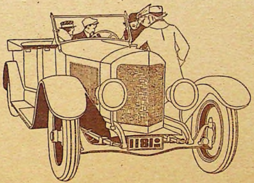
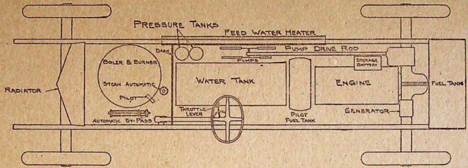
QUESTIONS AND ANSWERS



STANLEY MOTOR CARRIAGE COMPANY

NEWTON, MASSACHUSETTS



STANLEY CHASSIS LAYOUT

SHOWING LOCATIONS AND NAMES OF IMPORTANT PARTS

QUESTIONS AND ANSWERS

1. *Why is the Stanley car a Steam car?*

   Because steam is one of the only two powers which will meet the demands of a variable-speed, variable-power device.

2. *What is a variable-speed, variable-power device?*

   A machine that must operate under conditions of speed and power that are not constant. An automobile, for instance, is a variable-speed, variable-power device because it should run smoothly and efficiently at any speed from one mile an hour to 60 miles per hour. And it requires variable power even without variable speed, because it needs more power on a grade, or for acceleration in traffic, than it does on a smooth, level road.

3. *What power besides steam meets these requirements?*

   Electricity can be adapted to the work. But in an automobile it must have a battery which is limited in stored power and radius of action, and rapidly loses its maximum power.

4. *Why not an internal-explosive engine?*

   Because it is a constant-speed, constant-power device that operates efficiently only at a certain speed. That is, in order to get its rated power it must run at a certain constant speed. If it runs faster or more slowly than this, its power falls off. So an engine that gives 60 H. P. at 2500 R.P.M. can only produce about 5 H. P. at 500 R.P.M. and at very low speeds it has a "stagger point" at which it has just power enough to turn itself. Below this speed it cannot run smoothly, or may even refuse to run at all.

5. *How, then, are so many internal-explosive or gas engines driving cars today?*

   Simply because automobile engineers have *made* the internal-explosive engine operate under these conditions, by the addition of extraneous devices that make up for some of the shortcomings of the engine itself, and have thus adapted it to an automobile even though it is not well-suited for the work.

6. *What are these extraneous devices?*

   Carburetors, gear-shift sets, clutches, starting motors, jointed drive shafts.

7. *Why do you call them extraneous devices?*

Because they are not a part of an internal-explosive engine; but have to be added to it in the attempt to apply it to an automobile.

8. *Could not an internal-explosive motor drive an automobile without these devices?*

No, because it is a constant-speed, constant-load engine and has no starting effort, no stored power; nor can it be placed on the rear axle where the engine should be, and where the power is used.

9. *But is it not true that some gas cars have reserve power?*

Reserve power, yes — but not in the sense of stored power. A gas car can have any amount of power by using a large enough engine. But an engine large enough to handle the heavy demands, or "peak" loads, is larger than necessary, and therefore inefficient under the light demands of good, level roads.

10. *Then what do you mean by "stored power" in a power plant?*

Power which is generated in advance and is instantaneously available for use in any desired quantity when the driver wants it. Steam and electric power plants are the only ones that can have stored power.

11. *Why has a gas engine no stored power?*

Because in any engine the only source of energy is the fuel. And the internal-explosive engine cannot burn or explode its fuel without instantly converting it into rotative motion in the crank shaft. To have stored power, the fuel must be burned independently of the engine, and the energy taken from it in advance. When an internal-explosive engine is at rest there is not an ounce of power available — that is the reason it must receive an initial impulse from the outside by hand-cranking or from a starting motor, before it can turn itself. It cannot even start alone. And that is why the clutch is always put into an internal-explosive automobile. The engine must be started before it can deliver power, and it must be disconnected from the load till it is turning at a good rate of speed. Then the connection between power and load may be made, by "slipping in the clutch."

12. *Are the gears absolutely necessary with a gas engine?*

In an automobile, yes. This is the service where a maximum variation in speed and power is necessary. There have been times when you wanted a high power with a low car speed — as on hills, or for acceleration. At such a time the gear-box is absolutely necessary to permit a change of ratio between engine and axle, from say four to one, to seven to one, or to twelve to one. Were it not for this gear shift, which permits the engine to turn faster than the axle, the engine would run more and more slowly, and, of course, with less and less power, until it reached the "stagger point," and finally "stalled." This is not only inconvenient, but often dangerous. But by using the gear shift, the engine speed can be increased, and more power delivered, without increasing the car speed.

