A DISCUSSION ABOUT THE STEAM CAR

■

Some Straight-Talk Letters
Reprinted from
the

SCIENTIFIC AMERICAN

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THE
STANLEY MOTOR
CARRIAGE
CO.

NEWTON, MASSACHUSETTS

THE letters herewith are reprinted from the correspondence columns of the *Scientific American*, whose editors, of course, assumed no responsibility for any statements therein.

We are under obligations to the editors of the *Scientific American* for permission to reprint them.

It will be observed that omissions have been made in some of the favorable letters. The unfavorable letters, however, are reprinted in full.

A good many of the letters in the series have been omitted because they were merely repetitions of the points made in these we reproduce.

MR. PRIOR emphasizes a subject which is already critical and is bound to become even worse. With nature's supply absolutely limited, the two million automobiles to be built next year will not relieve the situation.

From the issue of September 9, 1916

One Solution of the Fuel Problem

To the Editor of the SCIENTIFIC AMERICAN:

"Owing to the increasing demand for gasoline, etc., engineers and inventors should bestir themselves and discover some method whereby kerosene, crude oil, etc., may be used as automobile fuels, etc."

This is the kind of thing we see in almost every issue of automobile and scientific periodicals, and the few who know about steam automobiles, past, present and prospective, cannot refrain from indulging in more than a smile.

Although not manufactured in large numbers, we still have the steam car in our midst, in spite of prejudice and superstition, and even though editors and writers seem to consider it as extinct as the dodo. With a successful example of the kerosene-burning automobile on the market, inventors continue to grope blindly for some method of satisfactorily using kerosene. But to continue the hunt is absurd in the extreme.

Technical writers seldom, if ever, refer to the possibility of "burning" fuel, being apparently obsessed with the idea that nothing is worth a moment's thought nowadays except the internal-combustion motor. . . . Inventors are after the most miles per *gallon* when what is most important to the automobilist is simplicity and the most miles per *dollar*. That means kerosene or crude oil and the steamers. The steamer is the simplest and most economical car to-day, and simplicity and economy will win out. Steam power needs only development and improvement — not discovery. . . .

There are many who believe this to be an undeveloped field, full of promise and possibilities. It is certainly a very fascinating subject to those who have handled a sturdy and reliable steamer. "Ask the man who owns one." You will find him a devotee, and his satisfaction increases every time he audits his expense account and checks over his fuel and tire bills. But when he reads that some one has still to discover a successful method of using kerosene as an automobile fuel, the only relief for his overwrought feelings is a ride in the car with the "yet to be

invented" kerosene-burning power plant. More light on this "burning" question is what is needed. CHAS. EDW. PRIOR, JR.

HARTFORD, CONN.

MR. HARBISON, below, touches on a subject which is even more vital to the motorist — the shifting of gears, which is the mark of the fundamental unsuitability of the internal-explosive motor for propelling a variable speed, variable load device like an automobile.

From the issue of September 16, 1916

Stripping Gears

To the Editor of the SCIENTIFIC AMERICAN:

L. B. Baker's letter on his unhappy experience with the gears of his motor car, due to his ignorance, touches on a matter that is merely a ramification of the big and vital subject of Service. Thorough instructions on the essential principles of the car's construction and operation should be given by every dealer to every purchaser. . . .

Mr. Baker, however, need not bother to learn how to avoid stripping gears. The car of the immediate and most imminent future will have none; and it will be steam driven. This is a prophecy and a prediction we are willing to put our money on. H. T. HARBISON.

GRAND RAPIDS, MICH.

THE letters are getting warmer. Witness the following tribute from "A Rider in a Steam Car." What manner of mind is this, to which a carburetor, a magneto, a timer, a distributor, a clutch, a fly-wheel, a change speed lever, are all less "complicated and mysterious" than the complete absence of them, as well as of their functions?

From the issue of October 28, 1916

The Steam Car?

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of September 9 I read with great interest Mr. Prior's article favoring the steam car, stating it had solved the big question

of the day for automobilists, simplicity and economy in operating a machine. I do not own a steamer, but Fate ordains that there should be one in the family whence comes my knowledge on the subject. In regard to Mr. Prior's first point, simplicity, to me the only connection the word has with the steamer is simply to leave it alone. If there is any gas car more complicated and mysterious than a steamer, I have yet to see it. To be really eligible for driving a steamer one should take an engineer's training. One has to keep a vigilant eye on the various dials of steam, pressure, etc., that keep company with several valves on the dashboard, to say nothing of pump valves located within reaching distance of the driver. These are only a few of the many simplicities that demand the constant attention of the careful driver, and help to pile up trial and tribulation for the owner of a steam car.

Next, the important subject of economy. Yes, kerosene is cheaper, selling for about nine cents a gallon, as compared with twenty-four for gasoline, but some things are worth the price. Perhaps Mr. Prior has been in one of the big stores in New York equipped with a restaurant where one may eat on the lower floor, closely connected with the kitchen, and for a moderate price not only can obtain food, but be entitled to all the savory and unsavory odors thrown in, including the aroma of grease, fish, stews, etc. And also for a little higher price one may have the privilege of dining on the top floor, far away from these appetizing smells, where one may masticate to the strains of music and aid digestion by the beautiful view of New York's sky line. For one not born and bred in a soap factory there is but one choice. Some things are worth paying for, and gasoline as compared with kerosene and its results is one of them.

