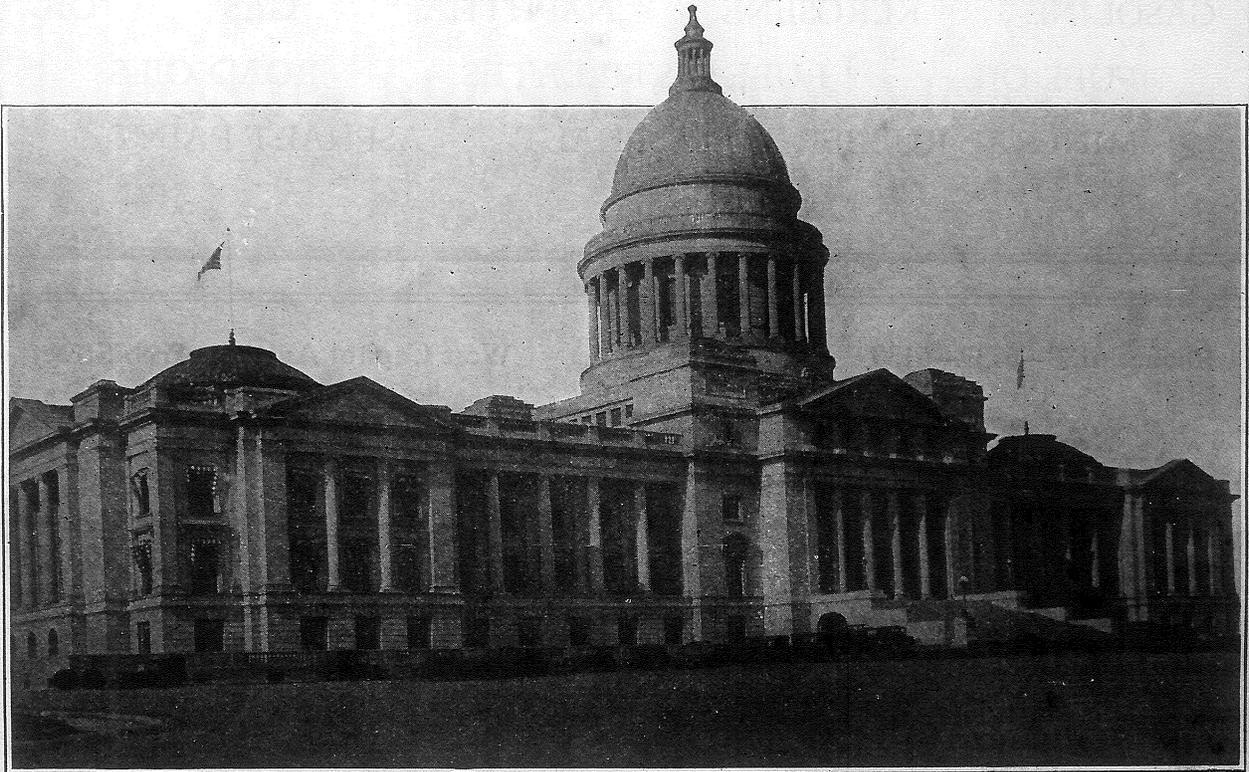


ARKANSAS HIGHWAYS

The Official Magazine of the Arkansas
State Highway Department, Little Rock



STATE CAPITOL BUILDING, LITTLE ROCK, ARKANSAS

Vol. 4

August • 1927

No. 8

Lion Oil Refining Company

El Dorado, Arkansas



Producers Refiners Marketers

of

GASOLINE	KEROSENE	NAPHTHA	GAS	OIL
FUEL OIL	LUBE DISTILLATES		ROAD OILS	
MINERAL RUBBER	ASPHALT	ASPHALT PAINT		

Phones 6138—6139—6130

West Capitol Ave. At Arch Street

Ford

CARS, TRUCKS AND TRACTORS

PARTS ACCESSORIES SERVICE

FORDSON TRACTORS

Contractors' and Road Builders' Equipment

FREEMAN & FREEMAN, Inc.

LITTLE ROCK, ARK.

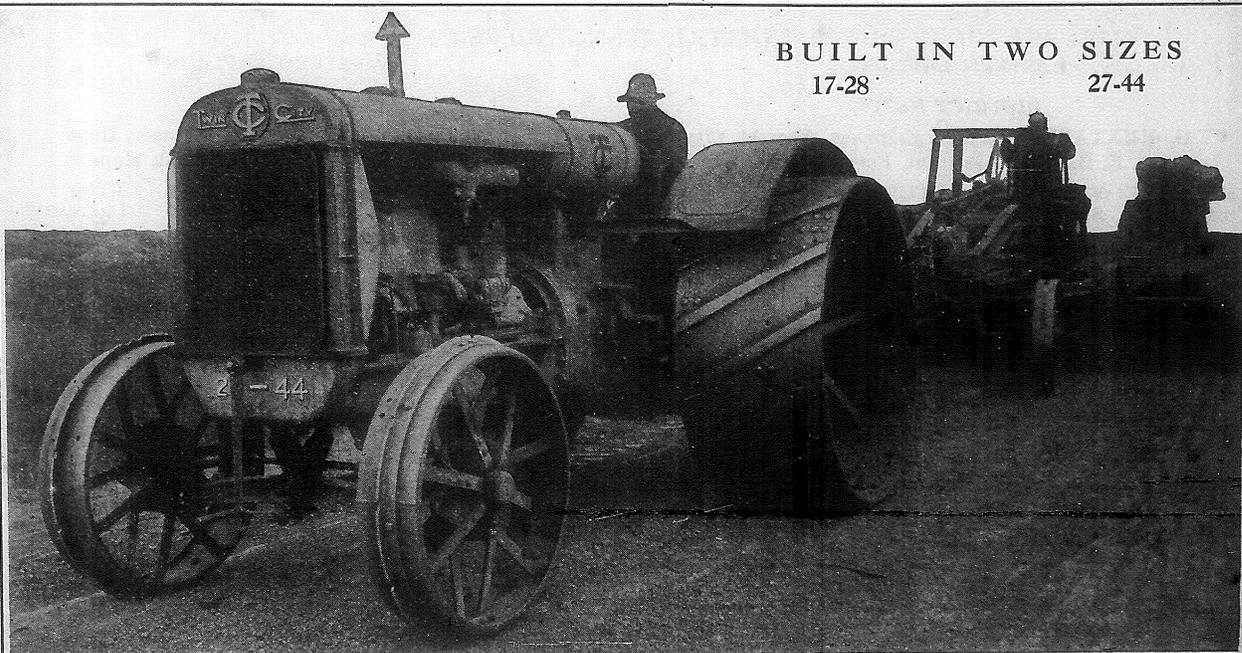
We Handle

Good Equipment and
Good Supplies for Building
Good Roads

Property of the
ARKANSAS HISTORY COMMISSION
STATE CAPITOL
Little Rock, Arkansas

FONES BROS. HARDWARE CO.

LITTLE ROCK, ARK.



BUILT IN TWO SIZES
17-28 27-44

"ROYALTY OF THE ROAD"

WIEMAN & COMPANY, *Distributors*

Stuttgart, Arkansas

ARKANSAS HIGHWAY ORGANIZATION

DWIGHT H. BLACKWOOD, Chairman

STATE HIGHWAY COMMISSION

DWIGHT H. BLACKWOOD, Chairman.....	Little Rock
J. L. WILLIAMS, Member.....	Osceola
SAM J. WILSON, Member.....	Portland
JUSTIN MATTHEWS, Member.....	Little Rock
J. S. PARKS, Member.....	Fort Smith
E. C. D'LETTER, Secretary.....	Little Rock

GENERAL OFFICE

C. S. CHRISTIAN, State Highway Engineer.....	Little Rock
V. A. KLEIBER, Chief Clerk and Auditor.....	Little Rock
BELVA MARTIN, Deputy Land Commissioner.....	Little Rock
A. V. DENNY, Chief Deputy, Auto Division.....	Little Rock
E. W. SMITH, Cashier.....	Little Rock
J. Q. BLACKWOOD, Purchasing Agent.....	Little Rock
B. F. WILLIAMS, Assistant Purchasing Agent.....	Little Rock
W. A. ROSS, Traffic Manager.....	Little Rock

ENGINEERING DEPARTMENT

E. N. JENKINS, Assistant Highway Engineer (Eastern Division).....	Pine Bluff
W. W. MITCHELL, Assistant Highway Engineer (Western Division).....	Fort Smith
W. W. ZASS, Construction Engineer.....	Little Rock
N. B. GARVER, Bridge Engineer.....	Little Rock
J. A. FRANCIS, Equipment Engineer.....	North Little Rock
C. W. HOLDERBAUM, Maintenance Engineer.....	Little Rock
E. H. FLANERY, Office Engineer.....	Little Rock
R. D. LIKINS, Engineer Materials and Tests.....	Little Rock
C. B. PENDERGRAFT, Chief Draftsman.....	Little Rock

