THE MODEL T FORD ENGINE

HORSEPOWER, TORQUE, MILES PER HOUR
VS
REVOLUTIONS PER MINUTE IN RELATION TO TIRE SIZE AND FINAL DRIVE RATIO

By TED ASCHMAN

The Model T engine, like all internal combustion engines, develops its maximum torque and maximum horsepower at its designed and engineered speed (RPM).* In the automotive industry, internal combustion engines fall into two categories - low speed and high speed. Low speed engines usually have a piston stroke longer than the bore diameter, and the high speed engines usually have the bore equal to or greater than the length of the stroke. The Model T engine falls into the former category, even though the stroke is but a quarter-inch longer than the bore diameter. Considering the two speed, epicyclic transmission and the high final drive ratio, it is obvious that a lot of engineering went into designing an engine that developed its maximum torque and maximum horsepower at relatively low speeds (RPM).

The accompanying graphs depict the torque and horsepower curves at various revolutions per minute for the "high head engine. These two curves hold true regardless of the final drive ratio or the tire size. Ford for years equipped the Model T s with a 40-tooth ring gear and an 11-tooth pinion or drive gear, giving a final ratio of 3.636 to 1. This was a high ratio considering that most of its contemporries sported a 5.5 to 7.5 to 1 ratio. With the advent of the heavier closed cars (coupes and sedans) Ford startled the engineering world by designing a lo-tooth pinion that would mesh with the original 40-tooth ring gear, giving a 4 to 1 ratio. (Today, with the touring people, this ratio is seldom seen, and if it is, it is usually coupled with an auxillary type of transmission so that a cruising speed of 30-35 mph can be obtained.)

At most "Gatherings of the Faithful, 55 to 60% of the Model T s are equipped with the standard rear end ratio. In second place come those T s with the standard ratio but equipped with a Ruckstell axle. Tying for third place are the "speedster type vehicles with a 3 to 1 (39-13) final drive and the T with a 3 to 1 ratio and a Ruckstell, or one of the other auxiliary-type transmissions. Occasionally an owner can brag a bit about having an original Ruckstell final drive ratio of 3.077 to 1 (40-tooth ring and 13-tooth pinion) with which this writer is blessed. In a touring car or a roadster, this is an ideal compromise between the standard Ford final drive and the high-speed or 3 to 1 ratio.

During the nineteen years of its manufacture, Model T s were shod with just two sizes of tires; the well-known 30 x 3% and the "soft-riding balloon, 4:40 x 21 which came along in 1925 as an extra-cost option. There is an interesting story to be told about the 30 x 3½. Early in the spring of 1918, during the Kaiser War, the War Board (similar to the OPS during the "biggie), in an effort to simplify the manufacture of tires, decreed to eliminate a number of tire sizes that were being produced. Into this category fell the 30 x 3%. Why this was done is still a mystery as at that time more cars came factoryequipped with the 30 x 3% than any other size. Of course, all tire manufacturers adhered to this mandate but the tires they did produce to replace the 30 x 3% still carried the label or size designation "30 x 3½." but immediately after this label appeared either "Ex-Size or "Oversize. In reality what the people then had, and what we have today, was and is a 31 x 4! With this new size tire the T owner got a little bit and he lost

Maximum torque (pulling power) and maximum horsepower do not occur at the same engine speed. Generally the torque peek is considerably lower (in RPM) than that of the horsepower, depending on the design of the engine (valve timing, lift, cylinder bore, stroke, etc.).

CHART 1
Engine RPM s at various Road Speeds
(Tire size 30 x 3½)

Rear Axle Ratio	3.636-1 40/11	3.077—1† 40/13	3.0-1 39/3
Miles per Hour			
10	390	330	322
15	585	495	483
20	781	661	644
25	976	826	805
30	1171	991	966
35	1366	1156	1127
40	1561	1321	1288
45	1756	1486	1449
50	1951	1651	1610
55	2146	1816	1771
60	2342	1982	1932

* This is the ratio furnished with some Ruckstell two-speed rear axles and seems to be a compromise between the standard Ford ratio and the high-speed (3-l) ratio used by many.

a little bit - he got more speed, and he lost a little bit of power (at any given engine speed). The average of four 30 x 3% tires measured came out at 31.39 inches, which would give approximately 644 revolutions per mile, and the average of four 4:40/4:50 x 21 (this writer is of the opinion that the true 4:40 x 21 is no longer being made), 665 revolutions per mile.