13. *Doesn't that make a satisfactory solution?*

No. It is a most unsatisfactory solution. Every motorist is demanding a better solution, and every manufacturer is trying to find it.

14. *What would be a satisfactory solution?*

Stored power. Power built up in advance, and the ability to apply that power in any desired volume to the rear wheels without gears to shift or clutch to pedal, and with only a finger-throttle control. Power that doesn't have to wait to build itself up in the speed of a fly-wheel, but is there all the time. Power that can be applied in maximum volume to the rear wheels, no matter how low the car speed.

15. *What uses is an internal-explosive engine fit for, then?*

It is perfectly adapted for purposes where only a constant power is wanted at a constant speed. The two most conspicuous examples of this are the aeroplane and the motor boat. These are constant-speed, constant-power devices. Land vehicles are not in this class. But the best example is a stationary plant, in a loft building, for instance, where not only the power and speed are constant, but the temperature and humidity as well.

16. *How did the internal-explosive engine ever acquire such general use if it is not suited for land vehicle work?*

As a matter of fact, it is not generally used in land vehicles. True, it has been used generally in automobiles, but that is only one type of land vehicle. Railroads have never been able to adapt the internal-explosive engine to their work, although it has been tried repeatedly. And railroads demand the best performance they can get in a power plant.

17. *Then why such general use of internal-explosive engines in automobiles?*

Because years ago an engineering fashion set in around the internal-explosive engine, and around the idea of getting "power direct from fuel." And the problem of adapting the gas engine to the automobile so absorbed the attention of the engineers of the day, they soon conceived their problem to be, not the perfection of a power plant that was fundamentally suited to the work, but the adaptation of the internal-explosive engine to the automobile.

18. *If the gas engine gets "power direct from fuel," is it not more efficient than the steam engine?*

That would be true if it always ran at its rated speed and power. But efficiency rapidly falls off if these depart from the narrow middle range. Even with the same fuel-cost, and with constant speed, the advantage would be slight, and is secured at the expense of long life, reliability and convenience. But when you consider that kerosene is used in the Stanley, the efficiency per dollar is about two or two and a half to one in favor of the steam car.

19. *Why is the gas engine* ***short-lived*** *as compared to a steam engine?*

It must run at much higher speeds, making lubrication uncertain and difficult, and because of this high speed, there is increasing wear and strain. At 3000 R.P.M. each piston travels up and down the cylinder fifty times per second, which is an almost incredible situation. Another reason is because in exploding (or burning) the fuel in the cylinder, the most delicate parts of the engine, —the valves, pistons and cylinder walls,—are exposed to the terrific heat of combustion and the action of the burning gases at these high temperatures. It is no exaggeration to say that the cylinder is actually used as a fire-box.

20. *Why is the gas engine more* **unreliable** *than a steam engine?*

Because it depends upon so many delicate devices and adjustments for its operation, any one of which can make trouble. These are such devices as carburetors, magnetos or generators, and distributors, cam shafts, timing gears, poppet valves, spark plugs and valve springs, etc. Not only are these devices themselves delicate, but the processes or functions they perform are even more so. There are no correspondingly delicate processes or devices on the Stanley car.

21. *Why is the gas engine not so* **convenient** *in an automobile as a steam engine?*

Because its successful performance in an automobile is contingent upon the manipulation of spark and throttle levers, transmission gears and gear shifting, and clutch; and it must have a highly-refined, semi-precious fuel like gasoline. The steam engine can use any fuel: crude oil, kerosene or gasoline; and such a refined power plant as the Stanley can burn either kerosene or gasoline or any combination of the two, without adjustment.

22. *You spoke, a minute ago, of getting "power direct from fuel." Why doesn't that make things simpler than in the Stanley? You have two conversions to make. You burn your fuel in one place, and use the power in another.*

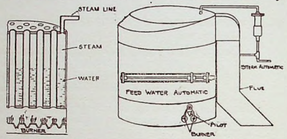
Yes, that is what is called the "two-stage" system. And if getting the power out of the fuel were the whole of the problem, then the "single-stage" might be better. But the whole problem consists of getting the power from the fuel to the rear wheels of the automobile. And engineers have found that all the mechanisms which have been necessary to do that with the gas engine, are far more complicated and unsatisfactory than the "two-stage" system which they set out to get around.

