounds. The site is low, and each winter for a number of years has been covered with water for several weeks at a time. Striving to keep as much distance as possible between the barns and the fair grounds as possible, W. L. Douglas, manager of the county fair association, decided that by filling in a portion of this low area a splendid location for the buildings will be created. Subsequently, the three big tractors were set to work and today the site has been raised to a level equal to that of the race-track."

[94] "County Fair Scenes at Agricultural Park," *Stockton Daily Evening Record* (August 26, 1922): 14, "The photo was taken by Photographer V. Covert Martin from Aviator F. W. Farris' airplane. It gives a birdseye view of the grounds and shows the new half mile track for running races within the mile oval." Picture quality is poor, but it mentions the racetrack, the part of the contract which *Mover of Men and Mountains*, 36–38 and 125, discusses. A better picture appears in Luisa Nella, *Our Fair 1860–2000: An Illustrated History of the San Joaquin County Fair* (N.p.: Eureka, CA, 2000), 114.

[95*] "This Year's Fair Building Program Now Under Way," *Stockton Daily Evening Record* (July 15, 1922), 13, "Two Caterpillar tractors and a scraper have been at work since the first part of June building up the new half-mile track. . . ." Ira Guy won the contract in late May. He first graded for the horse barns, so the carpenters could complete their work on time. Work on the racetrack itself began in June.

[96] If R.G applied for a patent on the Gondola, the patent office did not grant it. July 13, 1922, marks his first successful patent application (for the Mountain Mover), so the reporter may mean that R.G.'s first patent application was in Percy Webster's hands.

[97] "Fair Grounds Busiest Place in Community," *Stockton Daily Evening Record* (July 8, 1922), 11.

[98] The fifth article connects R.G. with this work: "Large Exhibits of Implements at County Fair," *Stockton Daily Evening Record* (August 26, 1922): 14.

[99] "Construction Started Today," 14. "High Bids for Fair Buildings," 14, establishes that the contract mentioned in the quote relates to new buildings, "The lowest of the five bids submitted was by Uhls and Van Tils of Ripon for $77,500. This was about $25,000 in excess of the architects' estimate. The work promised includes horse barns, cattle barns, hog corrals, additions to the grandstand, levelling [sic] and grading, and new wire fences." Although the bid includes leveling and grading, the same article (cited above in note 92) indicates that Ira Guy's contract involved the heavy grading in preparation for the building contractor starting.

[100] "New Logging Machine," [1–2], 186. The present writer would be uncomfortable with any suggestion that the Gondola was built in 1921. He recalls a few month gap between the machines, not a whole year. Furthermore, the Gondola was almost new when he used it at the fair, so it was a 1922 machine.

[101*] R.G. LeTourneau, Stockton, CA, Patent 1,512,614, United States Patent Office, "Scraper and Spreader, filed by Percy Webster, October 21, 1924.

[102] Carlton Case was LeTourneau's contract attorney, but Percy Webster's Stockton-based firm handled R.G.'s patents until the May 1, 1953, sale to Westinghouse. Case's advice to R.G. was not self-serving, since he was not a patent attorney. The patent firm listed on R.G.'s patents changed in 1953.

[103] *Mover of Men and Mountains*, 125. The U.S. Patent Office only retains the filing documents for rejected applications for twenty years. Thus, it is unclear whether he applied for patents on the Gondola. However, R.G.'s account of the talk with Carlton Case implies that it was prior to his first patent application. Since "Fair Grounds," 11, indicates that R.G.'s first patent application was before July 8, 1922, the "demonstration" mentioned by *Mover of Men and Mountains* occurred before the fair opened. Thus, Case advised securing patents at least two months before R.G. spoke with George Harris of Harris Manufacturing Company. *Mover of Men and Mountains*, 125, makes it seem that both talks were at the fair. The one with Carlton Case was earlier.

[104*] Some Schmeiser scrapers had a small floor (cf. patent 1,150,459); others had no floor.

[105] R.G. LeTourneau, "R.G. LeTourneau Talks about New Machines," *NOW* 7 (November 15, 1953): n.p.