In the accompanying graphs, the torque and horsepower curves are those published by the Ford Motor Company in 1922 and are for a standard Model T engine as it was being manufactured at that time. Four speed curves on each graph (one graph is for the 30 x 3% oversize and the other for the 4:40/4:50 x 21) depict the road speeds obtained by the standard Ford rear-end ratio and the 3 to 1. Bear in mind that these speed curves are for the brand of tires named, and each manufacturer s tires may vary slightly in size, and that these speeds may also vary to some degree. Bear in mind also that no tire is truly round when it is traveling down the road. Every tire leaves a "footprint (see Figures 1 and 2). The only exception would be in the case of a steel wheel as on a railroad car or engine.

Charts 1 and 2 show the relation between road speed and engine speed for three final drive ratios, including Ruckstell intermediate (low-high) for 30 x 3½-equipped cars. Charts 3 and 4 give the same figures for Model T s equipped with 4:40/4:50 x 21 tires. To allow for different makes of tires, whether old or new, a plus-or-minus 3 to 5% must be considered. Too, the higher speeds on Charts 2 and 4 are theoretical, as no standard T engine can obtain, let alone endure, such high speeds.

From the two graphs it is obvious that the maximum torque of a standard Model T is developed at near 900 RPM s. Torque is the "twisting power and translated into a more usable definition, is the holding or staying power your Model T engine develops or holds on a long climb. It doesn t take one too long to learn just what settings of the spark and throttle levers gets you over the hills. Some old hands at touring can be heard to advise that they set their spark and throttle at "quarter to four.

Another observation from the graphs shows that the Model T engine develops its maximum horsepower,

CHART 2

Engine RPM s using Ruckstell rear end in Intermediate (Ford High/Ruckstell Low) at various road speeds. Tire size: 30x 3½.

	Rear Axle Ratio		
	3.636-1	3.077-1	3.0-1
	Overall Axle Ratio		
MPH	5.55-1	4.67-1	4.55-1
10	592	501	488
15	887	752	732
20	1183	1002	976
25	*1479*	1252	1221
30	1774	*1503*	*1464*
35	2070	1753	1708
40	2366	2004	1952
45	2661	2254	2195
50	2957	2505	2439
55	3253	2756	2684
60	3548	3006	2927

Note: Engine RPM s in *italics* should be the "Red Line or top speed for sustained engine life. While some special-tuned and equipped Model T engines could and did obtain the higher speeds, these figures are shown here for illustration only.