DISTRICT ENGINEERS

EASTERN DIVISION

DISTRICT No. 1

W. G. HUXTABLE, District Engineer, Forrest City			
J. E. BLACK, Assistant, Forrest City			
Crittenden	Woodruff	Lee	Phillips
Cross	St. Francis	Monroe	

DISTRICT No. 2

A. S. MADDING, District Engineer, Pine Bluff			
JAS. B. LEIGH, Assistant, Pine Bluff			
Arkansas	Lincoln	Drew	Chicot
Jefferson	Desha	Ashley	

DISTRICT No. 6

A. W. BUFORD, District Engineer, Little Rock			
W. A. STANTON, JR., Assistant, Little Rock			
Faulkner	Lonoke	Saline	Hot Spring
Montgomery	Prairie	Garland	Grant
Pulaski			

DISTRICT No. 7

L. R. PLEMMONS, District Engineer, Camden			
J. O. JONES, Assistant, Camden			
Dallas	Ouachita	Bradley	Union
Cleveland	Calhoun	Columbia	

DISTRICT No. 10

SHELLY LEE, District Engineer, Jonesboro			
WEBSTER TURNER, Assistant, Jonesboro			
Randolph	Greene	Craighead	Poinsett
Clay	Lawrence	Mississippi	

WESTERN DIVISION

DISTRICT No. 3

M. H. BREWER, District Engineer, Hope			
EARL FERGUSON, Assistant, Hope			
Clark	Sevier	Hempstead	Miller
Pike	Little River	Nevada	LaFayette
Howard			

DISTRICT No. 4

W. T. BARRY, District Engineer, Fort Smith			
F. L. KIRK, Assistant, Fort Smith			
Benton	Crawford	Sebastian	Polk
Washington	Franklin	Scott	

DISTRICT No. 5

CONE MURPHY, District Engineer, Batesville			
L. A. ROBY, Assistant, Batesville			
Fulton	Sharp	Independence	Jackson
Izard	Stone	Clebune	White

DISTRICT No. 8

H. C. SELLERS, District Engineer, Russellville			
CARL BURKETT, Assistant, Russellville			
Johnson	Logan	Conway	Perry
Pope	Van Buren	Yell	

DISTRICT No. 9

F. E. COKER, District Engineer, Harrison			
C. L. CUTLER, Assistant, Harrison			
Carroll	Marion	Madison	Searcy
Boone	Baxter	Newton	

ARKANSAS HIGHWAYS

*Official Monthly
Magazine*



*State Highway
Department*

"Arkansas Highways" is edited in the offices of the Highway Department at Little Rock. Communications relative to advertising or articles and photographs submitted for publication should be sent to Bryan Lancaster, Editor, care Highway Department, Little Rock. The bulletin is sent free to State and County Officials, newspapers of the State and Road Commissioners who apply for it. Permission to reprint any matter contained in *"Arkansas Highways,"* with proper credit, is granted to all newspapers of the State.

VOL. IV.

AUGUST, 1927

No. 8

THIS IS YOUR BUSINESS

By DWIGHT H. BLACKWOOD, State Highway Commissioner

It has proven a very pleasant experience, my getting out in the various districts of this State and mixing with the people, talking with them about their roads and those they want, and perfecting plans for carrying out the building program.

Strange to note, there has long been an idea, seemingly growing out of claims of highway commissioners that they, the commissioners, were building the roads in Arkansas. I have always maintained that it is the people who are building roads, and it is with the people that I have been visiting and discussing their local problems. I am glad to learn that this attitude pleases the people, and I hope that a wider knowledge of the Highway Department's desire for co-operation and to give co-operation will result in a similar response from the public in all sections of the State that has been manifested where the visits have been made.

The Highway Commission to a man and every individual in the Department all feel the same way about this matter. We all realize that the people have us on the job to take care of their road building, and we are going to measure up to your fullest expectations.

Total Of Two Million Involved In Proposals To Be Let At August Meeting

Bids on State highway and bridge construction work to cost approximately \$2,500,000, will be received by the State Highway Commission when it holds its monthly meeting August 30th.

Work will be started on the new projects, on 28 of which contractors have been asked by Highway Commissioner Dwight H. Blackwood, to submit sealed bids, as soon as possible after the bids can be opened and tabulated and contracts awarded the low bidders, Mr. Christian said.

The new projects, the engineer said, will bring the cost of highway projects under construction as a part of the program provided under the Martineau Road Act to more than \$5,000,000.

TWO MILES OF BRIDGES

Of a total of 190 miles of construction covered in the jobs, for which bids will be received Tuesday, slightly more than two miles represents bridges. The remainder is highway construction of one kind or another.

Bridge work includes the concrete sections of the new Harahan viaduct, the concrete substructure and approach spans of the new Dardanelle bridge, and the new concrete and steel bridge over the St. Francis river at Marked Tree.

The highway work will include extensive repair work on the parts of the Little Rock-Hot Springs highway between Benton and Hot Springs and 18.25 miles of concrete surfacing on the Magnolia-El Dorado road.

CONTRACTS TO BE AWARDED

The individual jobs on which bids have been asked, listed according to the commission's project number, their location by town and county, the length in miles or feet, and the type of work, follow:

No. 716, Warren-Hermitage, Bradley County, 13.50 miles, grading and minor structures.

No. 707, Thornton-Hampton, Calhoun County, 364 feet, steel and concrete bridges.

No. 1016 (Federal Aid project No. 238-A), Corning-Piggott, 1.47 miles, grading and gravel surfacing.

No. 1017, Corning-Piggott, 9.536 miles, grading and minor structures.

No. 501, Heber Springs-Edgemont, Cleburne County, 8,899 miles, grading and minor structures.

No. 802, Cypress Creek, Conway County, 93 feet, steel and concrete bridge.

No. 1015, Lake City-Leachville, Craighead County, 3,038 feet, grading, minor structures and gravel surfacing.

No. 402, Alma-Mulberry, Crawford County, 8,967 miles, burt shale surfacing.

No. 102 (Federal Aid No. 300-9-11), Harahan viaduct, Crittenden County, 4,200 feet, concrete structures.

No. 120, Wynne-Harrisburg, Cross County, 15.181 miles, gravel surfacing.

No. 515, Newport-Grubbs, Jackson County, 1,180 feet, untreated timber bridge.

No. 331, Lewisville-Bradley, Lafayette County, 11 miles gravel surfacing.

No. 1101, Mansfield-Waldron, Logan and Scott counties, 274 feet concrete structures.

No. 803, Charleston-Paris, Logan County, 9.671 miles grading and minor structures.

No. 332, Ashdown-Ogden, Little River County, 7.469 miles gravel surfacing.

No. 900, Yellville-Marshall, Marion County, 8.504 miles grading and minor structures.

No. 103, Clarendon-Indian Bay, Monroe County, 10.236 miles, gravel surfacing.

No. 315, Rosston-Waldo, Nevada County, 74.525 miles, grading and minor structures.

No. 718, Camden-Chidester, Ouachita County, 1.449 miles, grading and minor structures.

No. 333, Murfreesboro-Delight, Pike County, 7.600 miles, gravel surfacing.

No. 1001 (Federal Aid project No. 245-A), Marked Tree bridge, Poinsett County, 2,000 feet, steel and concrete bridge and grading.

No. 800, Dardanelle bridge, Pope and Yell counties, 2,045 feet, concrete substructures and approach spans.

No. 615, Benton-Hot Springs, Saline County, 20 miles, grading and surfacing in flood damage repair work.

No. 404, Fort Smith-Greenwood, Sebastian County, 15.309 miles, grading and minor structures.

No. 405, Fort Smith-Greenwood, 227 feet, concrete bridges.

No. 415, Fort Smith-Charleston, Sebastian County, 9.954 miles, grading and minor structures.

No. 403 (Federal Aid No. 198-A), Mill Creek and slough, Scott County, 2,260 feet, concrete bridges and grading.

No. 715 (Federal Aid No. 232-B), Magnolia-El Dorado, Union County, 18.255 miles, concrete surfacing.