[106] The easiest way to describe a semi-drag scraper is in contrast with a carryall. In 1932, R.G. built his first production carryall scrapers. Such scrapers have a front apron that (when closed) contacts the cutting edge. A closed apron keeps the whole load in the scraper, regardless of travel speed. By contrast, semi-drag scrapers attain maximum hourly yardage by dragging the full scraper's cutting edge on the ground (as with a full-drag scraper). Although the semi-drag scraper can haul a larger payload, its travel speed is no faster than that of a full-drag scraper.

Later, he invented the Tournapull, because higher hauling speed raises efficiency. The Tournapull is a logical development for carryalls (which retain their loads at high speed), but makes no sense for a semi-drag design.

[107*] *Mover of Men and Mountains*, 122–23, "Between and in front of the [Gondola's] wheels I swung from the frame a scoop-shaped bucket 12 feet wide by four feet deep and four feet high. Loaded to capacity, it held six cubic yards." Gowenlock, *LeTourneau Legend*, 4–5, shows the Gondola's non-rectangular sides. *Mover of Men and Mountains*, 124, refers to part of its effective six-yard load resting in the bucket and dragging part in front, "Even when semi-dragging a six ton load [with the Gondola], my aging tractor could move along just twice as fast as when it was dragging a four-yard mass of tumbling earth. I could carry a third again as much per trip and make twice as many trips."

[108] *Mover of Men and Mountains*, 128.

[109*] LeTourneau, patent 1,470,853, 1.

[110] Shearing effort is a one-to-one function of bowl-width. Unfortunately, twelve feet was the maximum transport width (*Mover of Men and Mountains*, 128).

However, increasing bowl-length or bowl-height affect power-requirements exponentially (affecting two dimensions). As mentioned in the paper, dirt slides across the floor until hitting the back of the bowl. It then goes upward and forward. The motion can be compared to a snowball. A point is reached when the tractor cannot keep the ball of dirt rolling. Thus, the tractor may not fill a bowl that is too high or too deep. Tractive limits complicated any enlargement.

[111] *Mover of Men and Mountains*, 128.

[112*] LeTourneau, "Patent 1,470,853," 2, "After the inner scoop has received its full load, according to the judgment of the operator, the scoop is gradually drawn back as the machine continues its forward movement, allowing the incoming dirt to pile up against and ahead of the first load without having to forcibly push back or surmount the latter in order for it to be accommodated in the scoop." Compare the patent drawings.

[113*] An October 17, 2002, email from Caterpillar historian, Eric C. Orlemann to John H. Niemelä, says that only one Holt 75 was shipped from the factory in 1923. It is not clear at this time whether R.G. bought a machine produced in 1922 or whether he purchased the lone 1923 Holt 75. Gowenlock, *LeTourneau Legend*, 6, pictures this machine. Pictures of Larry Maasdam's comparable (1921) 4000 Series Holt 75 appear in Keith Haddock and Eric C. Orlemann, *Classic Caterpillar Crawlers* (St. Paul, MN: MBI, 2001), 18; and Eric C. Orlemann, *Caterpillar Chronicle: The History of the World's Greatest Earthmovers* (Osceola, WI: MBI, 2000), 15.

[114] LeTourneau, "Patent 1,470,853," 1, ". . . there is no difficulty in hauling such a load when once scraped."

[115*] *Mover of Men and Mountains*, 129, "When the upper [e.g., the inside] bucket was full and presenting an eight-ton resistance to taking on any more dirt, I released a catch. Back it rolled on oiled tracks, easily pushed to the rear by the dirt entering the bottom [e.g., the outer] bucket. In good going, with 16 tons in the buckets, I could still scrape another four tons ahead in the conventional manner [of using a full-drag scraper], giving me a load of 20 tons with very little spill." The drawings for LeTourneau, Patent 1,512,614, depict steel plates (item 21) for retaining the dragged portion of the load. Figures 1 and 3 in those drawings show the side plates as independent of the bucket.

[116] R.G. LeTourneau, Stockton, CA, Patent 1,470,853, United States Patent Office, "Scraper," filed by Percy Webster, October 16, 1923, 2.

[117] Robert H. Selby, "Appendix I," in "Earthmovers in World War II: R. G. LeTourneau and His Machines" (Ph.D. dissertation: Case Western Reserve University, 1970), 418–26, lists 298 patents. His compilation differs slightly from serial-number-plate lists (which include a few patents that were licensed or purchased from other companies). Selby only lists those where R.G. was the patentee, co-patentee, or assignee.

