

Steam Car Developments and Steam Aviation

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The Besler Steam-Driven Aeroplane.

At the Oakland Airport, California, U.S.A. a short time ago a silent 'plane slanted across the sky, showing a thin trail of white vapour. It was so silent in operation that spectators heard the pilot shout a greeting to those on the ground. He banked into a turn, and was watched sliding to a landing, and, with the propeller spinning backwards – roll to a stop in less than a hundred feet. This was Mr. William Besler giving his first demonstration flight, and it was, we think, for the first time in history that a man had flown in a steam-driven aeroplane.

This steam driven machine is the achievement of two brothers—Messrs. George and William Besler, and is the result of experimental pioneer work carried out by them during the past three years. Through their endeavours—undertaken with a good deal of secrecy—the steam-driven aeroplane, the possibilities of which have long been discussed, as become an accomplished fact. Our American correspondent, to whom we are indebted for the following particulars, tells us that passengers on the stem 'plane in full flight are able to carry on a conversation as easily as when riding in an open motor car. The pilot, when flying at 200 ft. altitude, called to the spectators below, and heard their answering calls.

During the demonstration Mr. Besler made three flights, taking off, circling about, and landing, to show the ease of control. What was generally remarked upon was the almost complete silence. The constant, wearing vibration of the internal combustion engine was gone; the elastic pull and push of the steam engine had supplanted it. Each time as the machine swooped down and the landing wheels touched ground, the pilot pulled back a small lever at the side of the cockpit and the steam engine at the nose of the 'plane instantly reversed, whirling the propeller backwards, creating a powerful braking effect which reduced the landing runs to a very short distance.

This is one of the fundamental characteristics of a reversing steam engine and that which can never be imitated by an explosion motor. There is, moreover, the fact that the reversed propeller applies its braking effect above the centre of gravity of the machine, and thus prevents it nosing over in a quick stop. Brakes applied to the landing wheels of a steam-driven 'plane are not necessary. On an I.C. 'plane landing wheel brakes—suddenly applied—have been a cause of somersaulting, and a ground crash. It is said that the Besler

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'plane, coming in at 50 m.p.h., can sit down, and come to a stop, in a field scarcely 100 feet square.

Turning now to the power-plant, this, of course, is of Doble Steam Motors and Besler's design and manufacture; and its main details are already familiar to many of our readers. The production of steam automatically, at a practically constant pressure and degree of superheat, from the forced-feed or flash steam generator, and the patented electric controls, by which it is accomplished; are fully described in the Doble-Besler Patent Specification, which we reproduce on another page.

The steam generator is fed with water by a steam donkey pump, the exhaust from which is first taken through a Feed-water heater, before finally passing into the condenser. The burner is similar to that described in our May 1931 issue of "S.C.D." The whole of the power plant is installed at the nose of the aeroplane, with the engine forward of the steam generator. The engine is a 2-cylindered compound, double-acting of a V-design, with the cylinders H.P. 3 inches and L.P. 5¼ inches bore, by 3 inches stroke. It develops 150 B.H.P. at 1,200 lbs. (temperature 800 degrees Fahr.) steam pressure, and about 1,650 revolutions per minute. The engine was not built particularly for lightness—it weighs 180 lbs.—and by using special aircraft materials, its weight could be lessened.

The steam generator tubing is coiled into flat spirals, and totals about 500 feet in length. The lower coils, into which the feed-water is introduced, are of tube about 3/8 of an inch bore, and the upper coils from which the superheated steam is drawn off, are about 5/8 of an inch bore. The water supply to the coils is thermostatically controlled to keep the steam temperature constant irrespective of the steam pressure.

Under the fuselage nose is the condenser—which is simply a section of an ordinary petrol car radiator, and this is said to be sufficient to recover more than ninety per cent. of the water from the exhaust steam

At the start of a flight, the pilot climbs into the cockpit and flips over a small switch. The electric blower immediately goes into action, driving air mixed with oil spray into the combustion chamber. Here, an electric spark ignites the mixture and sends a sheet of flame roaring downwards among the spiral boiler coils. A minute or so later, steam pressure is high enough for take-off. All the pilot has to do from then on, (as regards the power unit) is to operate the throttle and the reverse lever.

The tests have shown that ten gallons of water is sufficient for a flight of 400 miles. By increasing the size and efficiency of the condenser, the Besler Brothers believe they can make this amount of water last indefinitely.

The prospect of steam 'planes on the skyways opens up fascinating possibilities. Burning, as they do, ordinary furnace oil of so high a flash point that it merely smoulders if struck by the flame of a blowtorch, steam power plants have little to fear from the menace of fire. Moreover, fuel oil is cheap, sufficient for a hundred-mile trip can be bought for 1s. 8d.

At any height above a thousand feet a steam-driven 'plane is quite inaudible from below, this would give it particular value for military work.

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Noiseless war 'planes have long been sought; but attempting to muffle the noise of an I.C. aerial engine reduces its power to such an extent that the plan is impracticable. A steam power plant, silent by nature, would permit of long-distance raids above the clouds by 'planes giving off no tell-tale drone of motors to warn the enemy, or to aid in directing anti-aircraft fire.