GRAVEL ROADS PREDOMINATE IN FEDERAL AID SYSTEM

Gravel roads predominate in the 55,903 miles of Federal Aid roads constructed through the country, according to percentages recently published as follows:

	Per cent	Mileage
Gravel type	35.5	19,845.56
Graded and drained	23.2	12,969.50
Concrete pavement	22.0	12,298.66
Sand clay	8.1	4,528.14
Bituminous macadam	5.6	3,130.57
Bituminous concrete	2.4	3,130.57
Water bound macadam of brick	3.2	1,788.90
Total	100.0	55,903.00

During the past year there were improvements on 9,400 miles of the Federal Aid System, bringing the total improved highways in the system to 55,903 miles.

The Day When The Auto Was A Joke

By Chris Batchelder in Nation's Business

Business writers have worn out their adjectives in talking about the automobile industry. A business that in thirty years has gone from four cars to four million cars a year, and that put the value of its product at the top of American manufacturing, ahead of meat packing, steel making and petroleum refining can stand a lot of adjectives.

Looking back at this thirty-year-old business, it is hard to realize that it had its childhood, that the men who now are at the top of the industrial heap once were struggling to keep from being smothered at the bottom.

The real story of the automobile is a story of men—men who saw not a few rich men riding in \$10,000 cars but a whole world on rubber tires. And not even these men always saw how far they were to go.

INFLATION WORRY IN 1911

In 1911, leading car manufacturers of this country met at New York and were discussing plans for the coming year. The previous two years had shown substantial increases in production, and there was a little note of worry over inflation in the industry.

To learn the worst, it was agreed that the representative of each company should write his intended output for the year on a piece of paper, and that the total of all should be announced to those present. The computation was made and led to the disquieting discovery that 300,000 cars were planned for that year!

Most of the manufacturers agreed that such an unprecedented production boded disaster. But there was one who differed, William C. Durant, then president of the Buick Motor Company, rose and said, "Gentlemen, you do not realize the wealth of this country. I look forward to the day when we will produce and sell 500,000 cars a year." That prediction startled even those whose faith in the industry was unbounded.

But only three years later the industry exceeded by 70,000 the "ridiculous" estimate set by Durant. Following the successful attainments of the half-million mark, that gentleman was asked again how far he thought the market would extend. Then, with the warning that he did not wish to be quoted for fear of being considered crazy, he confided that some day he expected one million cars a year to be made in America. But that same industry produced 4,500,000 vehicles last year.

Of that mythical "saturation point," Edward S. Jordan, president of the Jordan Motor Car Company, has said: "The saturation point will be reached when every person in the world owns a motor car and no car ever wears out." He was serious about it.

But to advance even as far as we have on the road to that mythical saturation point called for patience and a sense of humor, as well as the energy and vision that are needed to make any enterprise great.

THE "BUILT TO RUN" ANECDOTE

Car makers in those days were hard pressed to make good on the claims of their early advertising. The Buick Company blazoned in the publications of the nation this conclusive evidence of its cars' reliability: "Built to Run and Does It," whereupon one owner cut

out one of the ads and returned it to the factory with a question mark that caused it to read, "Built to Run and Does It?"

The Oldsmobile, claiming mechanical perfection, adopted as its slogan the words, "Nothing to Watch But the Road," a boast championed by Roy D. Chapin, then of Oldsmobile and now chairman of the Hudson Company. But Chapin's assurance was rudely shattered by the receipt of a letter from an owner stating that everyone was getting tired of looking at the same piece of road.

The Brush car, the creation of A. P. Brush, noted inventor, was an early attempt to give the public a low-priced car. It possessed only one cylinder, and wood played a surprising part in its construction. The company advertised that its car had "wooden wheels, a wooden axle and a wooden frame." But one critic called attention to the important but unadvertised fact that "it wooden run."

From the very earliest days style has been an important factor in the automobile business. For some time manufacturers vied with each other to produce articles of elegance. Finally, Haynes carried in its advertising this statement, "The car with the Most Beautiful Lines." Imagine the consternation at the factory when one owner confided that the most beautiful line he had ever seen in a Haynes was the towing line.

Great engineers of the time, successful in other lines of mechanical endeavor, found themselves immediately



Our Pride Mark

*The Sign of Absolute
Quality in Printing*

THE QUALITY of our publication printing, of which the magazine you hold in your hand is a sample, is based on the same principle that carries throughout our entire line of efforts—that of making each job as good as it ought to be.

In addition to publication printing we do commercial printing, book printing, print catalogs, do ruling and binding, make blank books and loose leaves—in all offering a complete service, and

"We Actually Do Better Printing"

CENTRAL PRINTING COMPANY
Phone 7138 209 Louisiana Little Rock

under criticism upon their entrance into the fad of manufacturing automobiles. Ransom E. Olds, after leaving Oldsmobile to organize the Reo Motor Car Co., designed an automobile for Reo that was considered an engineering masterpiece. In presenting the new car to the public, Reo officials called attention to the fact that the Reo was bound to be a great car, for had it not been designed by R. E. Olds, who had just completed a great stationary engine for the city of Detroit? Critics were not long in making the comment that Mr. Olds now also had to his credit the greatest stationary automobile ever built.

THE FIRST CAR TO RUN

In America, the first practical car that really ran was constructed by Charles E. Duryea in 1892. The Duryea Buggyaut was built in the loft of a barn at Springfield, Mass. And, as if to prophecy the future potential destructiveness of the automobile in traffic, this first car, when cranked for its initial trial, plunged through the wall of the barn, all but wrecking itself at the very start. To the inventor, however, the crash was a joy, for it showed that his new vehicle would "move itself."

Other early experimenters in the field of the automobile were Elwood Haynes, who produced the Haynes; Henry Ford, whose car has ever since borne his name; George Seldon, who claimed the basic patents on the automobile; and Dave Buick, for whom the Buick car was named. Others were Benjamin Briscoe and Jonathan D. Maxwell of Maxwell-Briscoe fame, H. H. Franklin, and Rollin H. White. Franklin and White still remain trademarks in the business.

THIS YOUNG MAN'S BUSINESS

Most of those men were working to perfect automobiles thirty years ago, and of those named all but Haynes are alive today. Those very men whose laboratory experiments paved the way for the industry in America have lived to see it grow to be the greatest manufacturing industry in the country.

It has been a young man's business. With the development of the motor car, the business world saw men of thirty and thirty-five heading big business corporations.

Roy D. Chapin, as a boy only a few years out of the University of Michigan, while working with the Oldsmobile Company, succeeded in interesting E. R. Thomas, the capitalist, in the organization of the

Thomas-Detroit Motor Company, to be headed by Chapin and Howard Coffin, a young engineer. Then, only a few years later, Chapin organized the Hudson Motor Car Company, of which he has ever since been a guiding spirit.

A. P. Brush, while still a youth, helped to design the car destined to become the Cadillac, and for some time later guided the engineering policies of the company.

Automobile inventors were, for the most part, poor men whose earlier efforts were marked by the struggle that sometimes seems to be a prerequisite of success.

Henry Ford, while in the employ of a Detroit electric light company, worked on his horseless carriage in his spare time, and, after demonstrating the practicability of his vehicle, succeeded in organizing the Detroit Automobile Company, accepting for his services \$100.00 a month.

George Seldon, who filed the first patents on the automobile, tried unsuccessfully for years to interest capitalists in a project to manufacture his vehicle. His enthusiasm and his glowing prediction of the automobile's future led many to regard him as unbalanced.

Seldon, whose patent was the stormy center of the industry for many years, never realized in a monetary sense the benefits he felt were due him, and he died a disillusioned man. His patents, applied for in 1879 and granted in 1895, claimed to cover the use of the internal-combustion engine in a self-propelled vehicle with a disconnecting clutch mechanism.

Henry Ford led the fight against the validity of the patent, and the litigation lasted eight years. The testimony filled thirty-six volumes. Although first upholding Seldon, the final decision ruled that Ford's engine did not infringe.

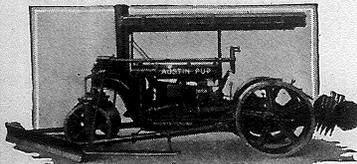
Both Duryea and Elwood Haynes have claimed the credit of producing the first real automobile.

Haynes, King and Ford were working at the same time, the early 90's, along similar lines, but it was in 1894 that there was consummated the sale that opened the way to future business. In that year Alexander Winton sold the first automobile to a Pennsylvania engineer named Robert Allison.

Automobile companies today are largely concerns of big capitalization, but most of them, with the exception of a few recently organized companies, grew from mod-

From RUSSIA to WACO

The first Motor Roller made in America was made by Austin in 1907. Backed by these 20 years' of experience, our engineers have designed Rollers known from Russia to Waco for their ease of handling and durability made possible by their perfect balance and rigid construction.