There is an everlasting odor, going, coming or standing, in the car that uses kerosene for fuel. Kerosene never will be popular or practical so long as it is accompanied by that penetrating and disagreeable odor, which takes us back to the days of smoking lamps. After a day's ride, the car, the passengers and in fact the whole outfit reeks with attar of kerosene, which can be purchased at any country store for nine cents a gallon.

Users of steam cars are getting less each year instead of more, and it is only a question of time when the old steamer will be as scarce as the deacon's one horse shay.

A Rider in a Steam Car.

NOW comes Mr. Lambert, absolutely denying, from experience with his Stanley, the imputations made by "A Rider in a Steam Car." And he is willing to back up his denial by demonstrative proof of most convincing nature. This, by the way, is universally true of Stanley owners.

From the issue of November 11, 1916

The Steam Car — A Challenge

To the Editor of the SCIENTIFIC AMERICAN:

Your issue dated October 28 contains an article on the steam-propelled automobile by "A Rider in a Steam Car" which was ostensibly designed as a reply or rejoinder to one in your issue dated September 9 by Mr. Prior.

It is the general belief that, when one sets forth his views on a subject which is more or less vital to the health, happiness or well being of the readers of a journal which is designed as a medium for instruction, which the SCIENTIFIC AMERICAN is, one would expect that the writers of such would be competent to handle their subject in a manner that would be instructive, but not necessarily technical; but in this case of "A Rider in a Steam Car" the article is neither instructive nor technical; and more than that, it proves that the person knows not one correct item relative to the steam car, and he is evidently very unfamiliar with the "family" steam car, or this car must be of the vintage of the "One Horse Shay."

The writer is the pleased owner of a 1916 steam car, and, as there is but one steam-driven automobile being made in marketable quantities at present, will allow "A Rider in a Steam Car" one guess as to the make.

Kerosene being slightly more than one-third the expense per gallon of gasoline and giving slightly more heat units, I am using kerosene; but for those who are not particular about expense, also the greater explosive risk in the use of gasoline, the latter fuel can be used in generating steam with no change in the appliance by which liquid fuel is used. The mileage will be less, however, and the "soap factory" perfume will be the same because there is none such with either fuel.

Having formed the habit years ago of never talking without a working knowledge of my subject and being prepared at all times to illustrate the facts of my "conversation," will engage to do this: Take "A Rider in a Steam Car" on a

trip covering from one hundred to two hundred miles in my five-passenger steam car, "up hill and down dale," any description of road from smooth asphalt or brick to logging roads in mountainous country and (this has to do with the manipulation of valves), if a valve is moved on the car other than the steam throttle valve throughout the journey, I will pay his expenses in coming to and going from the city in which I live, to his home.

Should the trip cover two hundred miles, we will take water once; and should a gasoline-propelled car pass us on the level going, or on the hills (any make of car), I will then pay the above mentioned expenses; and should he say at the end of the trip that the ride was not the smoothest, safest and fastest he ever had in any car, he can collect the expense.

We will also burn kerosene; and if he can detect any "smoky lamp" or "soap factory odors" during the ride, he will be welcome to collect.

C. F. LAMBERT.

MR. NIES follows with a letter which is technical, to be sure, but unusually clear and convincing. Perhaps it is his profession of teaching engineering in a leading institute which enables him to make his points easily comprehensible to the lay mind. You will admit his letter is mighty good reading. Mr. Nies owns a Buick and wants a Stanley.

From the issue of November 25, 1916

Figures on the Steam Car

To the Editor of the SCIENTIFIC AMERICAN:

The undersigned has read with much interest Mr. Charles Prior's letter on the steam car in your issue of September 9, 1916, and also a letter on the same subject in the issue of October 28, in which Mr. Prior is accused of eating in the kitchen. If Mr. Prior is willing to receive callers in the kitchen, the present writer will be glad to join him there, opening the conversation with the remark that a very good case can be made for the steamer — not only on the grounds that the steamer uses cheaper fuel, can be throttled to as low a speed as you please without loss of tractive effort, is smooth in action, and has no gear shift, though these are all points of advantage that would be proclaimed from the house tops by "gas car" drivers if they had

them on their cars — but on the grounds that the steamer is a more consistent and steadier performer, its engine much more powerful and responsive to the driver's will, and the car incomparably more active on the road.

On the road the steamer has all the best of it. On a straight speed trial it has to be an extraordinary gas car that the steamer will not run away from. In pick up, the steamer gets away at least twice as fast as any comparable gas car. A comparison between a steamer and a representative gas car will illustrate this point: the gas car selected for this comparison is a very good one and is not singled out for criticism; it has an eight cylinder 3.125″ by 5.125″ L-head engine geared 4.5 to 1 with 36″ wheels. This car can develop on high gear a tractive effort of 425 pounds; but this figure represents an absolute limit, and is not attainable unless the speed is about 15 miles per hour and all conditions favorable. At 2 miles per hour the tractive effort is practically nothing; at 5 miles it is about 300 pounds, rising to 425 pounds at 15 miles; beyond that speed it decreases. These draw-bar pulls are obtainable only on steady runs at constant speed; they cannot be obtained during rapid acceleration, as the conditions of carburetion and ignition timing are then unfavorable. It is doubtful whether this car can develop an average draw-bar pull as high as 350 pounds (giving an acceleration of 2.75 miles per hour per sec.), when rapidly accelerating through that part of the speed range lying between 2 and 30 miles per hour.