It is interesting to speculate upon the possibilities of steam on the airways of the stratosphere. In the thin atmosphere of this region, ten miles, or more, above the surface of the earth, experts predict, the high speed transport ships of the future will fly. The chief stumbling block at present is the internal combustion motor. It steadily loses power as it ascends, and it has been said that a motor, which delivers 150 H.P. at seal level, will only give about half that power when it has climbed to 20,000 feet altitude. At 30,000 feet the sea level horse power of 150, will probably have dwindled to about 45 horse power. And you are then only half way to the stratosphere!

Superchargers, driving a blast of air into the carburetter to make up for the reduced pressure in rarefied atmospheres, help these internal combustion motors, but they never completely prevent loss of power at high altitudes. On the other hand, a steam engine loses no power at all with altitude, and it gains in efficiency the higher it climbs—partly because the exhaust back-pressure is less in thin air than at sea level. Thus it seems that the perfecting of steam power aerial units will be an important step towards conquering the stratosphere.

There are several other engineering firms actively engaged in developing stem aviation, and we give some brief details herewith. These may perhaps, be of interest to our readers. In the first place, we are indebted to the "Daily Telegraph" of April 16, 1934, for the following extract:

Details are now available of the steam-driven aeroplane which has been under secret construction on the outskirts of Berlin for many months. The inventor is Herr Huettner, chief engineer of the Klingenberg electricity works.

The machine is not yet finished, but the plans, according to the "Berliner Tageblatt" have been submitted to experts and found to be theoretically satisfactory. They have been elaborated down to the smallest detail, and give rise to the following expectations:

Range: 60 to 70 hours non-stop flight.

Speed: 230 m.p.h. on starting, rising to a maximum of 260 m.p.h. when the "ceiling" is reached.

Maximum height: 43,000 ft.

Load: One ton for a non-stop flight of 60 hours.

Engine Power: 2,500 h.p.

Length: 6 ft. Breadth: 108 ft.

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If practice agrees with theory, a non-stop flight will be possible to Japan, Capetown, San Francisco, Rio-de-janeiro, or Singapore, of more than one-third of the circumference of the earth.

REVOLVING BOILERS.

The secret of these claims is said to lie in the fact that for the first time Herr Huettner has succeeded in solving the problem of a satisfactory ratio of weight to power.

Herr Huettner's solution consists of a revolving boiler combined with a steam turbine. If successful it will, of course, also be applied to motor-cars.

The fuel used is oil gas, and in view of the great power developed, Herr Huettner has adopted twin propellers, revolving in opposite directions.

In March last the Daily Telegraph Prague Correspondent reported that an article in the Czechoslovak newspaper "Prager Tagblatt," giving details of Herr Huettner's invention, has led to the arrest of the Berlin correspondent of that paper.

The following steam-aviation items have also been received from various sources:

In Akron, Ohio, last autumn, a local inventor, Harold C. Johnson, announced the completion of a steam engine with two opposed cylinders, weighing, complete with boiler, only 146 pounds. Some months earlier, it became known that the Great Lakes Aircraft Company, at Cleveland, Ohio, was working upon an experimental steam-driven biplane. Recent dispatches from France reported that a Paris mechanic had perfected a light steam power plant for aeroplanes. Another news item, coming from Sweden, told of steam-turbine engineers who are working on a new-type turbine for aircraft use; while a third—from Italy—carried the information that G. A. Raffaelli, an aeronautical engineer, had announced a steam engine for stratosphere machines. But we think, it was the two California inventors—the Besler Brothers—who first achieved steam-driven flight.

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Some adventures with a Rejuvenated Stanley Steam Car of 1912 Vintage.

BY RALPH NEVILLE.

One day when passing a scrap iron dump near Nottingham, I saw what appeared to be a vehicle which bore no resemblance to the ordinary inhabitants of the "bone-yard."

On close inspection, after removing at least the remains of four cars and a heap of tyres; I discover the remains the Stanley, the accumulation of rust and

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dirt showed that it had been there many years. The owner of the dump assured me it was in good order and would go, if anyone knew how to perform the necessary ritual! If needless to say, I "had ma doots;" but always having a love for steam, and observing that all the essential parts were in situ, I drove a bargain at 30 shillings delivered at my home.

In due course the car arrived, and work commenced.

First the burner was removed, disclosing where the slit should be, a solid mass of rust. The lower tube-plate was in a very doubtful state, so out came the boiler, and a hammer test applied. Half way round no appreciable thinness was found, but later, dints, and then the thin plate gave way. Boiler scrap—this is what I suspected; so the problem was were to obtain a new boiler? The solution—Messrs. Bolsover Bros., of Whitby. They supplied me with one of their semi-flash type, which is in every way a huge success.

At this stage I realize the cost of overhaul was beyond my somewhat slender means, so I recruited a friend, who, besides sharing expenses, has done all the donkey work, is a first rate mechanic and a wizard at sheet metal working—Mr. John Granger. While I worked on the chassis and body, he overhauled the engine. This only required the ball-races to be adjusted, the piston rods and valve rods cleaned, and new packing supplied by Messrs. R. Klinger.

The burner was a wreck, so Mr. Granger set on and sawed out the rust from hundreds of slits, re-made the casing, and brought the whole job back as knew. This is a Morriss Paraffin burner, and is a real crude job.

We hunted the bone-yards for tyres (810 x 90), and obtained a serviceable set. The plated parts were re-plated and we re-painted and varnished the body, under-carriage and wheels. One ball-race in the rear axle was scrapped, so I



Mr. Neville's Rejuvenated Stanley Car.

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managed to get one made for me by Mr. Hickling of Ransome & Marles, which was a splendid job.

