MILEAGE OBTAINED FROM SOME COMMERCIAL GASOLINES.

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Gasoline refiners in 1905 were getting less than four gallons of gasoline from a barrel of petroleum. Due to increased consumption, in 1923 they were getting 13 gallons by cutting deeper into the crude oil. This would have been inadequate had they not also resorted to cracking the heavy petroleum oils. Of course this made a less volatile gasoline and more difficult of use in automobiles, but by blending it with the more volatile casinghead gas, obtained from natural gas, they were able to make a very satisfactory product, giving probably a little more mileage than the old straight run gasoline. Today over 50 per cent of petroleum is turned into gasoline.

So the supply of gas has been able to keep pace with the growing demands, and to do so without working hardships on most makes of cars. But these necessary deviations from the old straight distillation process is putting a greater and greater variety of gasolines on the market. Then, due to the fact that some makes of cars have been slow to adopt self starters and other devices which would enable them to use the less volatile gasolines, the refiners were obliged to prepare still another more volatile type of gas known as the high test or aviation gas. This gas is indispensable for airplanes. It makes a good gas for use in winter and cold climates and in cars which start with difficulty when the motors are cold; but the more there is of the low boiling fraction present in a gasoline the less the mileage and the higher the cost of the gasoline. The distillation ranges of gasolines on the market today show a tendency toward a single product for summer and winter use; and are leaving it to the manufacturers to adapt the cars to a standard gasoline for all seasons.

We seem destined to have a special gasoline for the high compression engines, a gas that will stand greater pressure without knocking. The problem has been partially solved by the addition of certain antiknock substances to the ordinary gasoline.

Then the keen effort to conserve our petroleum has drawn to some extent alcohol and the benzol hydrocarbons into the preparation of gasolines. What has been said thus far in way of introduction is not for the purpose of describing these gases or finding fault with the number of them, but merely to call your attention to the fact that when you drive up to a station to fill your gasoline tank you have a bewildering variety from which to choose, and there seems to be a growing tendency to have at least four gasoline companies represented at each cross street; each dispensing at least two grades of gas, superior in mileage and "pep" to the types sold on the other three corners.

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In the absence of technical knowledge or training and of any gasoline recommendations from the manufacturer of the car, how is the average automobile driver to know which gas will give the best service? Aside from the matter of starting a cold, "lazy" motor, the most vital question for the average low pressure engine is that of the mileage obtainable from the various gasolines by their actual use on the road.

Every autoist has determined the mileage of some gasoline by using it on a trip and dividing the speedometer reading by the number of gallons of gasoline purchased. Results thus obtained are practically worthless for comparison of gasolines, since they do not take into account various factors which influence the mileage, such as the wind, condition and kind of roads, load carried, traffic congestion, tire inflation, speed of travel, and actual quantities of gasoline received at filling stations. There are enough variables involved in running an automobile that any mileage results obtained by disregarding them must be looked upon with a bit of suspicion.

So this paper is a report of an investigation undertaken with the intention of taking these variables into account just as fully as the circumstances would permit. But at best, the results are not strictly quantitative in character and the order of the mileage might have been somewhat different had some other make of car been used. The report is given, however, with the hope that the method at least may have some value.

A two-passenger Buick coupe, weighing 3,215 pounds, was used in the tests. The car had been run only about 5,000 miles and was in excellent running condition. A temporary gas tank holding slightly more than a gallon was mounted above and to the side of the carburetor. A T-connection was placed in the main fuel line at the point where it enters the carburetor. Through its side arm the gasoline from the temporary tank was admitted to the main fuel line. Valves were placed in each line so that the gasoline might be fed to the carburetor from either tank as desired.

A run with a given gasoline was made by placing a gallon of it in the temporary tank. A narrow neck bottle was used to measure the gasoline. It was calibrated to deliver a gallon at 25° C. The calibration mark was on the narrow neck. A second bottle of the gasoline was taken along for the return trip. The runs were made on a wide concrete road on which traffic was light. Nearly all the route is level. The runs were all made when the road was dry, and they were usually made early in the morning when the traffic was lightest. The car was driven to the starting point just outside the city. By this initial run and by means of the heat regulator the engine was warmed up to 130°, its normal temperature. This temperature was maintained as nearly as possible throughout the run. At the starting point the gasoline was shut off from the regular tank and the car run "idle" until the gas in the pipe and carburetor was used up. The valve in the temporary line was now opened, the trip speedometer set at 0 miles, and the car started and run as nearly as possible at a speed of 25 miles until the gallon of gas was used up. The speedometer reading gave the mileage for the trip out.

The valves in the two gas lines were reversed. The car was run a few feet further, turned, and driven back to the spot where the run had ended. The extra gallon of gasoline was put into the temporary tank, and the same procedure followed in making the return trip as on the outward trip. The run was made both ways in an attempt to eliminate the effect of any wind which might be assisting or retarding the speed; and to correct for any difference in elevation of the starting and ending points. The average of the two mileages was taken as the mileage for that particular gasoline.

The tires were each time inflated to 38 pounds pressure, and the carburetor properly adjusted for the gasoline. The same load was carried in the car, and the windows lowered the same distance to make the resistance of the air uniform in all the runs. In none of the runs was it necessary to stop the car or to change the speed more than two or three miles, and then only for a very short time. It is generally thought by experts that a car will give the best mileage when running at a speed of 20 miles. If this is the speed of maximum efficiency, then running either faster or slower decreases the mileage. But at a 25 mile speed deviations above and below tend to correct each other. While this speed may have cut down the mileage slightly, the comparative results were made more accurate. The relation of speed and mileage is shown in one of the runs with Indian common gasoline which was made at 40 miles speed. This cut the mileage from 17.83 to 16.