A steamer with a two-cylinder double-acting 4″ by 5″ engine geared 1.5 to 1 with 34″ wheels, when operating on 600 pounds steam pressure and full stroke cut off, can develop a draw-bar pull of 1,975 pounds. This is much more than enough to slip the wheels. Besides, at this cut off, steam will be used faster than the boiler can make it unless the speed is low. With the cut off at half-stroke the tractive effort on full throttle is still much more than enough to slip the wheels. On some cars the valve gear will not permit a cut off earlier than half-stroke, the control below that being by throttle. On such cars the throttle is never opened wide, and because of this there is some uncertainty in the position of the steam line on the card, and thus it is not easy to determine what card area and tractive effort are continuously available. To get a basis for comparison a cut off at one-sixth stroke (which can be had on some cars) will be assumed, with full throttle. At one-sixth stroke cut off with 600 pounds steam pressure and 200 degrees superheat the mean effective pressure is

sufficient to produce a tractive effort of 900 pounds. Although this cut off does not give a result especially favorable to the steamer, compare it with the gas car's average value of 350 pounds or best value of 425 pounds; even on the basis of the latter value the ratio is over 2 to 1 in favor of the steamer. But the steamer is not limited to this value. A later cut off than one-sixth can be taken; or on cars with cut off at half-stroke the throttle can be opened. In either case the limiting tractive effort of 1,300 pounds can be obtained, and sustained if the speed is not too high. On this basis at 5 miles per hour the comparison is between 1,300 pounds for the steamer and 300 pounds for the gas car, or 4.3 to 1 in favor of the steamer. The steamer is far more powerful and lively, and can get away from the gas car fully as fast as the gas car can get away from a post. Gas cars have speed enough, of course, but the instantaneous leap of the steamer in response to the throttle is unmatchable by any gas car.

In hill climbing the ability of the steamer is limited only by the ability to get traction. The steam car driver does not need to rush hills, but can approach and climb at any speed he may think advisable; the choice of speed is wholly his and is not subject to the dictation of his engine. He does not need to keep his mind and muscle set for the prospective shift of gears. He knows in advance, before the hill comes into view, that the car will climb it without asking any consideration from him. He also has that comfortable feeling that comes of knowing that he can beat the other fellow, *any* other fellow in a gas car, with ridiculous ease.

The performance of a gas car on a hill that is a little too much for the high gear is pure comedy. Borrowing from the kindergarten tale of the plucky, puffing little switch engine, "Life" put it this way:

IthinkIcanIthinkIcan!
I-think-I-can-I-think-I-can!
I–think–I–can–I–think–I–can!
I—think—I—can—I—think—I—can!
I—guess—I—can't—I—guess—I—can't!
Iguess———Ican't———Iguess———Ican't!
I KNOW I——————————CAN'T!

The poet had in mind a one-cylinder car, but the twelve-cylinder is essentially the same in kind and sings the same song. All members of the internal-combustion family are alike in having no reserve of energy beyond a mere trifle of kinetic energy in the fly-wheel; they all eke out the same kind of improvident, precarious, hand-to-mouth existence without a penny in bank.

The weakness of the gas car on hills (and in

pick-up) is the result of its bad speed-power characteristic; in this respect the twelve-cylinder car is really not much better off than the one-cylinder, multiplicity of cylinders having but little to do with the matter. The speed-power curve for the eight-cylinder engine already referred to shows this clearly. This engine is as good as any of its type, and can develop a maximum of 70 horse-power. The owner probably realizes that all this power is not ordinarily needed, but he tells himself (and this thought is usually fathered to some extent by the salesman of the car) that it is a fine thing to have a lot of surplus power when he wants it on grades or for heavy going. Right enough, if the power were only there, but the point is that it isn't there, *when he wants it.*

Suppose for example that the owner wants to take a hill at 10 miles per hour — how much power can he use? At that speed the curve referred to tells us that the engine on his car is an 8-horse-power engine and no more. It isn't a matter of calling it that; the engine *is* actually that; 8 horse-power is exactly what it develops. At 5 miles per hour the engine is entitled to a rating of but 1 horse-power and balky at that; at 20 miles per hour, 25 horse-power. Unless the speed is 60 miles per hour there is no 70-horse-power engine on the car. Fully two-thirds of that maximum power is non-available at the usual touring speeds.

In the gas car the process of combustion is involved with the motion of the engine, so that the rate at which fuel can be burned is rigidly dependent upon the engine speed; for this reason the power decreases with decreasing speed, and the former decreases at the more rapid rate, so that the power becomes small, uncertain, and reaches the edge of complete disappearance just when maximum effort is most needed for negotiating grades or heavy going at moderate speed. The worst of it is that the power and torque disappear together.

In the steam car the conditions are radically different. The transfer of heat to the working substance takes place in the non-moving boiler by a continuous process and the available rate of transfer is completely independent of the engine speed. Just as much steam can be made at the lowest speed as at the highest speed. If the boiler can make steam at a rate corresponding to a 70-horse-power output (this is conservative) at maximum car speed, then that 70-horse-power rate of steam production is available at all speeds down to standstill. Of course at 10 miles per hour the engine cannot develop 70 horse-power, but it can develop more than three

times as much power as the given eight-cylinder engine can develop at that speed, and have steam to spare. At 20 miles per hour the steamer can develop between two and three times as much power as the gas car, and at 30 miles per hour the available power of the steamer is about double that of the gas car. This is the real argument for steam: *you get several times as much power at the speeds you use.* Moreover this advantage is secured without entailing any loss of high-speed ability, and with an engine speed only about one-third of that customarily used on gas cars.