Mechanically the car was very good, no new parts, accepting the ball race, been required; only various adjustments to steering, glands, etc. As the old 3 tube water gauge was, to say the least, erratic; I obtained a 740 magnetic gage from Messrs. Bolsover. This is not much of an improvement going to very rapid evaporation of water, and the difficulties piping correctly on the water side. Usually we run with the boiler slightly priming to be unsafe side.

After about three months work, the great day arrived when we could get up steam. Finally the blow-lamp went wrong—jet choked; after much language, and methylated spirit, we got the pilot going and heated up the main jet; then, on with the main valve. The burner lit, and burned perfectly, everything was now set for steam. Throttle slightly open, drain tap open. Soon we heard steam coming out of the drain, and saw the pressure gauge rise. Then the burner went out. In the excitement of watching the steam gauge, we had forgotten to pump paraffin This was soon rectified—what a lot of pumping there is on a steamer! —and we soon had a working pressure. The wonderful silence of the car impressed us, and we set out with light hearts. After about 10 miles, a huge bang and clouds of steam from the front. Shutting the throttle shewed it was in the steam pipe, and we found a union had come off the pipe. An ignominious tow home to our first run.

A Sunday morning's work put the union where it should be, with no fear of it ever moving, and after lunch, we started again. For some reason unknown, the burner started to howl; nothing we could think of would quell it. Later on, we founded tilting the jet to the side of the air intake stopped it, and did not affect the heat to burner. We have now run the car for many miles, and caused a tremendous amount of interest wherever we have been. To pass modern cars on hills is a thrill; and we can pass most. I believe the Stanley is the only steam car in Nottingham and district. If any reader can give us advice on the correct way to work the Morriss burner—which is a temperamental devil—and how to fit a condenser, we shall be very grateful.

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The Internal Combustion Engine as an aid To a Steam Car.

Ardent steam car men will, perhaps, ridicule the idea that an internal combustion engine can be of any use to steam car. I will try to show however, in the lines that follow, that such invention applied in a certain matter, would prove to be a most useful auxiliary. It is quite evident—in these days of soft living—that no one will put up with the hard work necessary to start up steam cars of the past; it generally meant half an hour's work before car was ready to steam out of the garage.

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The mowing of one's lawn used to be a laborious undertaking, but not now. The smaller air-cooled 2 stroke petrol engine, suitably built into the lawn mower, saves time and labour. I propose to amount on my steam car chassis a lawn mower engine and, by its aid, it will only be necessary for me to press a starter button; and in about three minutes after doing so my car will have full head of steam, and I will not have to exert myself unduly in accomplishing it.

First of all, let me say that I have not actually tried out the plan suggested, but it seems to be—and several others—but there's no reason why the scheme should not be quite successful. It is generally accepted than auxiliary motor of some sort, whether in the form of a steam donkey pump, steam rotary engine, or an electric motor, is essential on the modern steam car. A lawn mower type of engine is robustly made, thoroughly reliable, cheap, and its consumption of fuel is very small; and it will work for long periods with little cost for repairs. The objection that it is, normally, a noisy machine, will, I think, be overcome by the way in which the exhaust gasses will be utilized in silence in steam car work.

For the sake of clearness probably the best method of explaining the application of the lawn mower engine, will be in the form of a specification. In writing the specification I will assume that one has a chassis with a Stanley steam engine driving the back axle directly by spur gear. As follows:

A METHOD OF CONTROLLING A FORCED-FEED (OR FLASH) STEAM GENERATOR, AND ITS FIRE, BY AN INTERNAL COMBUSTION ENGINE.

Boiler feed pumps.

2 of 9/16 in. bore and 1 in. stroke. Coupled in tandem.

Fuel pumps.

One driven by a yoke from the water pumps.

Both water and fuel pumps are driven, at a reduced speed by a Villiers air-cooled 2 stroke petrol engine. The gear ratios between engine and pumps is 8 to 1.

Water regulator.

Of the "White" diaphragm type, operating on the "all on, all off" system. A yoke from the spindle of the water regulator works a valve in the fuel line, so that when the diaphragm is "all off," i.e. at 600 lbs. boiler pressure, the fuel valve is at the same time shut, and the burner goes out. This combination of water and fire regulations looks after the maintenance of steam pressure.

Steam temperature.

A thermostat, on 750 deg. F. being reached, opens a valve and allows water, through a branch from the main water line, to enter the coils of the boiler. This lowers the steam temperature

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which operates the thermostat and closes the water valve.

Burner.

Of the vaporizing Bunsen type burning petrol. The initial vaporization is effected by the heat of the exhaust gases from the petrol engine. A coiled steel vaporizing tube enclosed in the silencer and exhaust pipe. The vaporized fuel is then taken through an ordinary vaporizer over the burner, and thence through the jet into the bottom end of the vertical mixing tube of the burner. The burner stands on its edge, and the flame from it passes horizontally through the vertical tubes of the flash boiler—which also stands on his edge—similar to a Brooks or Delling boiler/burner arrangement.

The exhaust from the Villiers engine is led into the down draught flue of the boiler, produces a useful draught effect. There is no pilot burner, ignition being effected by the spark plug located near the burner face. Spark is produced continuously by a magneto driven by the Villiers engine. The fuel pressure is maintained, as in a Stanley, by a fuel pump yoked to the water pumps. The cylinder lubricating pump is also driven from the water pumps in the same manner.