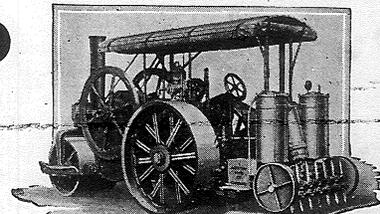
The Austin Pup
with scurifier and blade attachment

The Austin Line of Rollers include

- 3-wheeled Rollers or Tandems
- 3-ton to 15-ton
- 1-cylinder, 2-cylinder, 4-cylinder or Steam

There is something of interest to you about the world's most popular roller—the Austin single cylinder 10-Ton, 3-Wheeled Model.

The Austin-Western Road Machinery Co. 400 N. Michigan Blvd. CHICAGO, ILLINOIS



"The World's Standard"

LET US TELL THE NEWS
IN OUR BULLETIN NO. 20

est proportions. Many companies now selling millions of dollars' worth of cars a year began with capital of \$50,000 or less.

HENRY FORD'S MODEST START

The Detroit Automobile Company, predecessor of the Ford Motor Company and organized by Henry Ford, was incorporated for \$50,000, and Ford's later company began with the capitalization of \$100,000. Small figures those, in view of Ford's later operations in the motor field.

The Thomas-Detroit Motor Car Company began in 1909 with \$28,000 capital, and operations were begun in an old match factory in Detroit. This later became the Chalmers Company and, after combining with Maxwell, is the Chrysler Motor Corporation of today.

Many cars had their inceptions as side line businesses of companies engaged in other lines of manufacture. Dort and Studebaker, both wagon companies, and Nordyke & Marmon, a milling machinery concern, entered the automobile business. History has shown, however, that, with few exceptions, automobiles as a side-line product never survived unless they swallowed up the former major interest, as in the case of the three just mentioned.

Alco, made by the American Locomotive Company; the Moline, the Standard, made by the Standard Steel car Company, and many others, fell by the wayside because they were relegated to second place among the products made by the companies.

The manufacturing of automobiles has been a hard business, and many an able organization was unable to stand the strain of competition for the public's favor. The pages of the last twenty-five years reveal many names no longer on the industry's roster. In the passenger-car division alone more than 200 companies, or an average of eight a year, have been unable to survive.

Winton, Haynes, Lozier—those were magic names only a decade ago, but they are now fading rapidly from memory. Many other names recall the memories of cars which no longer grace the roads. Chalmers, Dort, Premier, Westcott—all those cars were made by companies of high standing, managed by men of great ability, yet they were unable to survive the hard competition of the industry.

The automobile met tremendous resistance in its early days. It was assailed from every side. People considered it a menace to pedestrians and horsemen. The cars were noisy, smelly, dirty and generally objectionable. The general opinion was that the motor car was a fad and a toy that would soon pass out of rich men's favor into oblivion.

It was an old stage driver in New England who summed up a characteristic American trait when he said of his wife:

"Celista was a nice woman, nice as they make 'em, but she always wanted to be just a little ways from where she was."

THE MOTOR AND THE NOMAD

We're a nomadic people, always wanting to be just a little ways from where we are, always asking what's over the next hill. And the automobile satisfied that longing.

It was much an article of universal desire as a pair of legs, and the car makers knew it.

The bicycle paved the way for the automobile—and the word "pave" is used advisedly. Roads built to accommodate cyclists did much to encourage the early use of automobiles.

There was also a second way in which the bicycle prepared the public for the advent of the motor vehicle, for the cycle had served to show the possibilities of individual transportation. It was an advance over walking, and in turn the automobile was an advance over the bicycle. Starting later than most other big businesses, the automobile industry was able to profit by the mistakes of others.

Anticipating a new kind of competition between industries rather than between companies, car makers early laid plans for proper administration of the industry as a whole.

Col. Charles Clifton, chairman of the board of the Pierce-Arrow Motor Car Company, when assuming the presidency of the manufacturers' organization known as the National Automobile Chamber of Commerce, twenty-three years ago, a post which he held without interruption until he was succeeded a few months ago by Roy D. Chapin, outlined the policy which the industry should follow, displaying a sage wisdom that has ever since been a guiding factor in the business.

"Our real business," said Colonel Clifton on that memorable occasion, "is our industry against all others. We cannot be divided in our work. Let us educate the public to the proper place of the motor vehicle as a utility, unite our engineering brains for the general good of the public as well as ourselves, foster highways, and create first of all a healthy industry, with broadening markets. Then let each manufacturer secure that share of the market to which his enterprise and the merit of his product entitle him."

That creed still forms the basis of the business.

Road and Bridge Contracts Awarded

Bids on six projects of new construction were received and opened in the office of Commissioner Dwight H. Blackwood on July 29th. Five of the projects were awarded as follows:

F. A. 240-B, Batesville-Heber Springs, gravel surfacing, 10.953 miles in length in Independence County. Awarded to Ellis & Lewis for \$37,794.10.

F. A. 242-A, Pheas Bridge-Paragould, grading, drainage structures and gravel surfacing, 7.765 miles in length in Greene County. Awarded to Merchants Transfer Company for \$78,391.84.

State C71-515-A, Alma-Fine Springs, grading and drainage structures, 4.737 miles in length, in Crawford County. Awarded to James & Hopper for \$27,057.41.

State 706, Two Bayou Bridge, treated timber bridge, 98 feet in length, in Calhoun County. Awarded to J. W. Covington for \$3,088.59.

State 201, Boggy Bayou Bridge, treated timber bridge, 400 feet in length, in Desha County. Awarded to J. F. Mullins for \$12,211.00.

All bids on the Dardanelle bridge project were rejected. This project will be readvertised and bids will be received on it at the August 30th meeting of the Commission.

Recent Developments in Highway Research

By S. S. STEINBERG

Assistant Director, Highway Research Board, National Research Council.
(Recent Radio Address from Station WMAL, Under Auspices of Science Service)

Few of us realize, as we travel rapidly along our modern smooth highway, the part science has played in the development of our present system of highway transportation. The highway industry, which in the last decade has become the largest in the engineering construction field, recognized early in its growth that its progress was dependent upon the development of the science underlying the industry.

As soon as it became evident that the motor vehicle had come to stay, highway engineers commenced experimentation and research to establish the scientific principles that would guide them in the solution of the many problems arising from this new means of highway transportation and to assure the economical expenditure of highway funds. The spirit of scientific inquiry in highway engineering has spread so rapidly and grown to such proportions that some six years ago there was organized, under the National Research Council a Highway Research Board whose function it is to coordinate the results of highway research throughout the country.

Of the many problems confronting the highway engineer, the most important, the most complex and the one in which the public is most vitally interested, is that of highway safety. The loss of some 25,000 lives annually, the injury of several times that number and the enormous property damage, have focused the attention of many agencies upon this grave problem of national concern. Highway safety, though primarily an engineering problem, is considerably influenced by the psychological as well as the physical demands upon the driver of a motor vehicle.

A recent statistical study of the distribution of blame among factors involved in highway accidents, has shown that the "human factor" is responsible for approximately 90 per cent of motor vehicle accidents, and that causes attributed directly to defects in the highway or the vehicle are of small relative importance.

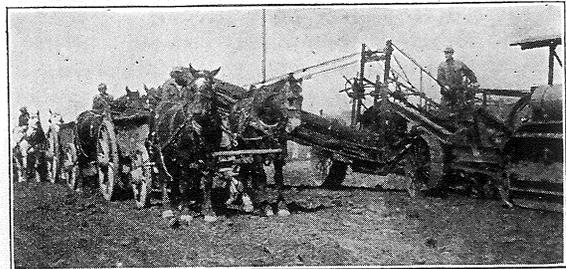
In order to secure concerted action in studying the causes and means of prevention of highway accidents, the Highway Research Board recently appointed a committee to initiate and coordinate research on all phases of this serious problem. This board, because of its contact on the scientific side with the National Research Council and on the practical side with the highway departments of the several States, is in a peculiarly fortunate position to accomplish important work in this field, assuring that the results of scientific research will receive prompt consideration by those who may be able to apply them.

Skidding of tires on wet pavements, which is a frequent cause of accidents, has been investigated at Iowa State College. These experiments, using pneumatic tires on various road surface conditions, show that on roads coated with snow or ice or with oily slime or mud, the force required to cause skidding is approximately one-third to one-fourth of that on clean, dry surfaces; while on icy roads that are thawing a little, the co-efficient may be as low as one-sixth of that on a clean dry surface.

A number of problems, especially those affecting motor vehicle operation, are being studied by the United States Bureau of Standards. One of the most important of these is safe and adequate braking control of vehicles. A simple and convenient indicating accelerometer has been designed with which the braking ability of several hundred typical motor vehicles of all classes, selected at random from traffic, has been measured. About a thousand such instruments are now in use throughout the country in order to make a more extended study of conditions in regard to this important phase of motor vehicle operation.