[118*] The 1923 self-propelled scraper was the last of these machines. Its frame was not suitable for road construction work. Cf. picture in Gowenlock, *LeTourneau Legend*, 8–9. A recent picture of the Mountain Mover appears in Orlemann, *LeTourneau Earthmovers*, 13.

[119] Prior to 1960 the Mountain Mover gained a gooseneck hitch, increasing maneuverability. See note 15.

[120] E.g., "Rubbing to Rubber," 3; "Scrapers from '22 to '44," *NOW* 8 (January 7, 1944): 4.

[121] R.G. was 33 years old in the summer of 1922. Ray Peterson was 20, and Howard was 16. Ray and Howard joined R.G. in 1921 (*Mover of Men and Mountains*, 99–100, 118). Eph Hahn began around then. The employees set grade-stakes, operated equipment, and helped with equipment design, construction, and repair. In 1923, *Mover of Men and Mountains*, 133, he had a crew of about a dozen, "[R.G.,] Eph Hahn, Ray Peterson, and about nine others." This crew operated, repaired, and built machines. The use of more than one tractor provided funds for designing and building new machines. R.G. credits Ray with direct involvement in designing equipment starting with the Gondola (*Mover of Men and Mountains*, 122). Harold Hahn, telephone interview by Dale Hardy, February 10, 2004, indicates that Eph Hahn did much of the brazing on the Mountain Mover (which he later bought). Howard Peterson (then age 16) was part of the team that built the Mountain Mover. He assisted Eph (who called him his "grease monkey").

[122] This assumes the validity of earlier proofs that the Gondola at LeTourneau University is a 1927 machine.

[123] The Tournapull enhanced scrapers' competitive edge against power shovels. Crawler tractors teamed with scrapers displaced many shovels, so the Tournapull represented an even greater threat.

[124] Harold F. Williamson and Kenneth H. Myers, II, "Appendix V–G: Bucyrus-Erie Company Shipments and Earnings by Major Product Categories, 1928–1939," *Designed for Digging: The First 75 Years of Bucyrus-Erie Company*, Northwestern University Studies in Business History, vol. 2 (Evanston, IL: Northwestern University Press, 1955), 366.

By contrast with B-E's declining revenues, LeTourneau manufacturing sales for a similar period increased from $110,808.60 in 1930 to $379,106.83 in 1933 (1930 is the first full year as a corporation and is the first year with published sales figures). A 1934 agreement with Caterpillar resulted in its dealers selling LeTourneau equipment. The sales figures continued to grow rapidly (Cf. "President's Annual Report to Stockholders of R.G. LeTourneau Inc., Peoria, Illinois, U.S.A., for the Year Ending Dec. 31, 1939," 4). Then, World War 2 created an unprecedented demand for LeTourneau machines. Selby, "Earthmovers in World War II," is a single reference that includes sales figures from 1929–1946. Cf. ibid., 100 (1930–35), 114 (1935–39), 143 (1938–41), 161 (1930–35), 392 (1943–46) for these figures.

[125] Williamson and Myers, *Designed for Digging*, 232.

[126] Williamson and Myers, *Designed for Digging*, 345, n. 9 for chapter 20, "W.K. Fawcett, 'Heavy Earth Moving Equipment (Such as Le Tourneau and Others)' (May 29, 1934)." Thus far, the present author has not secured a copy of this report, though it was accessible to Williamson and Myers fifty years ago.

[127] Williamson and Myers, *Designed for Digging*, 232.

[128] Williamson and Myers, *Designed for Digging*, 232–33.

[129] Williamson and Myers, *Designed for Digging*, 233–34.

[130] Williamson and Myers, "Bucyrus-Erie Company Shipments," in *Designed for Digging*, 366.

[131] Williamson and Myers, "Appendix V–G: Bucyrus-Erie Shipments," 366, indicates that Tractor Equipment contributed $1,088,000 out of $11,977,000 in manufacturing sales in 1939.

[132] Williamson and Myers, *Designed for Digging*, 319.

[133] *Mover of Men and Mountains*, 3. Caterpillar is the only one of these companies still building scrapers.