The flash boiler has a grids of Sempollet shape but the stand on edge instead of lying horizontally. These give 48 sq. ft. area, taxed at £8. Water enters the rear or flue end, and superheated steam from the grid nearest the burner. In a proposed arrangement, for a 2 seater car, the boiler is at the rear of the chassis—slightly aft of the driver's seat. Its overall sizes are such that it can be conveniently housed in the tail of an ordinary 2 seater body.

Water Tank: 11 gallons capacity housed under the bonnet.

Fuel Tank: Located under the scuttle.

Villiers Engine: Behind the radiator. The flywheel is fitted with fan blades to cause a cooling draught through the radiator, which draught also cools the engine. The engine drives, through a worm reduction gear, the pumps (water, fuel, and indicating) which work as a unit in Stanley fashion.

The method of working this system of steam generation would be as follows: The I.C. engine is started by the magdynamo. The blow-off valve on the steam line to the main engine is opened. The fuel pump produces the necessary pressure in the tank. After one minute's running of the I.C. engine the vaporizer will be sufficiently heated by the exhaust to allow the main burner being turned on. The hand water by-pass on the main water line is now opened, and the blow-off valve on the steam line is closed. The boiler pressure rises to 600 lbs. and, if the car is not at once driven away, the main fire, under the control of the fire regulator, goes out. However, whenever the driver moves

the car from rest, with the consequent reduction of boiler pressure, the main burner immediately lights up again.

For all stops during driving, the Villiers engine will, of course be kept running for the sake of keeping the main vaporizer hot. The system, if it be practicable—and I think it is—would make a steam car as easily started out, and as convenient as a purely internal combustion vehicle.

There are one or two snags to be overcome, and there might be certain amount of noise from the I.C. engine. I think, however, that the large silencer in exhaust pipe, which would be necessary to house the vaporizer; and after that the discharge in the exhaust gasses into the heavily insulated smoke hood and flue of the boiler, will effectually quiet the exhaust.

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Improvements in or relating to Steam Boilers of the Forced Feed Type.

Doble Motors and W. J. Besler's Patent specification.
No. 404,472 (British) accepted January 18, 1934.

This invention relates to primarily to mechanism for controlling generators of vapor, that is steam boilers, of the forced feed type.

In automotive practice in which steam propulsion is utilized, it is advantageous to employ a steam generator or boiler of the forced feed type, i.e. a boiler which comprises a relatively long heated tube into one portion of which fluid such as water is introduced and through the entire length of which the water traverses and emerges from the outlet and thereof as vapor, such as steam. It is customary to regulate the proportions of heat and water, so that the ultimately issuing fluid is superheated. It is desirable to maintain the temperature of the issuing vapor substantially other predetermined value despite rapid and wide and wide fluctuations in the load on the boiler or in the quantity of vapor issuing therefrom.

It is further desirable in automotive practice to make the mechanism for insuring a relatively fixed temperature of issuing vapour as simple as possible and subject to little or no supervision. In certain practical installations of forced feed boilers, the tube is approximately 600 feet long, and the time required liquid to traverse the initial portion of the tube and resulting paper to traverse the final portion of the tube is comparatively great.

It has therefore been proposed to utilize a thermostat situated adjacent to the outlet of the tube regulating the introduction of feed water into the inlet of the tube. Such arrangement is relatively unsatisfactory inasmuch as the time

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lag is so great between the introduction of feed water into the foot of the tube and its effect on the thermostat, as to result in large fluctuations in the temperature in the ultimately issuing steam.

The object of our invention is to provide a steam temperature controller which affords vapour of relatively constant temperature from the steam generator or boiler of the forced feed type.

Another object of our invention is to provide a steam temperature controller which is entirely automatic and which requires no supervision.

The steam temperature controller of our invention comprises the relatively long tube having an inlet and an outlet, a burner for heating the tube an adjacent thermostat responsive to the temperature of the tube at an intermediate point between the inlet thereto and the outlet therefrom, characterised by secondary feed conduit leading from a point in said tube adjacent to said inlet and re-entering said tube between said inlet and said intermediate point but near said intermediate point, which conduit after an initial adjustment of the portion of the secondary feed fluid remains continually open without further alteration.

The intention is hereafter more fully described with reference to the accompanying drawing in which the figure shows the diagram illustrating by way of example one form of the steam temperature controller in accordance with our invention.

In the form of our invention disclosed in the drawing, there is provided a forced feed steam vapor generator or boiler 6 comprising a casing 7 within a relatively long tube 8 is situated. The tube is preferably formed into a number of convolutions and is provided with a primary inlet 9 and an outlet 11. Flow of vapour or steam from the tube through the outlet 11 controlled by a throttle valve 12 in the customary fashion.

In order to impart the heat to the tube 8, the casing 7 is intersected by a venturi tube 13 through which a draught through which a draught of air is impelled by a blower 14. The blower 14 is driven by an electric motor 16, and/or any other suitable motive unit, and is effective to induce a current of air to flow through the venturi 13, aspirate fuel from the carburettor 17 and to emerge into the combustion space 18 at the top of the boiler casing 7 wherein the mixture is ignited by a spark plug 21. The products of combustion pass over the convolutions of the tube 8 and are exhausted through a flue 22.