CHART 3

Engine RPM s at Various Road Speeds (MPH)
Tire Size: 4:40/4:50 x 21

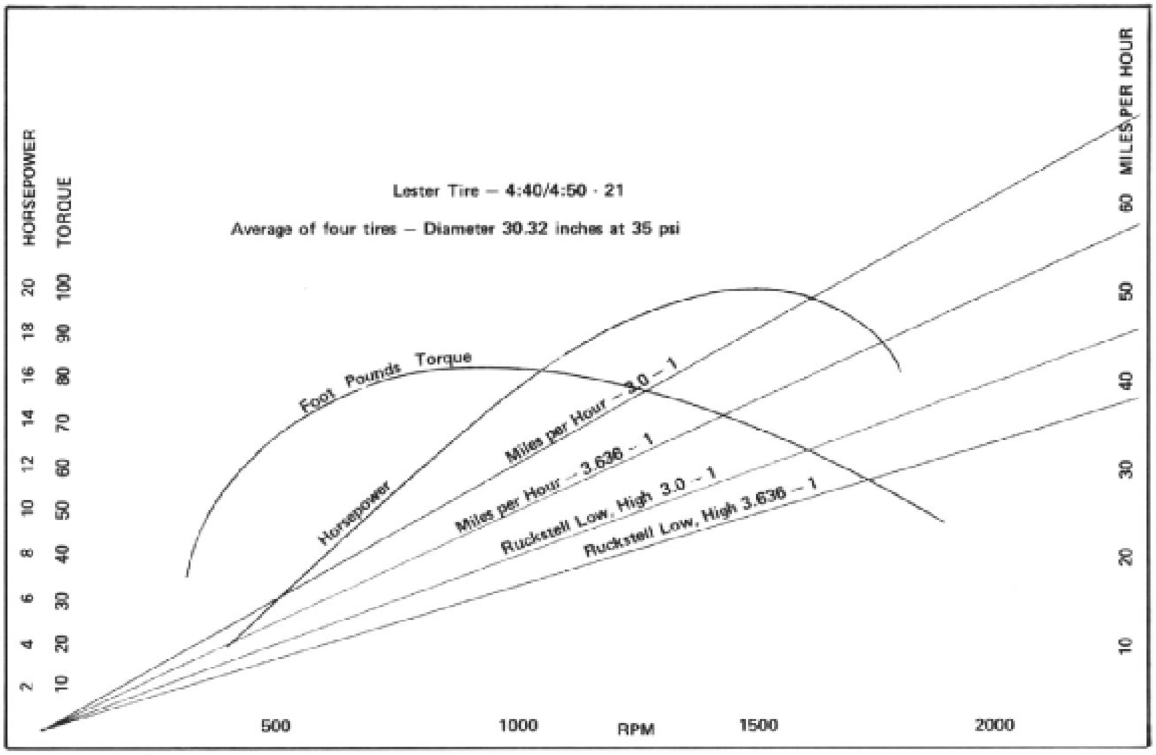
	Rear Axle Ratio		
MPH	3.636-1	3.077-1	3.0-1
10	403	341	333
15	604	512	499
20	806	682	665
25	1007	853	831
30	1209	1023	998
35	1410	1194	1164
40	1612	1364	1330
45	1813	1535	1496
50	2015	1705	1663
55	2216	1876	1829
60	2418	2046	1995

CHART 4

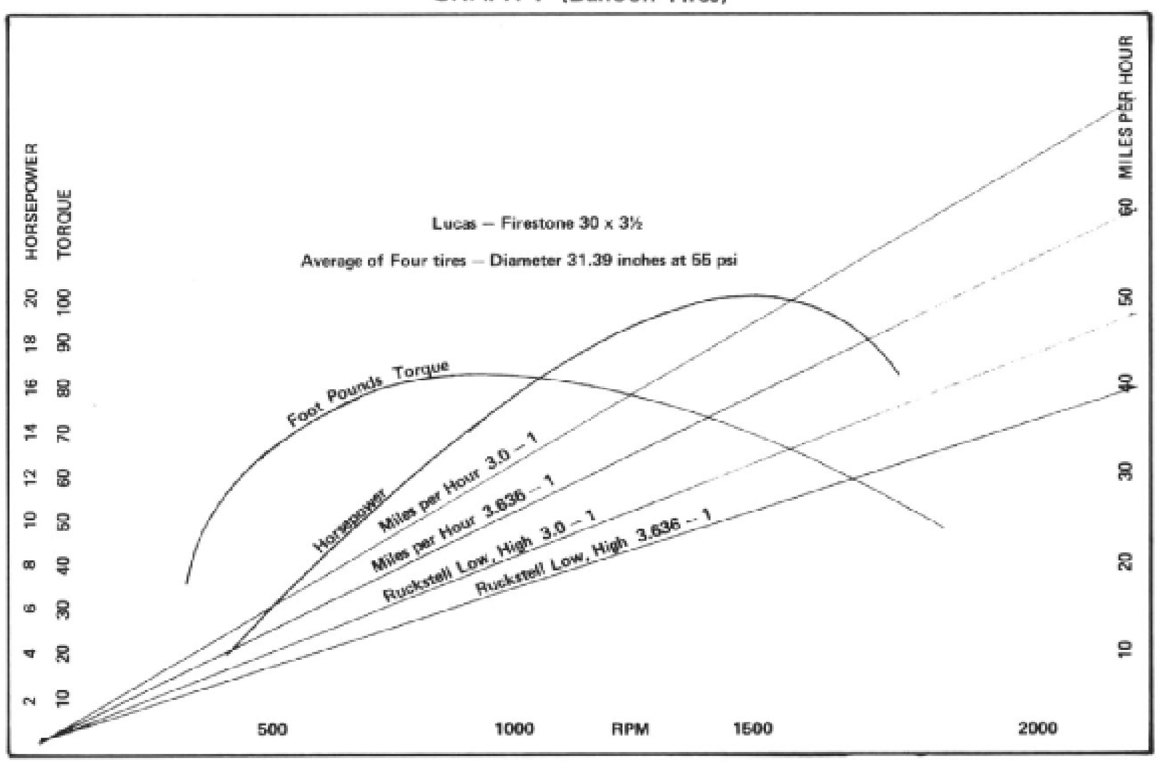
Engine RPM s using Ruckstell two-speed rear axle in Intermediate (Ruckstell Low/Ford High) at various road speeds. Tire size: 4:40/4:50 x 21.