23. *Why do you say more complicated?*

Because the clutch, the gear shift, the jointed drive shafts, the fly-wheel. the bevel driving gear which is necessary to make the power turn a right angle, altogether make a far more complex system than the steam generating unit which has no moving parts whatever.

24. *Then the power-processes of the steam car and the internal-explosive car are not the same?*

No. Any automobile must have means of generating power from fuel; of controlling the power; and of applying it to the rear axle. But while these functions are distinct and independent in the steam car, in the internal-explosive car they overlap so that they cannot be separated. In an internal-explosive car no power can be generated without either using it instantly or wasting it. It cannot be stored as steam can be stored in a Stanley.



BOILER (cross section) BOILER (outside view)

25. *How is the steam generated in the Stanley car?*

By heating water in a small boiler over a kerosene burner. The boiler, which is 23" in diameter and 14" deep, and contains the water, is under the hood of the car. Directly beneath it is the burner which supplies the heat.

26. *Where is the steam stored?*

Right in the boiler itself, which is kept about one-half full of water. With steam up, it holds enough stored power to drive the car two or three miles even if the fuel is shut off. There is only one type of boiler that can store power this way,— that is the kind we use,— a fire-tube water-level boiler.

27. *Just what is a fire-tube, water-level boiler?*

One that is built like a drum and holds the water inside it. Through it run vertical tubes, open at each end so that the heat from the burner can pass up through them. The object of these tubes is to give additional heating surface; so this boiler, which has only about 3 square feet of surface on the bottom, has a total heating surface, with the tubes, of 104 square feet.

28. *Why is this large heating surface so desirable?*

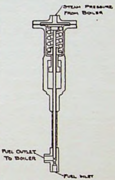
Because it makes rapid steam generation possible. The objective in boiler design is large heating surface in the smallest possible boiler, with water and steam capacity sufficient to give stored power. A Stanley boiler generates steam very rapidly and at the same time carries a quantity of hot water and steam. This is a combination that cannot be had in the so-called "flash" or "semi-flash" boilers, which can steam rapidly but have no stored power capacity.

29. *What prevents too much steam from being generated?*

An automatic valve governs the fuel, so when the correct pressure of steam is secured, the fuel is shut off till enough steam has been drawn from the boiler to lower the pressure. This device is called the "steam automatic."

30. *Is not an automatic device of this kind rather delicate?*

Not at all. Like the other devices on the Stanley, it is one of the oldest principles in engineering,—rugged and simple. It contains only one movable part.



STEAM AUTOMATIC

31. *How does the fuel come on after it has been shut off?*

As soon as the steam pressure drops, this steam automatic opens the fuel line and admits the kerosene to the burner. This is ignited by a small pilot light which is not controlled by the automatic, but burns continuously.

32. *What is this pilot light?*

It is a tiny burner at the mouth of the main burner, and is made so small that it requires very little fuel, even though it burns constantly. It is supplied with fuel from a tank separate from the main burner and is entirely independent of it. This pilot also keeps the main burner hot so the kerosene lights instantly when the steam automatic turns it on.

33. *Isn't this pilot troublesome?*

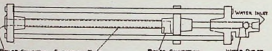
No. Why should it be? It burns steadily, under constant conditions. A twelve-cylinder engine has 12 pilots, each expected to ignite and go out by mechanical operation 25 times a second — a total of 18,000 times a minute. Ours is not mechanically operated, it is not electric, and burns steadily. This is another instance of the simplicity of our problems, as compared with internal-explosive problems.

34. *How is the fuel supplied to the main burner?*

By air pressure automatically kept up by a small plunger pump. A feature of this system is the pair of small quart pressure tanks which make a pressure feed possible without pressure in the main fuel tank. With this arrangement fuel can be taken in the main tank without losing the air pressure every time the filler cap is removed. The system has all the advantages of the old, reliable pressure system without the disadvantages.