In order that the tube 8 may be effective to generate vapour, feed liquid, such as water, is supplied thereto. In the present instance, there is provided a source of the fluid such as a water tank 23 which is connected by a duct 24 to a water pump 26. The pump discharges through a conduit 27 into the primary inlet 9 of the tube 8. Preferably the pump 26 is driven by a steam engine 31 which is directly connected thereto and which receives steam through a conduit 32 extending to the outlet 11 of the tube 8. In practice, the capacity of the pump 26 is usually such that it is capable under full output of introducing into the tube 8 more feed fluid than can be heated to the desired temperature under maximum operation of the blower 14, although, if desired the pump may be of limited capacity so that it ceased to work above the predetermined pressure.

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In order to control the operation of the pump 26 and of the blower 14, to supply vapour from the outlet 11 at the substantially constant predetermined temperature, we provide a thermostat 36 in their home relation to the boiler tube 8 adjacent to the final portion thereof. The thermostat includes the rod 37 which is moved with respect the boiler casing 7 under variations in temperature of the tube 8 and serves to actuate a pivoted rocker 39. The one extremity, the rocker 39 carries a contact 41 which is joined by a flexible lead 42 to the conductor 43. The conductor 43 extends to contact 44 on a lever 46 influenced or controlled by a pressure cell 47 subject to pressure in the outlet 11. The contact 44 co-operates with a contact 49 joined by the wire 51 to a master switch 52.

Furnishing electromotive force for the electrical circuit is a storage battery 53, or other suitable source of electromotive force, one side of which is grounded as at 54 and the side of which is connected by a lead 56 to the master switch 52. When the pressure in the tube 8 is below a determined value and when the master switch 52 is closed, current flows in the conductor 43 to the contact 41. If the contact 41 is in abutment with a co-operating contact 61 the current continues to flow through a lead 62 extending to one side of the electric motor 16, the other side of which is connected to ground by the wire 63, thus completing the circuit to the motor and causing the blower 14 to be driven.

As the blower driven and products of combustion heat the tube 8, the temperature adjacent the thermostat 36 increases until it arrives at such a value that thermostat rod 37 causes the rocker 39 to rotate on its pivot sufficiently to separate the contacts 41 and 61, thus breaking circuit to the blower motor 16 and causing a cessation of the heat supply to the boiler tube 8. By virtue of this arrangement the blower supplies heat to the boiler at all temperatures up to and including a predetermined temperature and the contact 41 and 61 separate, while above such predetermined temperature the blower 14 is not driven and the supply of heat is interrupted or stopped.

In order to control the supply of water or feed fluid to the tube 8, there may be provided at the extremity of the rocker 39 a contact 71 which is adapted to co-operate with a contact 72 connected by a lead 73 to the conductor 43. When the contacts 72 and 71 are in abutment, current flows into lead 74 extending to an electromagnet or solenoid 76 which is grounded, at 77. The electromagnet 76 controls the operation of the valve 78 governing flow through the conduit 32 that when the solenoid 76 is energized, steam generated within tube 8 flows through the conduit 32 and to the engine 31 thereby causing the pump 26 to extract the fluid from the reservoir or source 23 and introduce it through the conduit 27 and past a check valve 80 into the primary inlet 9 of the boiler tube 8.

Since we have found by an extensive practice that the introduction of the fluid into the primary inlet behind the boiler itself is not capable of producing a close regulation of the temperature of the issuing steam, we provide a secondary

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feed conduit 81 intersecting the conduit 27 adjacent to primary inlet 9 of the boiler tube, and extending into a secondary inlet 82 of the boiler tube 8.

The secondary inlet is adjacent to the thermostat 36 and is between the thermostat and the primary inlet 9. Since there is in practice a material pressure drop between the primary inlet 9 of the boiler tube 8, and secondary inlet 82 thereof, we find it advisable to insert in the secondary feed the conduit 81 not only a check valve 85 but also a control orifice, generally designated 83. The control orifice 83 preferably comprises a standard coupling having a male unit 84 and a female unit 86 between which there is clamped disk 87 provided with an aperture or orifice therethrough. The size of the orifice is fixed but by releasing the members of the coupling 83 and inserting disks comparable to the disk 87 but having different sized orifices 88 therethrough it is possible to provide the desired flow through the secondary feed conduit 81. Preferably that the portion of the total feed fluid which flows through the secondary feed conduit 81 is about 10 per cent. of the total flowing through the conduit 27 leaving a remainder of approximately 90 per cent. to flow through the primary inlet 9.

By provision of the branch conduit 81 for introducing feed fluid into the secondary inlet 82 relatively close to thermostat 36 a prompt effect is had on the thermostat so that as soon as the contact 71 and 72 have closed, which preferably occurs slightly before the contact 41 and 61 have opened, the valve 78 is opened, the engine 31 operates and the pump 26 introduces water or feed fluid through the primary inlet 9 and the secondary inlet 32 simultaneously and in the approximate proportions desired.

The effect of the injection of feed fluid is first on the thermostat 36 which is owned markedly by secondary water flowing into the inlet 82 and causes the thermostat rod 37 to move that the contacts 71 and 72 are separated, thus breaking the circuit into the electromagnet 76 and stopping the steam flow to the engine 31 whereupon the pump 26 ceases further pumping of water into the boiler tube 8.

Depending on upon operating conditions, the contacts 71 and 72 can open and close with greater or less rapidly and since they are usually adjusted with respect to the contacts 41 and 61 so that contacts 71 and 72 close preferably at a first predetermined temperature while the contacts 41 and 61 open at the second predetermined temperature which is a few degrees higher than the first predetermined temperature, the feeding of water into the boiler is rapidly the intermittent.