Automotive headlighting and its relation to highway illumination has also been a subject of recent study. The Bureau of Standards in co-operation with interested organizations has been making a study of the safety and effectiveness of different headlight illumination patterns. Work is under way to determine what type of lighting is safest for the driver when no other cars are approaching and what type is best for both when cars are approaching.

Interesting results have been obtained from investigations on tire wear, tractive resistance of road surfaces and wind resistance on automobiles, each of which is an



2000 Cubic Yards a Day —one-quarter the Cost

This great machine embodies two essentials—
Strength and Simplicity.

The first Elevating Grader—built at the close of the Civil War—has been improved to such an extent that it will handle 1000, 1500 and under exceptional conditions, 2000 cubic yards per 10-hour day at ¼ to ⅓ the cost of other methods.

It will excavate ditches 40-ft. wide, delivering earth directly to embankments. In one 10-hour day one machine will dig a ditch one mile long 6-ft. wide at top, 1½-ft. deep with 2-ft. base.

Our Elevating Grader catalog will tell you many more interesting facts. No cost or obligation—just write.

The Austin-Western Road Machinery Co.
400 North Michigan Blvd., Chicago, Ill.

important economic factor in highway operation. One of the problems that confronts all of us is the life efficiency of tires. Experiments on tires conducted at the State College of Washington show that tire wear increases with the speed of the vehicle and with increase in temperature. Rear tires are found to wear 50 per cent more than front tires. The experiments indicate that under normal conditions of vehicle load and tire inflation, the relative wear of tires on different kinds of roads represent useful mileage of 24,000 on the best road to as low as 2,000 on the worst. Considering that the average vehicle travels 6,000 miles per year, the annual tire cost per car varies from \$30 to more than \$300, depending upon the kind of road surface the vehicle uses.

Research conducted at the North Carolina State College on the power required to drive motor vehicles on different road surfaces, showed that at fifteen miles an hour twice the horsepower is needed to propel a vehicle on a wet and muddy surface as on a dry and smooth one. Studies on the effect of speed showed that almost four times as much power is required to run the vehicle at thirty miles an hour as at fifteen miles an hour.

An investigation on the effect of the wind upon a car traveling at various speeds was conducted at the Iowa State College and the results confirm those previously obtained at the Kansas State Agricultural College. In these experiments it was shown that when you drive your car at thirty-five miles an hour you use, on the average, eight horsepower to overcome wind resistance. If you reduce your speed to twenty-five miles an hour, you save five horsepower.

One of the serious problems confronting the highway engineer today is caring for the ever-increasing use of our roads by motor trucks. Heavy loads carried at high speed cause tremendous wear and tear on the highway. With the increase in use of the six-wheel truck it is interesting to learn from recent experiments conducted by the United States Bureau of Public Roads that the pressures exerted on the highway, as a result of road impacts under six-wheel trucks, are one-half those occurring under four-wheel trucks.

As a result of another comprehensive investigation recently completed by the Bureau of Public Roads, it has been demonstrated that paving brick $2\frac{1}{2}$ inches in thickness is satisfactory for heavy traffic and that 2-inch brick is adequate for light traffic. As these sizes replace brick of four inches and three inches formerly used, it is evident that the application of this single research will mean immense savings annually in road construction.

This study was conducted at the government experiment station at Arlington, Virginia, on a specially constructed circular roadway one-tenth of a mile in length: The road was divided into a number of sections paved with brick of varying thickness. It was then subjected to continuous traffic for several months with loaded trucks ranging in size from 3 to $7\frac{1}{2}$ tons, with and without heavy tire chain equipment. It is estimated that the traffic received by the experimental road in the few months duration of the test would be equivalent, if applied to an actual highway, to 18 years of service.

The historic Bull Run battlefield is the site of an important highway investigation being conducted by the Virginia State Highway Commission in co-operation with the Bureau of Public Roads. This road is to be ten miles long, made up of thirty sections each of a different type of concrete construction. The California Highway Commission has constructed a similar experimental road five miles in length composed of twenty sections of different pavement design. The Maryland State Roads Commission is likewise conducting certain tests in connection with the Crain Highway. The information sought in these various experiments concerns a number of questions not covered by previous tests, such as the use of steel reinforcement in concrete roads, the use of admixtures in the cement, the control of cracking and the best methods of curing the finished road.

One of the important highway research problems recently undertaken is that of scientific study of the soil underlying the road. Highway engineers have been severely handicapped by the absence of information regarding the various types of road soils and their behavior under all weather and traffic conditions. Due to lack of such knowledge pavements cannot be designed to fit subgrade conditions, with the result that roads often break down from causes not now fully understood. The Federal government, as well as a number of the States, have embarked on extensive soil surveys with the object of developing standard methods for identifying and testing road soils and determining methods for improving their quality to make them fit for use as road foundations.

During the current year, the mileage of new roads to be built in the United States will be more than sufficient to circle the globe at the equator; and there will be maintained a mileage ten times as large. This program will involve an expenditure of a billion dollars. If, as a result of research, a saving can be effected of but one per cent of that sum, it will amount to ten million dollars for the year. Many present practices in highway

1,500 Tons

700 Sizes

STEEL PRODUCTS

CENTRAL SUPPLY COMPANY

LITTLE ROCK, ARKANSAS

construction and maintenance have come from intensive research and have resulted in enormous savings of highway funds. Experience has proved that investment in highway research is a good investment, yielding large returns to the public in better and safer roads and in decreased cost of highway transportation.

LIFE

Man comes into this world without his consent and leaves it against his will.

During his stay on earth his time is spent in one continuous round of contraries and misunderstandings; in his infancy he is an angel; in his boyhood he is a devil; in manhood he is everything from a lizard up; in his dotage he is a fool; if he has no family he is committing race suicide; if he raises a check he is a thief, and the law raises Cain with him; if he is a poor man, he is a poor manager, and has no sense; if he is rich, he is dishonest but considered smart; if he is in politics he is a grafter and a crook; if he is out of politics you can't place him and he is an undesirable citizen; if he goes to church he is a hypocrite; if he stays away from church he is a sinner; if he donates to foreign missions he does it for show; if he doesn't he is stingy and a "tightwad." When he first comes into the world everybody wants to kiss him—before he goes out they want to kick him. If he dies young there was a great future before him; if he lives to a ripe old age he is in the way, only living to save funeral expenses.

Life is a funny proposition after all.—*Exchange.*

SHORTEST DISTANCE

Highway construction on the grand scale it has been for some years and now it is being engaged in this country has produced the highway engineer and taught the country much about road building. Highway engineering has become a highly specialized branch of engineering chiefly because modern methods of road construction demand exact supervision and planning.

One thing highway engineers have learned is that every foot a highway is shortened represents a considerable saving for the taxpayer and road users. The taxpayer saves because it means less road to build and maintain, while shortening the way results in economy and time saving for the traveler.

The old notion that a few extra miles do not matter so long as the road is good has been abandoned by all but the seekers after the longest route home.

An engineer points out that a curve with a 200-foot radius makes a road 86 feet shorter than if the road were permitted to follow the old square corner of the survey lines. Multiplying this by the number of sharp turns in the average old-style highway vindicates the road-straightening policies of the state highway departments.

Now that the motor truck is so extensively used for the transportation of food and other commodities for public consumption shortening the highway distance between the shipping point and destination means lower living costs through reduced cost of transportation. Railroads spend millions annually to find, for their tracks, the shortest distance between two points, and the saving is not all theirs.

W. P. McGeorge & Co.

RAILWAY, HIGHWAY, STREET
PAVING, LEVEE and SEWER
CONTRACTORS

PINE BLUFF, ARKANSAS

Pine Bluff Sand and Gravel Co.

PRODUCERS OF

CHANNEL WASHED SAND AND
GRAVEL

We Buy, Sell and Rent Used Equipment

PINE BLUFF, ARKANSAS

Cross County Gravel Company

Producers of

Washed and Sized Gravel and Sand
High Grade Road Gravel Railroad Ballast

WASHING PLANT AND PIT
CHERRY VALLEY, ARK.

Missouri Pacific Track

GENERAL OFFICE: PINE BLUFF, ARK.

Bearden Gravel Co.

PRODUCERS OF

HIGH GRADE ROAD GRAVEL

Pit Near Millville, Ark., on Cotton Belt Line.

Office, Pine Bluff, Arkansas.

A Statement to the Public by L. W. Baldwin, President of the

MISSOURI PACIFIC LINES

Railroading Has Been Revolutionized!