35. *Does not the water-level in the boiler drop as steam is used for driving the car?*

Yes, surely,— so it is necessary to supply it with water to replace that which is drawn off as steam. This is done mechanically by a pair of plunger pumps.



FEED WATER AUTOMATIC

36. *How is the amount of this "feed water" to the boiler controlled?*

By a valve which automatically regulates the feed water as it enters the boiler. The two pumps mentioned are driven from the rear axle and work whenever the rear axle turns. Therefore, there is a constant flow of water from them, which is always greater than is required by the boiler. The automatic valve on the boiler admits just the right amount of this water to replace that used as steam, and the balance is returned to the tank. By this arrangement the pumps can be ordinary plunger pumps and run at a low speed and still furnish the boiler just the right quantity of water.

37. *How much attention would I have to give the fuel and water systems while running?*

None at all. They are entirely automatic. When you start, you open your main burner fuel valve. After that, the automatic valve will open and close itself without your attention, and in fact even without your knowledge.

38. *Isn't there danger that the boiler will explode?*

None at all. It is provided with these automatic fuel and water devices, and with a safety valve.

39. *But what if all these should fail to work?*

Then it is no exaggeration to say that the boiler itself consists of 750 safety valves. There are 750 tubes. Since the shell is many, many times stronger than the tubes, the tubes would first yield to excessive pressure. The weakest one would yield first, and begin to leak like a safety valve. Then the next, and the next, until the leakage was greater than the generation. To cause an explosion, every one of the 750 tubes would have to go at once; which is just as impossible as to pull a chain with 750 links, and make them all break at once.

40. *Does not the fresh water pumped in tend to chill the steam and hot water in the boiler?*

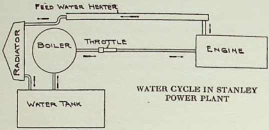
It would if it were cold, but this water is heated before it enters the boiler, by the feed water heater, which thus utilizes the heat of the exhaust steam.

41. *What becomes of this exhaust steam?*

As it is exhausted from the engine it passes through the feed water heater and is then led into the radiator where it cools and condenses into water again. From there it returns to the water tank.

42. *The water then makes a complete cycle through the car and is used over and over again?*

Yes, it makes the circuit about ten times, before it is lost through surplus exhaust and dissipation. That is why present Stanleys use so much less water than the older cars that exhausted the steam into the air and used it only once.



WATER CYCLE IN STANLEY POWER PLANT

43. *What do you use for a condenser?*

An ordinary Mayo radiator.

44. *What mileage does a tank of water give?*

One filling is sufficient for from 150 to 250 miles; it varies considerably according to the road, the load and the speed.

45. *Why is the Stanley engine on the rear axle?*

Because that is the ideal place for any engine,— right where the power is used. All cars would undoubtedly be built that way if the engine design would permit. Even electric trolley cars have their motors right down on the axles.

46. *Just why is this location the most efficient one?*

Because no jointed drive shaft is needed to carry the rotative power back to the rear axle. A drive shaft requires at least two and sometimes four universal joints, with double that many bearings, and every one of these added devices uses up power in friction, and requires attention and lubrication. Besides, the drive shaft must always be at right angles to the rear axle in a gas car, and bevel gears are required to divert the direction of rotation. Making rotative energy turn right angles is in itself bad practice. This crank shaft of the Stanley engine is parallel to the rear axle, geared right into it, and within 9 inches of it.

47. *How does it compare to a gas car crank shaft?*

It is only 8½ inches long, and runs on only two main bearings. Yet it performs the function of cam shaft as well as that of a crank shaft. Furthermore it delivers its power from the middle, between two closely associated bearings, and not from the extreme end.

48. *Why are gas engines not on the rear axle?*

For many reasons, but chiefly because they are too bulky and heavy to fit under a car. This is especially true of the big multi-cylinder engines such as the sixes, eights and twelves.

49. *What are the other reasons?*

Because they have so many moving parts that they must be accessible for adjustment and repair. The accessibility of a gas engine is a serious consideration, and is widely advertised by different manufacturers.

50. *But doesn't the Stanley engine ever require attention?*

Very little. About as much as the gear-box does in your car. The Stanley engine has only two cylinders and only 15 moving parts and has no carburetor, ignition, starting motor, spark plugs, cam shaft, poppet valves, timing gears, etc. Nor can it ever have carbon troubles.