Under light loads it requires a relatively small amount of water introduced into the secondary inlet 82 to affect the thermostat 36 quickly but under relatively heavy loads, particularly if the blower 14 increases materially the amount of heat supplied to the boiler, a relatively greater amount water introduced through the secondary inlet 82 is required to reduce the temperature and thermostat 36 sufficiently to cause the contacts 71 and 72 to separate. Under such conditions, that is when relatively greater amounts of water are introduced through the secondary inlet 82 there is a corresponding increase in

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the introduction of the feed fluid in the primary inlet 9 so that the entire boiler is accommodated to the increase in load thereupon.

When the load is reduced and the boiler is returned to a light load condition, any excess water which may have been introduced to the secondary inlet 82 is promptly effective on the thermostat 36 and causes it to cool materially thereby requiring a relatively long period of operation of the burner or boiler 14 before the thermostat 36 is again heated to such value that the contacts 71 and 72 are again closed.

Under a condition in which the supply of the fluid in the secondary inlet 82 is not sufficient to hold thermostat 36 despite the amount of heat being imparted thereto by the operation of the blower 14 the temperature of the thermostat 36 rises to the predetermined value so that the rod 37 causes the rocker 39 to pivot and to separate the contacts 41 and 61 thereby stopping operation of the blower 14 and preventing an additional amount of heat being imparted to boiler tube 8 until the temperature has again fallen to the predetermined value

Also, under the condition that the boiler pressure within the tube 8 rises to a predetermined value the pressures cell 47 causes the rocker 46 to separate the contacts 44 and 49 thereby not only causing an interruption in the supply of heat by virtue of stopping the operation of the blower 14 but also de-energizing in the electromagnet 76 so that the valve 78 is closed and further supply a feed water to the boiler is entirely interrupted.

In practice the preferred adjustment is the device is such, under a typical condition, that the pressure regulator is set for approximately 1,500 pounds per square inch while the contacts 41 and 46 are normally closed under low temperature but opened at approximately 900 degrees Fahrenheit, while the contacts 71 and 72 are adjusted to close at approximately 890 degrees Fahrenheit. We have found in practice that with this adjustment and under all variations in load and output of the boiler that the temperature varies substantially between the limits stated and does not surge appreciably beyond the limits indicated.

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News Items.

Mr. Ainley, of Stockmoor, is considering building a steam car fitted with a coke-fired boiler, which he has schemed out in the very ingenious manner.

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Mr. Cowper-Essex, Hawkshead, has now got his experimental steam car on the road. This car contains many interesting details of Mr. Cowper-Essex's own design construction, and its road performance is very good.

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Mr. H. W. Bolsover recently drove a large 740 model, 20 H.P. Stanley car from Whitby to Hawkshead, about 140 miles. This car has been fitted with an oversize Bolsover water-tube boiler, and did the trial run, as above, in very good time. On arrival at Hawkshead, he had the interesting experiences having a run in Mr. Cowper-Essex's steamer.

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Steam is coming for aviation, and during the next few months, we hope much interesting reading matter on the subject will be available for "S.C.D. & S.A."

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Mr. Neville of Chilwell, has restored a very old model 10 H.P. Stanley steam car, and put it into first-class condition—substituting a Bolsover "Express" water-tube boiler for his original fire-tube boiler. He reports that the car runs well.

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The new light cylinders of compressed coal gas, now available, may prove of value on the steam car, for quick light up; also this compressed gas may be useful for lighting the driving lamps on old-time steamers—not fitted with dynamos.

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Mr. J. G. A. Kitchen's letter—which is printed at our correspondence columns—is very interesting reading. It may be that so far our readers would like to take advantage of Mr. Kitchen's offer to inspect the steam power unit he refers to.

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Mr. Brian Stack, of Edgware, has sent some sketches of an atomising burner and boiler unit of his design, which it is proposed to install in the 740 Model Stanley car. We hope Mr. Stack will favor us with the details for publication, later on. The design has some novel features which, we are sure, will work very well.

* * * * *

The editors wish to thank the following old readers of "S.C.D" who have kindly written letters of encouragement for the new "S.C.D.& S.A" with their best wishes for its success: Messrs. Henry Love, A. R. Harwood, J. H. E. Rogers, Harold Illingworth, C. W. Wilding-Jones, J. C. Farnsworth, J. G. A. Kitchen, C. S. Cowper-Essex, Abner Doble, A. V. Williams, Thomas Hindle, K. A. Hellon, Jas. Wright, Alex. S. Wilson, A. A. Gomme, J. Cornford, R. Neville, A. Price, Brian Stack, A. W. Field, Brian H. C. Matthews, J. A. Edwards, T. L. Reepmaker d'Orville, E. A. Nurse, A. Edmonds, T. C. Cleave, C. H. Matthews, W. Blythe, Jas. Sadler, B. Watkins, F. R. Ashdown, G. M.

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Barrett, C. H. Titterton, J. M. Dimond, E. Ainley, G. R. Martyn, H. V. Gand, B. V. Young, F. Gibbons, D. A. Davies, J. C. Carr-Ellison, W. S. Paris, N. G. Scott and many others.

* * * * *

During the next few months working drawings for various steam cars will appear in "S.C.D. & S.A.", some with very interesting and practical features. These, we hope, will be an aid to those wishing to build a steamer for themselves.