In making these estimates it is assumed that steam is used only as fast as the boiler can make it so that the pressure is not pulled down; but steam can be used faster than that for a short time if necessary by drawing upon the reserve of energy in the boiler, about 750,000 foot-pounds being available, the pressure being pulled down on the grade and picked up again after the grade has been topped.

It is for these good reasons that no gas car whatever has the slightest chance with a steamer on hill work.

At this place the following extract from a paper by Browne and Lockwood (Trans. S. A. E., Volume 10, Part 1, Page 87) may be of interest: "It is the pull or push of the tire on the road that is effective in the propulsion of a car. Witness the utter absurdity of a steam car equipped with a 20-horse-power engine outpacing and outclimbing gas cars the engines of which will develop upward of 80 horse-power on the block. The steam car does this by greater and more uniform torque delivered to its rear wheels . . ." On Page 90: "The remark relative to steam car rating was taken from the basis of the . . . rating. I have driven in a . . . steamer which is owned by a friend of mine who enjoys an occasional brush on the road. He has a motor rated at 20 horse-power at 500 pounds of steam, I think. He carries 600 boiler pressure. I assure you that no 80-horse-power touring car built in this country has any license with him on the road." Now this is all true, but there is nothing absurd about it; it is exactly what should be expected from the far better speed-power characteristic of the steam car. If great power is the supreme motor luxury, then that luxury is only to be had through the use of steam.

Bona fide flexibility means the ability to put upon the rear wheels, in instantaneous positive response to the driver's will, at any time and at any speed, any tractive effort that may be re-

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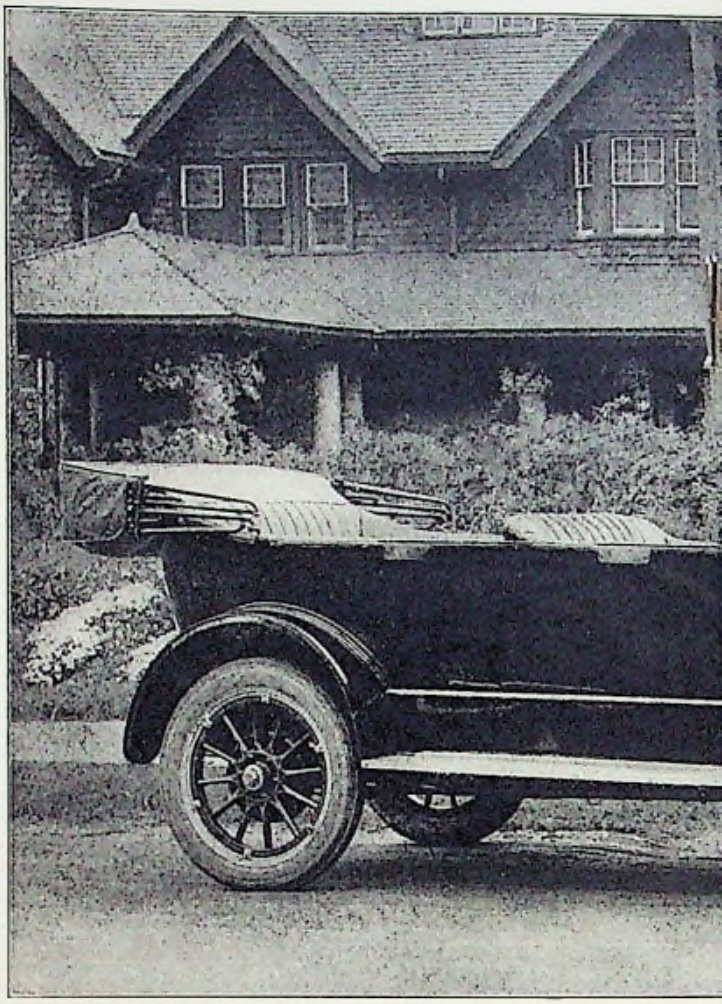
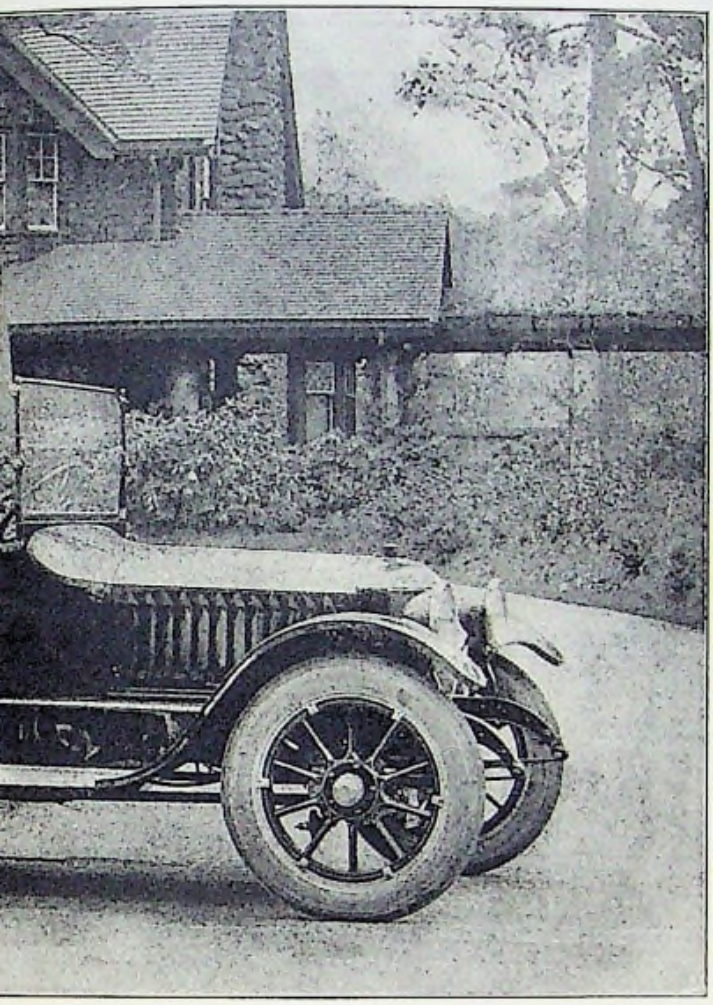


ONE-FINGER control and power at low speeds!