FEW persons realize the extent to which a revolution has been taking place in the business of providing the people of the United States with the best railroad transportation service in the history of the world. If the railroads were being operated today as they were less than 10 years ago, this country would be in the throes of the greatest economic disorder ever recorded. The explanation of what has happened should be known by everyone.

First, and most important, of course, is the new order of affairs under which those responsible for the management of great institutions like railroads and their armies of workers have set about aggressively to provide a maximum amount of the best service the traffic will justify. And, along with this, one of the most helpful things has been the better understanding between the public and the railroads, due in large measure to the policy of the railroads of trying to keep the public posted regarding all the facts about the transportation business.

Improvement of the physical plant of the railroads has been carried far beyond the realization of most persons. Since 1911 the miles of track operated have increased 57,000 miles or from 362,800 to 420,000 miles. The increase since 1921 has been only 12,500 miles, but in that latter period there has been invested in the railways for additional equipment, additional other trackage, heavier rail, additional shops and other facilities and for other improvements \$3,996,442,752.

The average tractive power of each locomotive in service on the American railways has increased in the last 15 years 48 per cent, and since 1921 the increase has been 18 per cent, while the total tractive power of all locomotives in service has increased 60 per cent since 1911 and 13 per cent in the last 5 years.

The number of freight cars has increased 11 per cent in 15 years, but the average capacity has increased 23 per cent, and the total carrying capacity has increased 35 per cent, and approximately one-third of this has been effected in the last five years.

The money invested in railway property in the United States has increased 59 per cent since 1911, and approximately 20 per cent of that increase has been made in the last five years.

In this connection it is interesting to note that the net capitalization of all railways at the close of 1926 amounted to only \$18,190,513,329, divided \$6,885,437,186 capital stock and \$11,305,076,143 of funded debt, while the replacement value is approximately twice that sum.

The improvement in service may be measured in any of a number of different ways, but the results speak for themselves.

I solicit your co-operation and suggestions.



"A Service Institution"

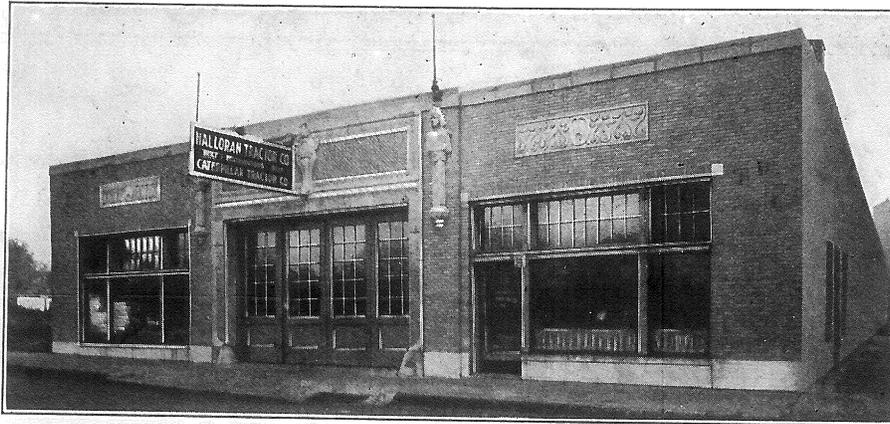
President
Missouri Pacific Lines

MEMPHIS
OFFICE and
WAREHOUSE

185-191
BUTLER AVE.
MEMPHIS

ONE BLOCK
NORTH OF
UNION STATION

LONG
DISTANCE
TELEPHONE
6-1710



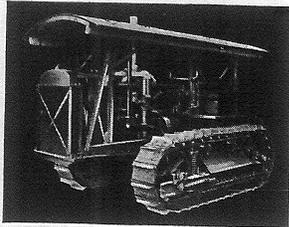
COMPLETE
STOCK, NEW
TRACTORS AND
REPAIR PARTS

FACTORY-
TRAINED
SERVICE MEN

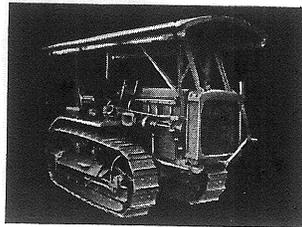
COMPLETELY
EQUIPPED
SHOP

REPAIRING
OVERHAULING
REBUILDING

All three models of "Caterpillar" Tractors are carried in Stock at Little Rock, as well as at Memphis—thus insuring you immediate delivery.



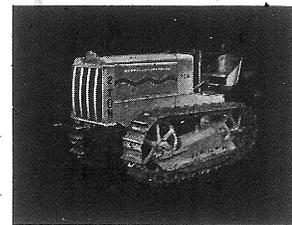
"Caterpillar"
Sixty
Tractor



"Caterpillar"
Thirty
Tractor



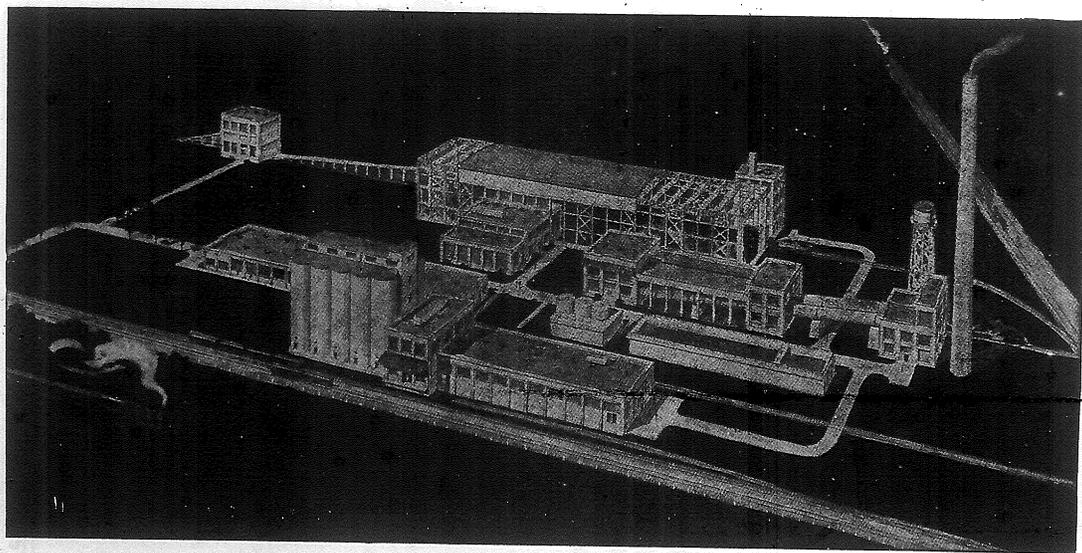
"Caterpillar"
2-Ton
Tractor



HALLORAN TRACTOR COMPANY, *Distributors* MEMPHIS, TENNESSEE

PHOENIX PORTLAND CEMENT CORPORATION

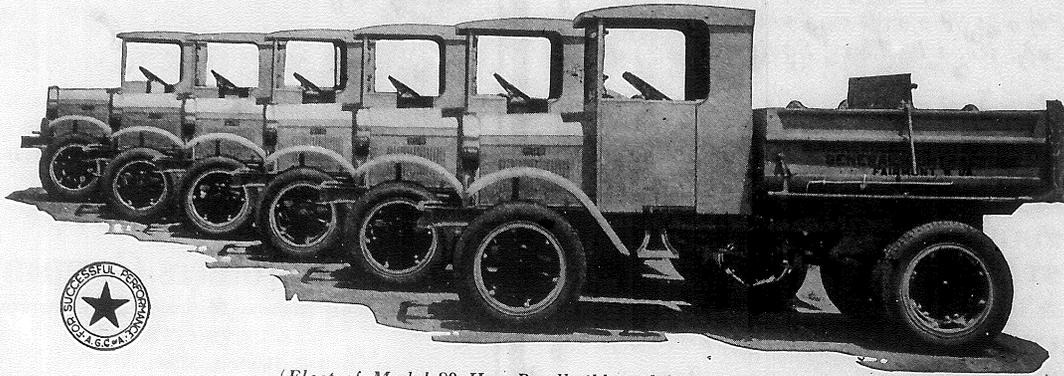
Manufacturers of High Early Strength Portland Cement



PLANT:
PHOENIXVILLE, ALABAMA
Birmingham-Bessemer District

SALES OFFICE:
ALABAMA POWER BUILDING
BIRMINGHAM, ALABAMA

ANOTHER Hug Fleet



*(Fleet of Model 80 Hug Roadbuilders delivered to the
Monongahela Construction Company, Fairmount, W. Va.)*

ANOTHER fleet of Hug Roadbuilders added to the list of Hug fleet owners, this time the Monongahela Construction Company fleet.