51. *Why no carbon troubles?*

Because in the Stanley the fuel is not burned in the engine. Nothing but steam enters the cylinders.

52. *You say the Stanley engine has only two cylinders?*

Only two, with 4 inch bore and 5 inch stroke. It is, however, a double acting engine. That is, the steam works against either side of the piston. This gives as many impulses as an 8 cylinder internal-explosive engine.

53. *Why does a gas engine have so many cylinders?*

Owing to the fact that the gas explodes violently, it is desirable to divide this destructive force up into as many smaller explosions as possible. Then too, by getting more impulses to the revolution it is possible to reduce the size of the fly-wheel, or as it is often called, the "balance wheel."

54. *Why does the gas engine have to have a balance wheel if the Stanley engine does not?*

To absorb and smooth out the sharp explosions, and steady the turning of the shaft. In addition to this the heavy balance wheel carries the gas engine over the three idle strokes, one of which is the compression stroke, which would otherwise stall it. The Stanley, on the contrary, exerts a *continuous pressure*. This pressure expands, instead of exploding, and does not have to swing a heavy weight to turn the shaft smoothly. And there is no compression stroke to a steam engine, nor is there any "stalling,"— so a fly-wheel would be superfluous.

55. *If four or eight or twelve cylinders are better in a gas car, why not in a Stanley, too?*

Because the whole object is accomplished in a Stanley with two. That is, a smooth continuous flow of power. We spoke of impulses a minute ago. That is a misnomer, as applied to the Stanley engine. They are not impulses, but a uniform, continuous flow of power. Any number of additional cylinders could not make the "push" on the crank shaft any more uniform and continuous.

56. *You say you do not have any poppet valves, or valve springs, or cam shaft. How do the valves operate, then?*

Only two valves are used, one for each cylinder. They are not mechanically lifted, and do not depend upon valve springs, but merely slide back and forth over an opening or port which connects the cylinder with the steam chest. There are several well-known methods of operating these slide valves, but we employ the oldest and simplest, the "Stephenson link motion."

57. *What do you mean by the steam chest?*

That is a chamber in the engine through which the steam passes to the cylinder. The valves operate in this chamber.

58. *What is the function of the Stephenson link?*

It is this action that makes it possible to reverse the car without reverse gearing. It is an arrangement by which the motion of the slide valves is reversed, changing the entrance of steam into the cylinders and turning the axle the other way.

59. *How is this valve action controlled?*

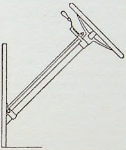
By a pedal at the left foot of the driver. When the foot is released a spring returns the pedal to normal.

60. *What other pedals are there on the car?*

Only the service brake. The Stanley has no clutch pedal because it has no clutch.

61. *If the engine and axle are direct connected how is the speed and power of the car controlled?*

By a throttle lever which controls the flow of steam. This little lever does it all, and is so small in size and easy to handle that it is placed right on the steering post under the wheel. To get more speed or more power it is only necessary to advance the lever. This opens the throttle valve in the steam line and lets more steam to the engine. The steam is controlled like the water in a faucet, —in fact, the functions of faucet and throttle are identical.



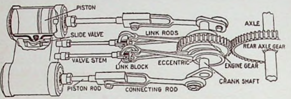
STANLEY STEERING WHEEL AND THROTTLE LEVER

62. *How can the car climb a steep grade without gears to shift?*

Because the Stanley engine is powerful enough to slip the rear wheels, which is all the power that can possibly be used in a car.

63. *How about steep hills at low car speed?*

Power does not depend upon speed in a steam engine. A gas engine, on the other hand, must be turning fast to deliver its rated power. Gears in a gas car simply provide a means of getting high engine speed with low car speed. In some gas trucks the engine turns forty times as fast as the rear axle. This gear reduction is necessary to get power out of the engine at low car speeds.



STANLEY ENGINE (stripped to show moving parts)

64. *What is the ratio between the engine and the rear axle in the Stanley?*

The engine gear has 40 teeth and the differential ring-gear 60, so the ratio is 1½ to 1.

65. *What is the differential ring-gear?*

The big gear on the rear axle. This gear is present in any car around the differential, but in a shaft drive car it is a bevel gear driven by the drive shaft. In the Stanley, it is a straight spur gear and meshes directly into the engine gear.