[134] "Highway Bid Prices Up," *Engineering News Record* 157 (December 6, 1956): 109.

[135] Selby, "Earthmovers in World War II," 34.

[136] Selby, "Earthmovers in World War II," 150–51, refers to a chart (ibid., 116), in which 1935 LeTourneau sales to the government totaled $102,833. It increased to $382,820 by 1939. Both figures are about 5% of total sales ($2,004,595 in 1935; $7,731,324 in 1939).

[137] Selby, "Earthmovers in World War II," 150–51.

[138] "LeTourneau Band Welcomes Gen. Wheeler," *NOW* 10 (November 2, 1945): 6. Wheeler's speech was on October 25, 1945. Each tractor cost more than the earthmoving equipment attached to it. LeTourneau and LaPlant-Choate made attachments for Caterpillar tractors. Other manufacturers supplied attachments for International, Allis Chalmers, and Cletrac. *Mover of Men and Mountains*, 3, says that LeTourneau built "over fifty percent of the earthmoving equipment in combat." Earthmoving equipment here excludes the bare crawler tractor. It only refers to Tournapulls or attachments for tractors: dozers, scrapers, rooters, rollers, etc. Although the military bought attachments from other companies (e.g., Baker, Bucyrus-Erie, Gar Wood, Heil, LaPlant-Choate, and Wooldridge), the Caterpillar-plus-LeTourneau combination was particularly prominent.

Tractors Plus Attached Earthmoving Equipment		
1. Caterpillar Tractors		2. Other Crawler Tractors
x = LeTourneau	y = LaPlant-Choate	z = Other Attachment Makers

Now, LeTourneau made over 50% of earthmoving equipment. The following describes this: $x > (y + z)$. This was a function of production capacity and quality of products by both LeTourneau and Caterpillar. Performance was an essential element of Caterpillar-LeTourneau becoming the preferred combination.

[139] Selby, "Earthmovers in World War II," 416–17.

[140] *Mover of Men and Mountains*, 3.

[141] See note 117 (above).

[142] "How the Scraper Began," *Western Construction* 38 (August 1963): 41–46.

[143] Ibid., 41–45.

[144] Ibid., 46.

[145] Ibid., 46.

[146] Ibid., 46.

[147] Reynold M. Wik, *Benjamin Holt: Tracks and Combines* (St. Joseph, MI: American Society of Agricultural Engineers, 1982), 15, describes the Glenn Ranch of Colusa County, CA, with 66,000 acres in wheat in 1880. During the Bonanza Wheat era a few landowners owned most California farmland. They could not afford irrigation works for such large tracts, so dry-land wheat predominated.

[148] Wik, *Benjamin Holt*, 18.

[149] This is not the place to consider why these ranches failed. However, newly-formed irrigation districts raised taxes on some bonanza lands in level areas. As California's wheat acreage decreased, steeply sloped areas of the Pacific Northwest attracted many growers. (Such fields will never be irrigated) As wheat moved north, the average size of California ranches decreased, the number of ranches increased, and irrigated acreage increased.

[150] R.G. did land leveling work in Sacramento, San Joaquin, Stanislaus, and Sutter counties in 1920–23 (Drawn from Gowenlock, *LeTourneau Legend*, 38–39. This convenient list resembles LeTourneau, "Personal Data Sheet," [1], but is published. R.G.'s chronological recollection is helpful, but less precise than a daily journal). Figures for 1909 and 1919 derive from U.S. Bureau of the Census, *Fourteenth Census of the United States Taken in the Year 1920*, vol. 7, *Irrigation and Drainage* (Washington DC: Government Printing Office, 1922), 139, 142–45. U.S. Bureau of the Census, *Fifteenth Census of the United States: Irrigation of Agricultural Lands* (Washington DC: Government Printing Office, 1932), 93, 96–97, supplies 1929 figures. R.G. leveled land in Sacramento, San Joaquin, Stanislaus, and Sutter counties during 1920–23, a time when irrigation expanded.