	Rear Axle Ratio		
	3.636-1	3.077-1	3.0-1
	Overall Axle Ratio		
MPH	5.55-1	4.67-1	4.55-1
10	610	518	504
15	914	776	756
20	1219	1035	1009
25	*1524*	1294	1261
30	1829	***1553***	***1513***
35	2134	1812	1765
40	2438	2070	2017
45	2743	2329	2269
50	3048	2588	2521
55	3353	2847	2774
60	3657	3106	3026

Note: Engine RPM s in *italics* should be the maximum engine speed for sustained engine life. Some special T engines may be able to sustain higher speeds.



GRAPH 1 (Balloon Tires)



GRAPH 2 (30 x 3½ Tires)

depending on the rear axle ratio being used, at road speeds from 35 to 45 miles per hour. As each Model T is quite an individual, it won t take long to learn what setting of the spark and throttle levers it feels "comfortable.

Obviously there is a certain amount of theory and hypothesizing involved in these graphs and charts, but do remember that these findings were based on operation at or near sea level (maybe up to 1000 feet above), so when popping over Loveland Pass at around 12,000 feet, forget all this and just hope your T has enough "moxie to make it to the far side.

In summation, remember that at speeds of from 15 to 30 mph your T will climb its best and at 30 to 45 mph you are getting all the horsepower that was engineered into the product. Keeping within these engine speeds (and road speeds) you may not get down the road the fastest, but you might get down the farthest!

CHART 5

As most Model T s were not equipped with speedometers, one might wonder how to know how fast they are traveling. It is quite simple. All that is necessary is a stop watch, or better still, a watch with a second hand. With the watch in hand, observe the mile posts along the highways. Using the table below and the time required to cover one mile, the speed may be found.

Time (seconds) for One Mile equals Miles Per Hour

Time	MPH
65	54
70	51
75	48
80	45
85	43
90	40
95	38
100	36
105	34
110	32
115	31
120	30
125	28
130	27

Most all speeds shown are approximate. If you can cover a mile in a little less than two minutes, you are averaging a pretty good speed and one that will really 'eat up the miles on a long journey. (Have you ever noticed how the same modem car will pass you three or four times during a long trip in your T?)

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AN ORIGINAL CAR

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law seat so I had one made but it didn t come with it.

I suspect that the William Warnoch Co. which you say was in Sioux City, Iowa, not Missouri. Sioux City, Iowa. is only about seventy miles south of Sioux Falls, S.D.

One thing I know for sure is that the original color was gray, not green. When I stripped the many coats of grease and black paint off, I found gray with black striping on the springs, and the bottom coat on everything was gray. I repainted it red as in 1965 I didnt know that only tourings were red. I liked red better so that s the way I did it!

The car had apparently been used pretty hard before our family got it as the engine and rear axle had been changed. It had also apparently been in a wreck, as the front axle, front fenders, hood and radiator had all been changed. The front axle was DB (Dodge Brothers) and the fenders and radiator were 1913.

Anyway I had quite a time picking up the front axle and spindles, motor and rear end, and all the lights, five-ball carburetor, etc. (I ll have to admit I changed an August motor number to match the body tag.)

David Grow
Rapid City, SD

Obviously the auto worker of 1909 was about as careless as the ones of 1981! Not only did he get the wrong state down, he apparently got the wrong color as well! This would have been easy to do, for at the time there were green and gray runabouts, red and green tourings, and green or gray town cars and laundelets.

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