Hug fleet sales are the result of Hug performance—Hug performance has been outstanding because Hug Roadbuilder trucks are designed expressly for roadbuilding, and are built with a large factor of safety assuring efficient operation under the most extreme conditions.

Original Hug fleet sales invariably result in additional Hug sales. Hug owners appreciate the earning capacity of Hug trucks and the assurance that they will receive 100 per cent performance satisfaction. Hug owners never think of buying anything but additional Hugs.

Hug Roadbuilder Trucks are sold as a complete unit, the body is furnished as an integral part of the truck, and is built into the Hug Chassis; they are not an altered commercial chassis offered as a roadbuilders truck.

**THE HUG CO., St. Louis Branch
3030 Locust Street
St. Louis, Mo.**

THE HUG CO.



**HUG ARKANSAS TRUCK CO.
421 East Markham Street
Little Rock, Arkansas**

Highland, Ill.

BUSINESS IS
PICKING UP

Be Ready!

*Prompt Shipment on Contractors'
and Road Builders' Equipment*

REX mixers and pavers
CLYDE hoists and derricks
BLAW KNOX curb and gutter, road and side-
walk forms, bins, batchers, truck turntables
RED EDGE shovels and picks
RED STAR wheelbarrows
C. H. & E. hoists, pumps, saw rigs
ADVANCE RUMELY road tractors
NORTHWEST shovels, cranes, draglines

Joe Lyons Machinery Co.
120 North Louisiana Street
Little Rock, Arkansas

Warrenite-Bitulithic Pavement

—“A WARRENted Product”—

WILL IT PAY FOR ITSELF?

It may seem peculiar to ask that pavement actually pay for itself in ways other than in transportation and ease of travel, but as a matter of fact the question is a fair one.

WARREN BITULITHIC PAVEMENT

on the basis of cost-per-mile-per-year challenges comparison with other type pavement in giving an honest answer to that question of paying for itself. Figures that speak volumes are yours for the asking.

Warren Brothers Company

International Highway Engineers and Contractors

EXECUTIVE OFFICES:

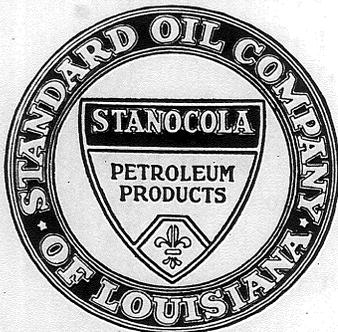
Boston, Mass.

DISTRICT OFFICES:

Havana, Cuba
New York, N. Y.
Portland, Ore.
St. Louis, Mo.
Winnipeg, Man.
Harrisburg, Penn.
Vancouver, B. C.
Chicago, Ill.
Phoenix, Ariz.

Washington, D. C.
Utica, N. Y.
Minneapolis, Minn.
Oakland, Cal.
Toronto, Ont.
Memphis, Tenn.
Birmingham, Ala.
Los Angeles, Cal.
New Orleans, La.

Dallas, Texas
Charlotte, N. C.
Oklahoma City, Okla.
Salt Lake City, Utah
Melbourne, Australia
Sidney, Australia
Buenos Aires, E. A.
Tokyo, Japan



*“Better Stick
to the
Standard”*

“Standard” Motor Oil

(FORMERLY STANOCOLA POLARINE)

and

“Standard” Gasoline

(FORMERLY STANOCOLA)

are the two Motor necessities so essential to the efficient operation of your Automobile or Motor Truck—Look for the dealer displaying Stanocola signs and call for Stanocola Polarine or Stanocola Gasoline by name.

ASPHALT—The Standard Oil Company of Louisiana, with its modern Refinery at Baton Rouge, is the largest manufacturer of Asphalt and Asphaltum products in the South.

Asphalt and good roads are synonymous and you will find it used on better Highways from Maine to California and from Canada to the Gulf of Mexico.

Standard Oil Company of Louisiana

NEW ORLEANS, LOUISIANA



What You Get In An Adams

The popular Adjustable Leaning Wheel feature originated by Adams and which has forced straight-axle grader manufacturers to imitations. The patented Adams "One-Piece" Rear Axle—much more simple and practical than the telescopic or pivotal types.

Equalizing Blade Lift Springs for easy blade control.

Strongly riveted, well-balanced and refined construction—Adams Graders are easiest to operate and outlast heavier but cheaply designed machines.

J. D. Adams & Co.

20 Adams Ave.

Memphis, Tenn.

Complete Stock Carried for Immediate Shipment

ADAMS ADJUSTABLE LEANING WHEEL GRADERS

"The Original—A Proved Success Since 1885"

Watch The Road That Uses Them

The very next time you are out on one of the Highways keep on the lookout for a corrugated metal culvert.

When you come across one examine it carefully. See whether or not it is giving the kind of service that you do expect a corrugated culvert to give.



Every time you run across a Toncan Culvert, we're willing to bet it will be in A-1 condition.

Toncan Culverts give better service because they are made of better material, Toncan sheets have in them TWICE as much copper as any other sheet in addition to mo-lyb-den-um which no other culvert metal contains.



Mo-lyb-den-um

IRON CULVERT PIPE

Together with Toncan Culverts let us furnish you with Jaeger Mixers, Heltzel Forms, Sterling Barrows, Archer Hoists and Spouts, Littleford Asphalt Heaters, Dynamite, Thew Shovels and Cyclone Road Guard.

Choctaw Culvert & Machinery Co.

Second and Butler Streets

MEMPHIS, TENNESSEE

Russell Motor Patrol - in 4 sizes Perfected Powerful Units

Better Built Motorized Patrol Graders. With these highly finished machines comes refinement of design eliminating mere clumsy weight—machines which give speed and ease in control and a standard of efficiency which can scarcely be overestimated—then too, they afford a minimum of up-keep cost.

Russell Motor Patrols are built in four sizes—

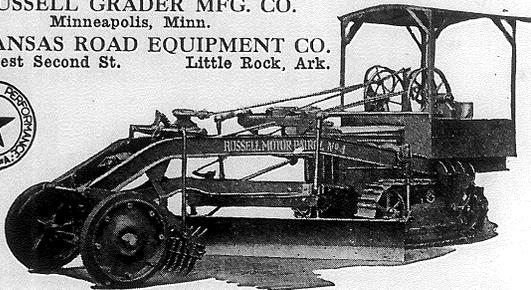
- No. 2 for Fordson tractor for power
- No. 3 for 10-20 McCormick-Deering tractor for power
- No. 4 for "Caterpillar" 2-ton tractor for power
- No. 5 for "Cletrac" 20-K tractor for power

Each of the four models No. 2—No. 3—No. 4—No. 5 is equipped with scarifier—worked with blade or independent of blade, as desired.

Our catalog of special interest to all road builders—sent free and postpaid.

RUSSELL GRADER MFG. CO.
Minneapolis, Minn.

ARKANSAS ROAD EQUIPMENT CO.
214 West Second St. Little Rock, Ark.



Printers to Arkansas!

Gradually through the years there has been built up a State-wide appreciation of what the "Calvert-McBride" mark means on printing.

Quantity Production
Highest Quality
Prompt Delivery
Lowest Price

*These Things Tell
The Story*



Calvert-McBride Printing Company
FORT SMITH, ARKANSAS

Hermitage Portland Cement

SAND • GRAVEL • STONE

STEEL
ROAD
MESH

*Our facilities for supplying
road building materials
are unexcelled*

CAREY'S
ELASTITE
EXPANSION
JOINT

FISCHER LIME & CEMENT CO.

MEMPHIS



BUY
En-ar-co
 MOTOR OIL
 At the Sign of
 The
 Boy and Slate

Costs less per mile

En-ar-co Motor Oil forms a perfect seal between rings and pistons, between pistons and cylinder walls. Gasoline can't penetrate this seal and get down into the crank case to destroy the oil. Surplus oil can't get past this seal to form carbon on valves and spark plugs.

EN-AR-CO MOTOR OIL
 LIGHT—MEDIUM—HEAVY—EXTRA HEAVY

THE NATIONAL REFINING CO.
 Memphis, Tenn. Little Rock, Ark.

National Headquarters, National Building
 CLEVELAND, OHIO

IMMEDIATE SHIPMENT ON
IRON and STEEL

For Bridges and Buildings

Plain or Fabricated. Over Two Thousand
 Tons in Stock.

Bridge Bolts and Hardware
 Manhole Rings and Covers
 Catch Basins and Covers
 Road Center Strip
 Reinforcing Bars
 Wire Mesh

KOEHRING DANDIE MIXERS
 and parts in Little Rock Stock

Complete Stock of Truscon Products and
 Fireproofing Specialties.