The results obtained by using 24 of the more common gasolines, purchased at the regular filling stations, are tabulated in the table on the following page.

It is very easy to draw false conclusions from these data. The relative commercial values of these gasolines is not shown by these mileages for they are not all competing solely on the mileage basis. There is no very sure standard for rating them when such qualities are considered as freedom from knocking, ease of starting, carbonizing the cylinder, etc. But for the particular car used in these tests, and probably for most cars, these figures represent the relative number of miles per gallon which can be obtained from these different gasolines.

The distillation range of each gasoline was determined and appears in the table. This was done to see if the mileage might not be a function of the position and shape of the distillation curve. In general the higher the end point the greater the mileage, unless it has also a large volatile fraction. This is due to the fact that the larger molecules burn longer and deliver power during the entire stroke of the piston. But a few of the curves obtained for these gasolines need further study before any definite statements can be made on the above question.

Table Showing Mileage and Distillation Range of 24 Gasolines Marketed in Terre Haute.

SAMPLE	MILES			Tire Pressure	Speed in Miles	Barometer	Specific Gravity	Cost per Gallon	Cost per 1000 Miles	DISTILLATION RANGE FAH.°													
	Out	In	Aver.							1st Drop	10	20	30	40	50	60	70	80	90	End Point	Recovery	Residue	Dist. Loss
Culley—Common	16.9	16.15	16.53	38	25	747	720	18	10.88	93	140	174	203	232	259	279	313	347	388	433	97	1.7	1.3
Culley—H. T	17.3	17.9	17.6	38	25	750	740	21	11.93	109	165	187	199	214	230	255	291	329	374	421	97.5	1.6	.9
Red Crown	17.2	16.65	16.92	38	25	750	740	18	10.64	111	167	208	230	255	279	300	324	347	379	415	97.5	1.7	.8
Solite	16.7	16.3	16.5	38	25	748	715	21	12.72	100	147	179	207	226	244	256	280	302	334	392	97.5	1.5	1
Diamond—Common	17.15	18	17.58	38	25	748	740	18	10.24	106	167	203	230	261	279	300	325	356	390	448	98	1.7	.3
Diamond—H. T	15.95	17.95	16.95	38	25	750	735	21	12.39	106	169	216	248	273	304	329	347	374	406	455	97.5	1.6	.9
Linco—Common	17.1	18.51	17.8	38	25	750	735	18	10.11	104	158	196	223	248	273	297	322	349	381	421	97	1.7	1.3
Linco—H. T	15.76	16.9	16.33	38	25	750	715	21	12.86	100	144	171	192	212	228	243	261	291	329	383	97	1.5	1.5
SinClair—Common	17.2	18	17.6	38	25	757	735	18	10.23	97	144	190	228	259	288	315	345	370	399	424	97.5	1.2	1.3
SinClair—H. T	17.7	17.85	17.77	38	25	750	750	21	11.81	111	169	207	232	257	279	300	331	365	401	423	97	1.4	1.6
Producers—Common	16.75	18.45	17.6	38	25	751	735	17	9.66	109	169	207	228	250	275	300	331	358	394	432	97.5	1.6	.9
Producers—H. T	16	16.1	16.05	38	25	750	685	20	12.46	100	126	136	147	156	169	179	189	208	235	300	97	1.3	1.7
Quality—Common	16.9	17.4	17.15	38	25	755	730	18	10.49	109	160	192	221	241	268	300	336	367	405	439	97.5	1.6	.9
Target	16.4	18.2	17.3	38	25	756	735	18	10.40	95	138	181	214	246	275	300	334	365	401	428	97.5	1.5	1
Silver Flash	16.7	16.6	16.65	38	25	754	725	21	12.61	93	138	174	205	214	250	275	297	320	349	374	97	1.5	1.5
Shell—Common	16.73	17.9	17.31	38	25	754	730	18	10.40	111	154	194	226	252	275	300	324	349	378	401	97	1.4	1.6
Shell—H. T	16.6	17.05	16.83	38	25	754	730	21	12.47	99	156	181	210	239	259	279	298	322	347	376	97.5	1.1	1.4
Johnson—Common	17.3	16.85	17.08	38	25	753	730	18	10.54	102	154	196	230	257	284	316	349	378	410	437	97	1.3	1.7
Johnson—H. T	16.9	17.4	17.15	38	25	750	710	21	12.24	102	144	172	196	219	235	253	291	302	336	385	98	1.1	.9
Indian—Common	18.35	17.3	17.83	38	25	749	730	18	10.09	108	162	199	226	259	280	302	325	354	390	430	97	1.7	1.3
Indian—Common	16.9	17.3	17.1	30	25	757	730	18	10.53	108	162	199	226	259	280	302	325	354	390	430	97	1.7	1.3
Indian—Common	15.5	16.5	16.0	38	40	754	730	18	11.25	108	162	199	226	259	280	302	325	354	390	430	97	1.7	1.3
Indian Red	17.2	18.1	17.65	38	25	753	735	21	11.33	102	160	192	221	241	262	280	302	329	367	414	97	1.6	1.4
White Rose	16.8	17.28	17.04	38	25	750	735	21	12.32	117	174	210	234	252	275	293	315	342	378	415	97	1.6	1.4
Ethyl	17.45	17.5	17.48	38	25	755	735	21	12.01	111	171	207	235	257	279	304	325	349	383	421	97	1.2	1.8
Aerolene	17.45	18.1	17.78	38	25	748	780	21	11.25	131	189	212	228	248	271	289	307	327	370	430	97.5	1.6	.9