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Steam in the Air promises to be a formidable rival to the internal combustion driven plane, for reasons giving in our leading article. Steam car designers may congratulate themselves that they are, in no small measure, responsible for the successful application of steam aviation. This paper may, in future years, be known as the first publication to uphold steam aviation matters.

* * * * *

We note that the Germans regard the revolving boiler and steam turbine aviation unit as being applicable also to steam car propulsion. That, however, remains to be seen; but there is little doubt that users of steam—both in the air, and on the ground—will help one another effectually.

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Correspondence.

The editor is not responsible for opinions
expressed by correspondents.

Sir,

I have in the past spent considerable time and money in developing steam cars, and have designed and made several successful vehicles, the last one ran for some 30,000 miles without trouble.

Some 20 years ago I realized that the IC engine is going to lend itself to the propulsion of road vehicles or easily than steam, and not seeing much in steam cars is a commercial proposition, dropped the idea.

For my own use I built a small plant, generator and engine, entirely devoid of automatic controls, gauges, etc., and controlled from one valve only; this is still in working order, and open to inspection anytime.

If it is of interest, I have some photos of a "Bus" designed and constructed in 1908. This vehicle was ahead its time, it gave a performance far better than the contemporary IC vehicles of the same class, unfortunately its sponsors were keener on other lines and lost a golden opportunity.

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At the present time I feel that with the development of stainless-steel, but steam car would be possible, (it might only be appreciated by the expert), it would, however, cause something like £1,500 to develop, and this factor precludes me from making the attempt.

J. G. A. KITCHEN.

Windermere.

Sir,

I must commend your enterprise in again reviving the "S.C.D. & S.A." and I will gladly become a regular subscriber. There is an enormous amount of master that can be easily discussed by those, who have had experience with this type of car or are willing to experiment.

In the past, correspondence on steam car matters always goes off into impractical channels. Mostly ideal specifications are lavishly produced, quite regardless of the fact that the cost of such experimental work would run into thousands of pounds in many cases far beyond the scope of the average amateur. At the present moment the position of the perspective steam car owner is that he must make it himself. Chassis are easily in a picked up from the car breaker. I assume that Messrs. Bolsover can put up at reasonable price, boiler, burner and tanks for any car, but the real hitch lies with the engine. What can be done in the way of combined effort introducing a suitable design, loaning patterns, finding suitable firms to do castings and machining for a small lightweight engine, suitable for an Austin 7 chassis? Anything bigger, I fear, is out of the question.

I'm aware that old Locomobile and Stanley engines can occasionally be picked up, but what sort of condition are they in? Probably they would require re-boring and a thorough overhaul to fit them for running at all. It is my experience a steam engine with a leaky piston is even more unsatisfactory than the petrol motor. Whatever may be the merits or demerits of the 3-cyl. s.a. engine it is about the only type of engine the amateur could hope to tackle. Can't help feeling that in the past this type of engine has been murdered by buy real bad design. The valves and ports were so small that red hot steam and an immense pressure was required to shift the engine and all.

A very neat set of 3-cyl. Richardo engine castings used to be marketed by the Liverpool Castings Co. I wonder whether they still have to patterns and in what sizes. It is worth looking into, as the engines would be big enough for steam bicycle work.

The Brotherhood 3-cyl. radial engines would probably be the easiest job to machine, especially if some enterprising firm would agree to the heaviest machining and reasonable rate. The main objection to this type of engine is water in the crankcase, but I believe that certain types of emulsified oil can be used satisfactorily. If so, will some subscriber kindly state to name and where obtainable?

The rotating cylinder type of engine has certain advantages and I hear that locally some small power steam engines have been made experimentally and ran

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successfully on trial. I will try to get further particulars of them. If they could be made about the same size as the flywheel and clutch unit of the petrol car, conversion would be much simplified.

In my workshop I have present a small steam feed pump, cylinder 1 in. bore x 1/2 in. stroke, pump 1/4 in. bore x 1/2 in. stroke under construction. For a steam clothes pressing and cleaning establishment. It might be useful for a steam car boiler, as personally I should never care to use an engine driven pump again. There are two special points about this design:

- (1) It is within the power of a 4" Drummond lathe to machine it.
- (2) No oil for cylinder lubrication can possibly contaminate the feed water.

If successful I will publish the designer and arrange to supply castings for anyone who wants a small pump. I originally fitted a Locomobile steam pump for the clothes press boiler, but the internal workmanship was not good enough for satisfactory service.

If other subscribers, who have useful patterns for small engines, steam car fittings, etc., could arrange in a similar way for castings it might be very helpful.

Insurance of steam cars and bicycles is a most urgent problem. We must get hold of firms who will take an interest in this boiler insurance business. I heard comparatively recently of two steam bicycles completely dismantled by insurance difficulties.

H. E. RENDALL

Teddington.

Sir,

I am in receipt of your Circular with reference to the proposed revival of "Steam Car Developments," and in the event that this scheme should materialize, shall be glad to support the movement with a subscription to the paper at the price you mention.

May I suggest that you, as editors, will use your discretion in censoring the forthcoming correspondence, so as to eliminate passages or contributions that savour of interested or acrimonious criticism, or mere sarcasm. From past experience, I regret to say, that this mischievous and futile pastime has been much too freely indulged in.

If this proposed attempt is intended to bring steam car enthusiasts together, let us avoid throwing too many gloves in the ring; and instead, give various views a decent chance to be examined and heard courteously. After all, no one single individual can claim to possess the monopoly of steam car design.