"It Pays To Get Our Prices"

Arkansas Foundry Company

1500 East 6th Street

Little Rock, Arkansas

"We Repair Contractors' Machinery"

S. G. Adams Stamp & Stationery Co.

ST. LOUIS, MO.

Manufacturers of

ROAD MARKERS AND ROAD SIGNS—METAL TAGS—EMPLOYEES' IDENTIFICATION BADGES—RUBBER STAMPS—SEALS—STENCILS—
 AUTO LICENSE PLATES, ETC.

Write for Catalog

A. G. LORENZ, Selling Agent

2419 Battery Street

LITTLE ROCK, ARK.

Phone 4-6558



Under Terrific Strain!

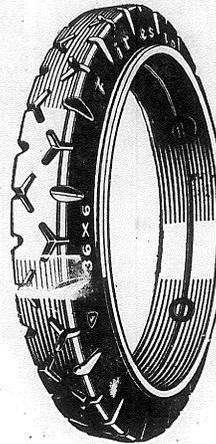
MACHINERY used in road construction is under a terrific strain and unless its moving parts are properly protected by quality lubricants, the toll taken by wear and tear is enormous.

Protect your machinery with Gaymobile Oils and Gay Greases which have served contractors so successfully for more than twenty years. We quote special prices on large quantity orders. Let us give you prices today!

GAY OIL COMPANY
Gay Agents All Over Arkansas

Firestone

"Master of the Highways"



Whether yours are dump trucks, speed wagons or moving vans, whether you operate over paved roads or in and out of excavations—there is a scientifically designed and specially built Firestone Tire for your service. Each one provides the right amount of cushion, traction, mileage.

Buy Firestones for greater trucking efficiency and less operating costs.

PNEUMATICS
CUSHIONS SOLIDS

555 Tire & Service Co.
Third and Broadway Little Rock, Ark.

Big Rock Stone and Material Company

**CRUSHED STONE, SAND AND
BUILDING MATERIALS**

Especial Attention Given to Road Materials—Ready Mixed
Concrete—Highest Grade Stone—Blue Trap Rock

OFFICE 111 CENTER STREET—LITTLE ROCK, ARKANSAS

W. W. DICKINSON,
President.

R. SNOW WILSON,
Vice-Pres. & Gen. Mgr.

The Voss-Hutton Company

WHOLESALE DISTRIBUTORS

LITTLE ROCK, ARKANSAS

Klaxon Horns

Black & Decker Drills

Black Hawk Wrenches

Timken Bearings

Raybestos

Hyatt Bearings

Pedrich Rings

New Departure Bearings

Weaver Equipment

U. S. L. Storage Batteries

Smith Welding Equipment

Eveready Dry Cell Batteries

Automobile Accessories
Garage Equipment

214-16-18-20 W. Fourth St.

Long Distance Phone

4-0433, 4-0434

*“A Friend of
Good Highways”*



Armco Culverts

For Economy

"Look Under Your Roads"

5 Important Causes of Culvert Failure

Field investigation of some 18,000 culverts indicates the five principal types of culvert failures are:

- 1 **CRACKING:**
Due to load of traffic and fill on brittle material. Can be avoided by using elastic materials.
- 2 **DISJOINING:**
Caused by lateral soil movements and poor foundations. Can be minimized by using culverts having a positive bond between adjoining sections.
- 3 **BREAKING:**
Due to impact of traffic on culverts under shallow fill. Can be avoided by using flexible type culverts.
- 4 **UNDERMINING:**
Caused by erosion of foundations. Can be minimized by using a type of culvert adaptable to unusual conditions.
- 5 **DISINTEGRATION:**
—Of Porous Materials
Caused by freezing and thawing. Can be avoided by using a non-porous material.
—Of Metallic Materials
Caused by electrolytic action due to the presence of impurities in the metal. Can be minimized by using culverts made of a metal containing a minimum of impurities—**ARMCO INGOT IRON.**

Armco culverts provide protection against the greatest number of destructive elements

"Always at Home"

Dixie Culvert Mfg. Co.

LITTLE ROCK, ARKANSAS

Armco Ingot Iron Culvert Pipe Great Western Slips
Calco Automatic Drainage Gates Plows, Wheelers and Fresnoes
Welded Gas and Oil Tanks Page Hi-Way Guard

TUCKER

SAND AND GRAVEL CO.
BENTON, ARKANSAS

WASHED AND SIZED GRAVEL
CONCRETE SAND AND
CONCRETE MIX

We furnished Sand and Gravel for the construction of 26 miles of the Little Rock-Hot Springs Highway.

Drew Gravel Company

ROAD SURFACE GRAVEL
Furnished in Any Quantity

• Pits, Ballast Junction and Ozman Bluff
Shipping Point, Monticello

OFFICES

MONTICELLO AND McGEHEE
ARKANSAS

M. E. SHERLAND, Sec.-Treas.
McGEHEE, ARKANSAS

For Concrete Roads— For Gravel Roads

Solvay Flake Calcium Chloride may be used with equal success in the building of concrete roads and the maintaining of gravel roads.

Solvay Flake Calcium Chloride is unexcelled as a curing agent for concrete roads, doing away entirely with the older methods with a distinct saving in time and money.

SOLVAY Calcium Chloride

For the gravel or water-bound macadam road, Solvay Flake Calcium Chloride is the ideal dust layer and surface binder; while harmless to horses' hoofs, automobile finishes, etc., it will positively kill weeds and give a perfect, dustless road surface.

Send for Descriptive Booklet 7251

Solvay Sales Corporation

40 RECTOR ST.

NEW YORK, N. Y.

"Easy To Buy When New"

"Easy To Sell When Old"

Ford

CARS • TRUCKS • TRACTORS • PARTS

LOWEST INITIAL COST
 MOST ECONOMICAL IN UPKEEP AND OPERATION
 MOST SATISFACTORY IN SERVICE

We are the oldest and largest Ford Dealers in Arkansas, and solicit your business on our record of satisfactory service and responsibility to our patrons.

SHOEMAKER-BALE AUTO COMPANY

Friends of Good Roads

Markham and Arch Streets

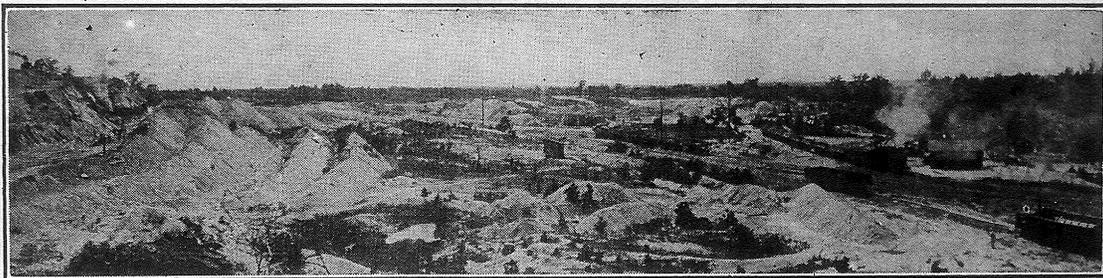
Little Rock, Arkansas

Ball-Benton Gravel Company

J. J. BALL, President
 CHAS. M. KING, Secretary

821 Home Life Bldg. Little Rock, Ark.

W. D. CAMMACK
 Vice President & Treas.



Plant: Benton, Ark.

REAL GRAVEL—

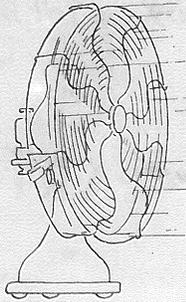
FOR HIGHWAYS—FOR RAILROAD BALLAST—FOR CONCRETE CONSTRUCTION

Our road clay gravel, weighing 3,000 pounds per yard, is best by every test for road building purposes. Our capacity is from 50 to 60 cars per day, as a result of our separate road gravel loading organization using Bucyrus "70-C" shovels and Baldwin 50-ton locomotives.

Our capacity for washed ballast, washed concrete gravel or washed sand is from 60 to 70 cars per 12-hour shift. Our service to road districts, railroad projects and large construction jobs is of proven dependability.

Call us over Phone 4-3788 or Long Distance 133, Little Rock, or Benton 93, for quick action.

SINCE 1898



KEEPING COOL

— a summer's drive
over friendly concrete pavements
without annoying jogs or ruts
IS ONE CONTINUOUS STRETCH of
PLEASURE

When built with—

High Test!

**Marquette
CEMENT**

Marquette Cement Manufacturing Co.

Southern Office—Union & Planters Bank Bldg., Memphis

Plants at La Salle, Ill., and Cape Girardeau, Mo.