The two things that every man or woman who has ever driven a car has been looking for. The two things that you have been made to believe were impossible to get.

One-finger control means simply this — a complete mastery of a high-powered, comfortable, beautiful car without the constant mental and physical strain of shifting gears, pedaling a clutch, advancing or retarding a spark and gasoline lever, without a thought for carburetor, magneto or starting motor.

The actual control of the car is almost as easy as the thought.



The Stanley gives the performance a *man* demands, with the control a *woman* wants.

It is unfailing and satisfying in operation and performance.

The single characteristic of power at low speeds is in itself an epoch-making attainment. Sand, mud, hills, traffic — none of the bugbears of the motorist's life give the Stanley owner the slightest concern.

The car has the same maximum power available for tractive effort at one or two miles an hour that it has at sixty.

One-finger control and power at low speeds —

Yours, if you drive a Stanley.

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quired by the road condition. That kind of flexibility can be had only with steam.

In consistency of performance the steamer is far better than its rival. There is no known way to make a steam engine miss fire, but the number of ways by which a gas engine will miss fire is beyond any counting. The performance of the steamer is entirely regular, the same every day and every mile; it is beyond comparison with the whimsical and temperamental performance of the gas car.

J. D. NIES.

CHICAGO, ILL.

THE internal-explosive car, of course, has its champions, and Mr. Wilson's views are interesting even if they don't quite hold water from the steam car standpoint.

From the issue of December 16, 1916

A Few Questions Concerning the Steam Automobile

To the Editor of the SCIENTIFIC AMERICAN:

I have been very interested in the letters on the steam car in your issues of September 9, 1916, October 28, and especially one on November 25 by Mr. J. D. Nies, and as they have all been on the same subject — the steam car — I would like to ask a few questions concerning it, and to say a few words in behalf of the gasoline car.

I notice that Mr. Nies says that the steamer uses cheaper fuel. Yes, kerosene is cheaper than gasoline, but how about the quantity consumed? One hundred ——— cars all over the United States were tested as to their gasoline consumption a year ago, and it was found that the average of all the cars taken together was 32.8 miles per gallon, and in the new ——— cars this year the gasoline consumption has been decreased 17 per cent. How much does the steam car average to the gallon of kerosene and do the prices of the two fuels differ to such an extent that in the end it costs the man with the gasoline car more for fuel than a man with a steam car?

In regard to the pick-up ability of the steamer I do not deny the fact that it is far better than the gasoline car, but what good does the ability of a car to pick up extremely quickly do the average man who drives his car for the pleasure in it, with a view to preserving his

health and the convenience derived therefrom? It doesn't matter to him whether he can pick up quite as quickly as some other car or not, or whether he can go fast for a short spurt. His main thought in buying a car is the pleasure he is going to derive from riding in it, and not how quickly he can pick up so that he can beat anybody on the road. As a matter of fact the gasoline car can defeat the steam car with ease in regard to speed for any length of time, as the steamer cannot make steam fast enough to average 106 miles per hour for over 300 miles — a record made not long ago by a gasoline car. If the steam car can go so much faster than a gasoline car, why do not its makers enter it in some of the automobile races, where it has a chance to go as fast as it wants to, to prove to the gasoline car makers that the gas car is to the steam car as a snail to a rabbit?

The steam car is undoubtedly the best hill climber, but that doesn't say that the gasoline car is not a good enough one. Why is there any use in having a lot more power than is necessary? The ——— car will go up any hill that any sane man would want to go up, but the majority of the hills that one usually has to climb year in and year out are not awfully steep. When comparing the hill climbing powers of a steam car with a gasoline car one should make comparison with the ability of the gas car on low gear. When one compares the steam car with the ability of the gas car on high gear he does not make a fair comparison, because it must be remembered that the gas car is many times as powerful on low gear as it is on high gear. I notice that Mr. Nies says: "If great power is the supreme motor luxury, then that luxury is only to be had through the use of steam." This is not the case, however, for great power is not supreme motor luxury. Supreme motor luxury consists in freedom from excessive vibration, easy riding and minimum of trouble in taking care of the car.

The steam car demands a great deal more attention than the gas car. On the ——— car there is nothing to do except to turn a few grease cups once a week, fill with gasoline, and oil several parts once a month. In the steam car it is necessary to keep the pilot light going all the time, therefore requiring that the gasoline tank be filled every two days and that a consistent watch be kept, especially in winter time, to see that the pilot light does not go out. Also that the kerosene burners be cleaned very frequently, besides turning some grease cups, repacking the various pumps, and filling with water. When a man is very busy all the time

he does not want to have to tend to his car every two days, and so this is a constant cause of annoyance. The modern motorist does not want to have to bother with fixing his car except at week-ends. His idea of a car is one that requires an hour's attention perhaps once a week, and the rest of the week nothing to do but just to go to the garage and get the car out. He also wants to throw a switch and have the car start, and not to have to attend to anything else except to drive, rather than have to pump several pumps, be sure that the steam pressure is high enough, and that there is plenty of water in the boiler. Where water is expensive, as in some places, there is an added expense for fuel.