66. *What is the engine gear?*

The gear on the crank shaft which the engine pistons turn.

67. *Why are these gears necessary?*

Because the pistons and connecting rods have to work on a crank shaft. These two gears, and there are only two, permanently connect the crank shaft and the rear axle direct.

68. *What takes the rear axle torque in a Stanley car?*

The engine acts as a torque arm. It is bolted solid to the rear axle housing and hung flexibly at the front end. So, little if any, of the torque is on the springs.

69. *What kind of springs are on the Stanley?*

Full elliptic in the rear. Semi-elliptic in front

70. *What takes the drive?*

All four springs. This method has all the advantages of the Hotchkiss drive, but instead of the rear springs taking the entire driving strain, the load is distributed through both front and rear springs by tie rods which connect the front and rear axles. This is an exclusive Stanley feature and is one reason the cars are so comfortable to ride in.

71. *What are the other reasons?*

The steam power itself, smooth and noiseless, is the main reason; but the absence of gear-shift, clutch, starting motor, controls,— in a word, the simplicity of Stanley control is one of its greatest charms. Especially in traffic or on bad roads the Stanley control is a real comfort. Drivers soon learn instinctively that it is no effort to change the car speed — no shifting of gears, no pedalling of clutch, no separating the power from the load. So the Stanley owner slows down for bad spots in the road more often than the driver of a gas car. This, we think, is the principle reason why Stanley cars have the reputation of being the easiest riding cars in the world. Then there is no vibration or consciousness of mechanical forces at work.

72. *What tire mileage do you get on Stanley cars?*

Excellent. Five thousand miles is regarded as good mileage on the average car, but the Stanley under the same conditions gets 10,000 miles from the tires.

73. *How do you account for this tire economy?*

By the smoothness of the steam power plant. It is the internal strains on tires which cause them to give out. In a gas car a violent strain is put on the tire every few minutes; especially when starting or shifting gears. When the clutch engages, no matter how gently, there is a point at which it takes hold and the hard, inflexible, rotative force of the drive shaft must be transmitted through the tire on the road surface. Then the car moves, but for the instant during which the inertia of the car was being overcome, the tires had to absorb and cushion the jerk on the axle. This is so hard on tires, as compared with the smooth, flexible pressure of steam, that one tire manufacturer was on the point of giving a special long mileage guarantee with tires that were to be used on steam cars.

74. *Isn't the Stanley uncomfortably warm in summer?*

No. There is no more heat to be felt than in any gas car. In fact, there is less than in those where the exhaust pipe comes close under the floor boards.

75. *How about cold weather? Will Stanley cars freeze in cold weather?*

The Stanley is the best car in the world for winter going, because it has more stored heat than any other. It will freeze if you don't look out for it, just the same as your car will — just the same as your fingers or your ears will freeze, if you don't take care of them. But the precautions necessary to protect a Stanley car are less than with a gas car.

76. *What do you do if you are to leave your car in the street for two or three hours in zero weather?*

Nothing, just leave it there. Or if you leave it in an unheated garage over night, just leave it there. If you are going to leave it a week or so, in zero weather, then turn out the pilot and drain it, just as you would your present car.

77. *What did you mean by stored heat?*

Hot water. Eight gallons in the boiler, 20 gallons in the tank. You are more careful to have your radiator full in the winter than in the summer, because you want this stored heat, so your engine won't chill so quickly. The more stored heat you have, the better. In the Stanley, by the way, the radiator contains not a particle of water while the car is standing. It all goes back to the tank.

78. *How about starting up after a stop — say a two hour stop?*

The pilot will maintain two or three hundred pounds of steam. The car is ready to go instantly. There is no "ten minute fight with your engine," as one manufacturer advertises it.

79. *What would happen if it did freeze in a cold garage?*

Nothing. Stanley cars have been left all winter in unheated garages, undrained. They have frozen and thawed a dozen times. There is no harm done, beyond bursting a pipe or two — nothing critical or expensive.

80. *How much time is required to get up steam in the morning?*

Steam is already up in the morning if the car has been used the day before. With just the pilot burning, two or three hundred pounds of steam will be maintained over night, and the pilot will burn several days without attention.