COUNTY	**ACRES IRRIGATED**			**PERCENTAGE INCREASE**		
	1909	**1919**	**1929**	**1909 to 1919**	**1919 to 1929**	**1909 to 1929**
Sacramento	53,683	72,960	98,667	36%	35%	84%
San Joaquin	59,811	183,923	281,629	208%	53%	371%
Stanislaus	84,015	197,249	241,712	135%	23%	188%
Sutter	1,173	47,305	98,771	3,933%	109%	8,320%
Subtotal	198,682	501,437	720,779	152%	44%	263%
State	2,664,104	4,219,040	4,746,632	58%	13%	78%

[151] Such tractors became part of California agriculture, when Benjamin Holt first tested his experimental steam crawler near Stockton on November 24, 1904.

[152] O. H. Barnhill, "Land Leveling Aiding Crop Yields," *Stockton Daily Record* (September 27, 1930): 34.

[153] The telescopic design would not work with rivets. Brazing (and later welding) allowed superimposing telescopic buckets. Cf. *Mover of Men and Mountains*, 128. Of course, R.G.'s use of welding meant that his equipment testified to that process. The Mountain Mover's impact goes far beyond the earthmoving industry itself.

[154] *Mover of Men and Mountains*, 141ff.; Grafton, *Peterson Tractor*, 5. These accounts of their meeting differ slightly, but Kaiser saw that R.G.'s machines made dirt fly (*Mover of Men and Mountains*, 144–45). An earlier dam there failed (possibly because of frozen fill). Cf. Robert Colby, "Philbrook Dam: Where Giants Made History," *Tales of the Paradise Ridge* 42 (June 2001): 7. Curry Dam (the size of Philbrook) had taken him two seasons (September 1924–January 1926), so Kaiser needed to speed up the job. Cf. A. Kempkey, "The Gordon Valley Dam," *Western Construction News* 2 (May 25, 1927): 49–51. Maintaining Philbrook's fill over winter would be costly, because it is in snow country. Philbrook only took four months with four telescopics plus other equipment. The subtitle for "The Philbrook Earth-Fill Dam for the Pacific Gas & Electric Co," *Western Construction News* 1 (January 10, 1927): 38, says, "By Concentration of all Equipment Possible, Contractor Completes Dam Before Winter Interrupts Work." The article (ibid., 39), says, "One of the interesting features of this job is that the contractor used an unusual amount and variety of equipment, the total value of which (new) was over $150,000, whereas the contract amounted to only $220,000. The contractor put more equipment on this job was ordinarily used in order to complete the same before winter and resuming work in the spring would have been excessive."

[155] "Unique Earth Mover in Use on Peninsula Highway," *California Highways* 4 (February 1927): 10.

[156*] *Mover of Men and Mountains*, 138. This was not his earliest version of five-bucket track-mounted telescopic scrapers. "Earthmoving from Rubbing to Rubber," *NOW* 10 (December 14, 1945): 33, shows the earlier cable-operated version. Since R.G. mounted his first bulldozer in 1926 on a Best tractor (*Mover of Men and Mountains*, 139; pictured in Gowenlock, *LeTourneau Legend*, 12), the push-type telescopic scraper did a function that dozers later performed, filling deep ravines on the 1925 Valley Springs, CA, railroad job (cf. *Mover of Men and Mountains*, 138). Presumably, by reversing the yoke, he made it a towed scraper.

[157*] A picture of the latter scraper appears in Leffingwell, *Caterpillar Dozers*, 122.

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Bibliographic Notes

[1] The earliest complete issue known to the present author is November 1929. Issues of this journal do not give publication data (other than naming the journal) after the front cover. Volume numbers are irregular. The article says the plant opened seven weeks earlier. Was it seven weeks before: (1) visiting, (2) writing, or (3) publishing?

[2] *Western Construction News* used dual pagination in 1930. The “feature-articles” section (my characterization) used one system of page- numbering, while the “regular-columns” used another. This article is on pages 262–70 of “feature articles” plus page 46 of “regular columns.” Oddly, page 46 follows page 270.

[3]* The picture (showing the Mountain Mover working in California) has a June 1966 processing date. The question is whether this date is when the film was first processed or when additional prints were made. In other words, it indicates that the picture was not later than June 1966. The picture depicts it moving dirt, so the picture probably was taken prior to June 1966.

[4] The attorney’s signature appears to say “Knowles.”

[5] The attorney’s signature appears to say “G.H.”