It is true that there is no way to make a steam car miss fire, but it is also true that there are thousands of ways that a steam pipe can leak. This is usually the case when you are in a hurry to go anywhere in a steam car. Either the superheater tube is split, or one of the pipes is stopped up with sediment, or one of the pumps needs packing. An ordinary gas car, with slight care, will very seldom miss, and the engine will always perform consistently if it is cared for at all properly. Our ——— car has been driven over 14,000 miles. It has only missed twice during that time, which was due to the fact that the magneto points had worn out, a matter of a short time to replace.

If the steam car's transmission of power is so uniform why are strut rods used? The —— car can boast of not using a single strut rod to the back axle. The back axle hangs alone on the rear springs. This is one of the reasons that the tire economy is so great. ——— owners all over the country average from 8,000 to 14,000 miles on their tires. This is due to the fact that the traction power is not too great as on the steam car.

I have stated above that easy riding is one of the supreme motor luxuries. In this respect the ——— car is better than the steam car, because how can a car with full elliptic springs front and back, set on an angle so as to offset road shocks, and with a wooden frame that absorbs the road shocks, ride harder than a car with a steel frame and *without* full elliptic springs?

I will be very much obliged if Mr. Nies will answer some of my questions as I would very much like to get some data on the steam car and to know something of its capabilities and troubles. I am not at all prejudiced against it, and if it can be shown to be better than the high class gasoline car for the average man, I should like to uphold it to the best of my ability.

F. Vaux Wilson, Jr.

Grande Mere, P. Q.

THE racing question comes up pretty often, so Mr. Warren, out of a long Stanley experience, tells the story from the "other" side — the side you don't often hear.

From the issue of January 20, 1917

The Steam Car: One Question Answered

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of December 16, Mr. F. Vaux Wilson, Jr., asks, among other questions, this one: "If the steam car can go so much faster than a gasoline car, why do not its makers enter it in some of the automobile races where it has a chance to go as fast as it wants to, to prove to the gasoline car makers that the gas car is to the steam car as a snail to a rabbit?"

The information seems to be due Mr. Wilson, as well as to such of your readers as may consider this a fair question, that steam cars have for years been persistently excluded from racing events by the terms of the entry blanks. "For Gasoline Cars Only" was a very familiar phrase appearing after the description of each event on such entry blanks. Occasionally, where a free-for-all event was scheduled, the steam cars were not excluded.

In former days price and performance were the determining factors. Cars were classed as to their price, as shown in manufacturers' catalogues. Free-for-all events were, of course, open not only to stock cars, but to specially constructed cars.

Sometimes these entry blanks were very ingeniously drawn up. On one occasion, for instance, the phrase "For Gasoline Cars Only" appeared on the event for cars from $1,200 to $1,500 inclusive, but did not appear on the event from $1,501 to $1,800. There was a well-known make of steam car which had two models between $1,200 and $1,500, but there was no known make of steam car which had a model listed between $1,501 and $1,800. The whole entry list was made up in this ingenious way.

On another occasion entry blanks in various price classes had been sent out, without the

excluding phrase, "For Gasoline Cars Only." Steam cars were entered in all the events for which they were eligible, whereupon the manager of the meet informed the entrant that he was obliged to withdraw the original entry blanks and substitute others with the excluding phrase, and was candid enough to say that if the original entry blank stood, he would be unable to secure any gasoline car entries.

On another occasion, a hill-climbing contest, the steam car having been excluded from all price-class events, but being admitted to the free-for-all, the local dealers in a certain steam car entered their stock models in the free-for-all event for the purpose of making records to be compared with those made in the price-class events. And entrants of stock gasoline cars in the price-events protested against allowing these steam stock cars to compete in the free-for-all. They were permitted to compete, however, and showed that they were easily capable of winning the price-class events, had they been admitted.

For years steam cars were prevented from getting an officially observed and certified test on the famous Brooklands Track in England on the ground that the Governors had no formula for determining the horse-power rating of steam cars.

And the exclusiveness of gasoline cars is not confined merely to hill-climbing events and speed events. At the famous "Dust Trials" in England in 1906 a steam car won handily. Steam cars were barred from subsequent similar events. At a recent "Slow Race" in a Western city — a race on high gears without stopping — the steam car entrant was protested at the post, and when the protest was overruled, one of the best known makes of eight-cylinder cars and one of the best known makes of twelve-cylinder cars were withdrawn and did not start.

These are but a few instances, but they are typical of almost innumerable ones. They will serve, perhaps, as an intelligent answer to Mr. Wilson's question.

It is not surprising, in view of this persistent exclusion, that manufacturers and owners of steam cars should have eschewed racing; but it is rather ironical that they should now be twitted of it.

PRESCOTT WARREN.

NEWTON, MASS.