81. *How long will it take when the pilot has been turned off a week?*

About seven or eight minutes. Experienced drivers do it in six minutes, but eight minutes would be a good average for Stanley owners. A beginner would, undoubtedly, require a little more time.

82. *Isn't steaming up a slow, difficult process?*

Not at all. You turn a switch and the pilot vaporizer is heated electrically and the pilot is lighted electrically. Then you turn on the main fuel.

83. *But isn't seven or eight minutes' delay inconvenient when starting?*

Yes, it would seem so, but as a matter of fact, it is this very time which gives you the stored power that is essential to good performance, so the time is well worth spending. There is scarcely a gas car owner who would not gladly stay in his garage, behind closed doors, and shift gears steadily for even fifteen minutes, if he knew that when he got his car on the road he would have stored power, and would not have to shift another gear all day. But most Stanley cars are not steamed up oftener than once a month or so. They are left every night with the pilot burning.

84. *Can't a steam car be made that would get up steam in a minute or two, even when cold?*

Yes, easily, but that would mean a flash or semi-flash boiler, that could not possibly have the hot water and steam reserve that gives the Stanley its stored power and ideal performance. Quickly built up power is quickly spent, and such a change would reduce the Stanley (as far as flexibility and stored power are concerned) to the level of the internal-explosive car.

85. *What about fire? Can I get a Stanley car insured?*

Certainly. Insurance rates are just the same as on internal-explosive cars. The fire risk is less, in fact, since we use kerosene fuel.

86. *If steam cars are so superior, why so many gas cars?*

That's a very proper question, and at the same time a very broad one. The motives that govern mankind in the aggregate are usually as varied as the number of individuals concerned and cannot be ascribed to any single reason. There are four general reasons for the prevalence of gas cars.

First: At first the internal-explosive engine, by getting "power direct from fuel" seemed the best for the very moderate standard of performance required. The self-propelled vehicle was, even then, so superior to horse-drawn vehicles, that no one seemed to mind cranking, occasional balking, vibration and noise, complicated control and indirect transmission. The gas power plant, as then conceived, seemed simpler than the steam plant, as then conceived, and was consequently adopted.

Second: Automobile engineers were largely recruited, not from the engineering profession, but from those who first became interested in the sport of automobiling. For the reasons set forth above, their entire environment and habit of thought was solely gasoline-propelled vehicles,— in other words, they accepted without question, as a habit, that the only motive power was the internal-explosive engine.

Third: Automobile manufacturing is a commercial enterprise, following the path of least resistance, desiring quick sales, and like any other industry, fearing radical innovations. As a result of the habit of thought alluded to, it continued to adhere to the internal-explosive engine.

Fourth: The standard of performance has steadily risen. The car that was satisfactory a few years ago would not be tolerated today. The effort to meet the demands has resulted in such great elaboration of the internal-explosive power plant, that it has long since lost its imaginary initial advantage and has become far more complicated and burdensome to maintain and control than the steam plant, and even then, is inferior in performance, since it cannot have stored power.

87. *Then why do not manufacturers abandon gas cars?*

Because big issues are involved. A manufacturer's reputation and good will,— frequently valued at millions of dollars,— might greatly suffer by a radical change of policy. Their advertising, designs and specialized manufacturing facilities, represent vested interests of equal or greater amount. While an untrammelled engineer of broad outlook might advocate abandoning these assets, yet the financial management, conscious of the effect of these assets in their statements, and more concerned with dividends than pioneering, over-rule the engineers who might advocate such a course, until the situation becomes sufficiently tense to compel them to do otherwise.

88. *But the Stanley car is not so trammelled,— why has their output not assumed greater proportions?*

Because the Stanley Company has been a close corporation, conducted in what would be called an old-fashioned way; more animated by high ideals of perfection than by any desire for big output or big profits. As the Stanley car from the beginning has always delivered a better performance than any internal-explosive car, this policy may have been open to criticism. The Company has now been reorganized with more aggressive management. It is, we believe, the first automobile concern to pass into the hands of the second generation of the same family. The production is being increased, and modern methods adopted for public enlightenment. As one of our customers said, "You are to blame for this condition yourselves. In spite of the fact that you have the best performance in the world, the very performance everybody wants, you have never told anybody about it. You have, in fact, taken particular pains to keep it secret."