A "COMPOSITE" letter automatically closed this series. We hope the editors of the SCIENTIFIC AMERICAN *may see fit to bring this big subject of "steam vs. gas" into their columns again.*

From the issue of February 3, 1917

Steamer *vs.* Gas Car; the Last Word

(In his issue of December 16, and in connection with the discussion of the relative merits of the gas and steam cars started by Mr. C. E. Prior, the Editor of the SCIENTIFIC AMERICAN carried a series of questions proposed by Mr. F. V. Wilson. A number of correspondents have answered these in full or in part. All of these writers bring out points of interest which the others overlook; but there is so much duplication between their letters that complete publication of all of them seems inadvisable. The Editor has accordingly prepared a composite letter embodying the essential portions of all these communications; and he prints this herewith to close out the present discussion. For this very fair presentation of the steam owner's attitude the Editor is indebted to Messrs. J. D. Nies and Herbert H. Frey of Chicago, Dr. Malcolm Dean Miller of Wollaston, Mass., and several others who have expressed a desire to remain anonymous.)

To the Editor of the SCIENTIFIC AMERICAN:

Mr. Wilson's first question concerns the fuel expense of the two cars. The steamer gives from 10 to 14 miles per gallon of kerosene. Mr. Wilson claims that the gas car makes 32.8 miles per gallon of gasoline; but this is surely an excessive estimate. We know of but two gas cars which claim a mileage greater than thirty. A fair summer average for gas cars of moderate size would certainly be no more than 20 miles per gallon, perhaps not so high. In the bad going of winter it falls considerably lower. Under average conditions we would place the mileage per gallon of a 125″ wheel base gas car at 25 per cent more than that of the steamer.

This leaves the steamer's fuel bill about half that of the gas car. But the steamer has a power plant about three times as powerful as that of the gas car at the average running speed. Combining the two factors, it is clear that for each dollar spent on fuel the steamer places at the driver's disposal six times as much power as does the gas car.

Of course the gas owner can shift to the low gear for greater power at reduced speed. But every time he does this he concedes the claim that the steamer possesses superiority in not doing it. Moreover, he himself will do it only as a last emergency measure; he admits with mortification that he is ever forced to do it; so any effort on his part to derive controversial advantage from his ability to do it is distinctly double-faced.

As a matter of fact, however, even this unfair advantage does not make his showing a creditable one. The tractive effort on high gear of the typical gas car may be put at 425 pounds. Taking the ratio between this and first speed as 3.33 and deducting 20 per cent for friction — less than the usual allowance — the tractive effort on first speed is 425 x 3.33 x 0.8 = 1,133 pounds, as against 1,975 for the steamer with full stroke cut off and 1,400 to 1,500 with half stroke cut off.

Mr. Wilson suggests that the rapid acceleration of the steamer is of secondary importance. Now pick-up is not to be confused with speed. A car may possess very ordinary maximum speed and yet be able to attain that maximum like a flash. This ability is always satisfying to the soul, and there are times when convenience and even safety depend upon it. When you go to town, it enables you to take instant advantage of every hole in the traffic. It also makes it possible to extricate the car from the tight place between the trolley and the coal truck or to leap out of the path of the joy rider. The most careful driver in the world will some day find himself in front of a train or another car on a blind crossing, and here surely Mr. Wilson will not discount the ability to shoot the car ahead.

The difference between the steam car and the gas car under this heading is just that between the athlete and the rheumatic. One should be able to drive as a healthy man walks, as slowly as he pleases, but in full command of his muscles, ready and able to leap backward or forward at an instant's notice. Certainly many accidents would be avoided if at the critical instant the victim's car possessed power in place of paralysis.

Another correspondent has brought out very ably the answer to Mr. Wilson's query as to why the steamer does not go out on the race track and show up the gas car. Let us mention another angle of this situation. How many owners use their cars on the track, and how many on the roads? What proportion of the power that the gas car develops on the track is

available on the road? To the average owner what is the sense of a track performance that can't be duplicated *on the road that he is going to use?* Eliminating racing luck, it is to be supposed that a track race between gas car and steamer would be very much of a nip and tuck affair, and that, if not actually a winner, the gas car's driver could go home with the satisfaction of having held his own. If next day he should meet his antagonist on the road, the latter would leave him as though anchored, because at road speeds of road cars the steamer has the use of several times the power of the gas car.

If, in Mr. Wilson's words, "the average man who drives his car for the pleasure in it, and with a view to preserving his health," finds these requirements fulfilled through the ability of his car to "average 106 miles per hour for three hours," then his choice of a gas car might be justified. But if he cares for the quality of the ride he is going to get, we cannot see the gas car at all. How many gas cars does one meet in the course of an afternoon's drive, with enough noises emanating from the hood to supply a boiler works? To the driver of such a car the vibration and mechanical noises to which he is accustomed are conspicuous in the steamer by their total absence. As long as the engine is supplied with its steam, it goes right on doing its work without obtruding itself upon the driver's consciousness at all. This absence of sensible effort on the part of the engine lends to the driving of a steamer a peculiar charm which the gas car can never possess.

It is argued that the steamer requires more care than the gas car. Of course to state that the steamer demands little attention would be the wildest hyperbole. But it is easier to keep pumps and piston rods packed than to keep valves properly ground; it is easier to keep vaporizers clean than to remove carbon from cylinders. Both cars require attention, but the steamer surely gives a longer ride for each hour spent puttering with it than does the gas car, provided both are kept in first class condition and the time spent by others than the owner is counted. The steam owner usually does this work himself, and a certain type of owner would of course find it irksome. For the man who objects strongly to the little operations that are taken as a matter of course by the mechanical man, who wants to press a button and get there, doubtless the gas car is preferable, he can keep it in such condition that it will run, somehow, with a minimum of effort on his part.

But to keep the gas car in the condition which the careful owner of mechanical bent would

exact, is something else. For while the fundamental principle of the gas car seems simpler than that of the steamer, since it generates its power by direct combustion rather than through the agency of a secondary vaporization, in its construction it is vastly more complicated. One convert from the gas to the steam car speaks as follows:

"I have driven my car over 14,000 miles since May, 1915. In securing that mileage I have many times been stuck on the road or in the garage by such troubles as are inevitable with spark plugs, magneto, carburetor, valves and valve springs, clutch, transmission and rear end. The self-starter, in particular, has been such a nuisance that I now use the storage battery for lighting only and prefer to crank the car. Some sort of repair, replacement or adjustment has been necessary almost every week, and had I not been situated near an excellent service station, I should have had much more trouble. I notice that many of my neighbors have had similar difficulties, in some instances so onerous that they have disposed of their gas cars in order to stop the drain on their finances.

"It seems to me that the steamer is superior because it has so few parts to get out of order. Electrical troubles are limited entirely to lights and horn; a storage battery for lighting only will seldom give the great amount of trouble that one designed for starting and lighting usually causes. It is not true that the kerosene burners have to be cleaned frequently. Several times a year it is well to pass a fine wire through the nozzles, but that is all the attention needed. Possibly once a month the boiler has to be blown off. The oiling system needs refilling after the car has run upward of 2,000 miles, not the adding of a pint or a quart of oil every little while, as with gas cars."

This question of starting is not so serious as Mr. Wilson supposes. To begin with, a single filling of the pilot is sufficient for four days, not two. Even if it were not so, an owner, who begrudges a trip to his garage every other day would better not have a car if he can't afford a chauffeur. And as for cost, experience shows us that if the pilot were kept alive 24 hours a day for 365 days of the year, and if the car's mileage in that time were only 10,000, the cost for fuels would be just about the same as for a 20 horse-power gas car in use throughout the year in all kinds of going.

It takes from four to twenty minutes to get a gas car out of the garage. During this time, in summer, even a cold steamer could be started,

provided one thinks to light the pilot first before attending to tires, grease cups, etc. In winter, on the other hand, an hour is frequently spent before the gas car will start, whereas continuous burning of the pilot allows the steamer to be started promptly, regardless of the temperature. Freezing can be easily prevented, even if the pilot is not kept burning; a very little heat from a gas jet will suffice if the car is properly housed and blanketed, or if it is used but seldom the water can be drained off. Plenty of gas owners have to do all these things.

Tire wear is *not* excessive on the steamer because it has "too much power." The control is so perfect that the good driver never has too much power — he always has just the right amount. In the gas car the clutch is engaged three times in starting and repeatedly on the road; at each engagement there is a forced adjustment of engine speed that takes it out of the tires. Other strains are caused by the inherent irregularity of drive and by the necessity for rushing hills; the driver takes sharp turns and stony roads at high speed to avoid losing headway on approaching an acclivity. In spite of greater weight on the rear axle, the steam car is conceded to be easier on tires than the gas car.

No one has ever designed a piece of machinery that will run indefinitely without attention of any sort. The car owner must expect to give his car a reasonable amount of care. And it stands to reason that in the steam car, with only thirty-two moving parts, there is far less likelihood of trouble than in the gas car, with its multitudinous moving parts, to say nothing of the complicated accessories and electrical devices, failure of any one of which will impair or prevent operation.

While the steam car is well available for the man who likes a lively drive and a little fun, its best field is found in its use by the man who prefers to drive at a reasonable pace without being penalized for his lack of the speed mania by being deprived of the use of 85 per cent of the power of his engine — without being continually pestered as a horseman would be if his mount had no pace but a trot, and could not walk without stumbling, or stand still without falling down.

JUST how many letters were sent in to the editors of the *Scientific American* which they were unable to publish, we have no means of knowing. The number was undoubtedly large, because the subject is one of general interest and one that is growing in importance every day. But it is safe to assume that the other letters were somewhat similar in tone to those few that found their way into print.

Now let's see what they mean. The pro-steam letters, you may observe, are a good deal different in tone from the anti-steam letters, and the difference is an unfortunate one for the anti-steam scribes. The former seem to be more specific, more constructive, more to the point. The impression is, in other words, that the pro-steam correspondents know what they are talking about and the anti-steams do not.

We speak of this because these letters illustrate in this way a condition that is generally true all over the country. Nine times out of ten when you find a man knocking the steam car, he does not know what he is talking about. No one who has ever gone carefully into the relative merits of the two types of power can conscientiously recommend the internal explosive engine. Mr. J. D. Nies, the author of the letter on page 7, "Figures on the Steam Car," summarized the situation unusually well in another place when he said:

"The gasoline engine will never be the equal in performance of the steam engine until it is provided with a gear box having an infinite number of speeds; until the gears in this box change themselves without attention on the part of the driver, and, in fact, without his knowledge and in such a way as always to give the ratio best suited to the work at hand; until the changes of gear are made without noise and without interruption of the tractive effort; until the engine secures overload capacity and starting torque; until it ceases to have a 'stagger point'; until it has some reserve of power, in some degree at least resembling the tremendous storage of energy provided by the hot water in the steam car's boiler; until it runs with the mathematical steadiness and consistency of the steam engine. This list might be extended to cover many other points, but it seems unnecessary. Faults may be found with the steam car, but absolutely not with the characteristic of the steam engine, which propulsion approaches the ideal for automobile work."

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