89. *What is the wheelbase of the Stanley?*

Wheelbase, 130 inches. Track, standard 56 inches.

90. *Do you use any standard parts?*

Timken front axle, Warner steering gear, Timken bearings in rear axle, Wyman and Gorden forgings, Mayo radiator, A. O. Smith frame.

91. *Equipment?*

Goodyear Cord Tires, Klaxon Horn, Warner Speedometer, Apple Generator, Willard Battery, electric lights, head, tail and dash, Troy Windshield, Valentine's Varnishes, one man top, tire iron at rear, etc.

92. *Electric lights on a steam car, how?*

By a storage battery which is charged by the Apple Generator on the rear axle.

93. *Then the car has all that any car should have?*

Yes, and many things that other cars cannot have, such as power at low speeds, one-finger control, silence, stored power,— the very things you have always wanted most.

94. *And it has no gear shift or starting motor?*

Neither has it clutch, magneto, spark-plugs, carburetor, distributor, fly-wheel, drive shaft, spark or throttle controls, accelerator, universal joints, crank shaft or timing gears.

95. *Its engine has only 15 moving parts?*

Only 15 in the engine, 24 in the complete power plant and 37 in the entire car.

96. *Tell me again what Stored Power means.*

It means power built up in advance of the time you need it, and stored in the boiler. This means that you need no clutch or fly-wheel or change-speed mechanism— that you can apply full power instantly, without any waiting, to the driving wheels, no matter what emergency you are suddenly confronted with — and with no effort or anxiety on your part, except a touch of the finger on the throttle. But it means something far greater than that to you,— it gives you a feeling of security and safety for yourself and your family — a consciousness of practically unlimited power available at your merest wish, and never depending upon your own presence of mind and agility in shifting gears, pedalling clutch, and stepping on accelerator, all at once. You can dismiss that anxiety that comes from lack of stored power, the minute you get behind the wheel of a Stanley.

This is precisely the performance which every manufacturer would like to deliver you, and is trying honestly to deliver. But it never has been, and never will be delivered with the internal-explosive car. It is the performance which goes with steam, and steam alone.

97. *And its fuel is kerosene?*

Yes, although if you wish it will burn either kerosene or gasoline or any mixture of the two without adjustment. So if you need fuel any time and can't get kerosene you can get home on gasoline.

98. *Can you beat it?*

No!

STANLEY SPECIFICATIONS

Body—Aluminum, stream-line, with flush-doors.

Upholstery—Genuine leather, straight grain, bright finish, stuffed with curled horsehair.

Top—Improved one-man type.

Windshield—Rain vision, ventilating, built into body.

Colors—Body, Valentine's Regent green; running gear, black.

Lighting System—Electric, with Apple generator and Willard battery. Large headlights with dimmers. Electric dash and tail lights.

Horn—Electric, under hood, button under driver's left foot.

Steering Gear—Warner, worm and gear type, with 18-inch wheel.

Wheelbase—130 inches. Tread, standard 56 inches.

Wheels—34 x 4, with Firestone light demountable rims. Houk wire wheels $100 extra.

Tires—Cord, 35 x 4½, straight groove.

Springs—Full-elliptic in rear, semi-elliptic in front.

Front Axle—Timken.

Rear Axle—Stanley, with Timken bearings.

Service Brake—14-inch diameter, contracting, operated by pedal.

Emergency Brake—14-inch diameter, expanding, operated by lever.

Pumps—Long stroke, plunger type, driven from rear axle.

Water Tank—Under frame, 24 gallons, with gauge.

Condenser Radiator—Mayo, V-shaped, giving water mileage of 150 to 250 miles.

Fuel Tank—Main fuel (kerosene) tank at rear, with quantity gauge. Capacity 20 gallons. Pilot tank, with gauges, capacity 5 gallons.

Boiler—Regular Stanley type. 23-inch diameter.

Burner—Improved drill type. Can burn either gasoline or kerosene, or any mixture of the two, without adjusture.

Engine—With oil and dust tight housing. In unit with rear axle. Runs in bath of oil.

Four Passenger Touring Car . .	$2,550 *f.o.b. Newton*
Seven Passenger Touring Car . .	$2,600 *f.o.b. Newton*
Chassis	$2,225 *f.o.b. Newton*

Stanley
STEAM CARS
22nd year