Wishing you can very best of good luck in your latest venture,

T. L. REEPMAKER D'ORVILLE

Esher
Sir,

STEAM CAR DEVELOPMENTS

I should be pleased to subscribe to "S.C.D." in any form in which you like to publish. Not that I am interested in cars particularly, but in Engines and Boilers themselves; and I have found your publications very instructive in the past, and hope to again.

T. C. CLEAVE

Lymington.

Sir,

I suggest you obtain from the "Autocar" a complete reprint of the illustrated description of the English "Pearson-Cox" car which they published about 20 years ago. The car embodied the elements of the steam car in their simplest form. It can be understood very easily by those unfamiliar with steam—its design emphasises the simplicity of steam (which some steam cars do not)! It of the type cheap to build—it gave reliable service in the hands of a novice and a performance, when running under favourable conditions, which would be acceptable today—and its weaknesses could probably be overcome today, in the light of modern experience.

I can think of the better Primer—in two senses! for the steam car novice that a detailed description of Messrs. Pearson and Cox's system.

With best wishes for the success of your venture.

H. A. ILLINGWORTH

Penrith.

Sir,

I am more than delighted to hear of the prospective re-birth of "S.C.D." and wish you every possible success with the venture, you may certainly count on my subscription, and I do not think I could, if I wished, refrain from entering the lists in the correspondence columns.

I hope you will not to strictly observe the limitation you suggests and will again let us have some brief notes, illustrated possible, of systems that have had some measure of success, or even promise, and also of any new application to the development of steam vehicles.

If the cause of the steam car is to gather impetus we must interest young people in its possibilities, otherwise your paper will inevitably become the debating ground diminishing band of old fogey enthusiasts. I do not want to say cranks; and academic interest only.

The young have had little opportunity of learning what has previously been accomplished, or attempted, so cater for them in this respect, catch their interest, and set in motion that driving force of youthful enthusiasm.

Very few people have any experience or knowledge of very high-pressure, very hot steam, cannot you persuade one of these few to submit some facts and figures? Your own experience in that direction would be a great interest and value. Where the knowledge exists please help to disseminate it.

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K. A. HELLON

Cuffley.

Sir,

"Steam Car Developments."

In answer to your circular re the above mentioned journal, the Patent Office Library would be prepared to subscribe if and when the journalists re-started.

A. A. GOMME

H.M. Patent Office Library

Sir,

I am delighted to hear you are starting another Steam Car paper, and that it is to be printed, and I shall be glad to receive copies the same.

I would suggest some space were also devoted present-day matters, improvements, new inventions, etc. Wishing you every success.

D. W. WILDING-JONES.

Malpas.

Sir,

I am glad you proposed to revive "Steam Car Developments," and I, for one, and very keen on same. I would like to see the steam car forge ahead and be what the petrol car is today; of course will take some doing, but the people who think there is no place on the road for steam, know nothing at all about steam. I have had many talks with petrol men, and they think that steam is too slow and cannot be applied to a car. Of course what they go by, is steam locomotive; they seem to forget the close steam engines they have seen, our goods engines, and which they pointed out to be were so, and I pointed out to them that those engines were working on the gradient of 1 in 38, and were hauling a train behind them of 150 tons, I asked them, could they show me a motor that could do this? They had to admit they could not.

With the best of luck for "S.C.D.", please don't forget my first copy.

A. B. WILLIAMS

Dowlais.

Sir,

I was very interested in your leaflets concerning your proposed revival of "Steam Car Developments." Please put me down as a subscriber.

I'm afraid my experience of steam cars is very limited, but as a possible line for discussion, like to raise the question of frost.

This problem occurred to be in examining the Doble cars at the Sentinel Works in December last, it being extremely cold at the time. The cars being

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garaged in a heated shop the trouble was not apparent, but it occurred to me that the precautions necessary must surely be even greater than the tiresome radiator draining with petrol cars. In Mr. Doble's two-seater coupe the water tank is under the driving seat, where it is sheltered to a certain extent; but in another car of four-seater saloon—which is, presumably, the standard American job, the tank is strictly beneath the condenser, i.e. between the dumb-irons. I should have thought that in very cold weather, a part from precautions very in left standing, water that tank by freed up and traveling. It is an exposed position, and condenser would be so effective at temperatures that the heat of the condensate would scarcely be high enough to prevent freezing at the bottom of the tank.

No doubt I'm betraying my ignorance in such matters, but I should like information and enlightenment on the subject.

Perhaps through the medium of your publication Mr. Doble may be induced to come for did explain the matter.

Wishing you every success with the "S. C. D."

L. T. C. ROLT

Cheltenham.

* * * * *

Server,

I was glad to receive your letter and enclosure, telling me that you plan to publish steam card development again.

They're very kind in your remarks about the little contribution needed me the honor to into the 1930, and I should like to be of such help to you analyze within my power. Just now I fear will not possible for me to write anything for you. The difficulty occurs to be, which is that I am not now are free glance; I'm afraid that the sort of article of your readers would most like to have would be about those new developments which I could not divulge!

Mr. Brian Stack informs me that he has worked out the small steam car design, which seems to possess while features. Perhaps you write to an article describing it?

ABNER DOBLE

Shrewsbury.

For Sale. 16 in. Stanley fire-tube boiler, new. Only used six times. Klinger Water Gauge. Stop Valve and super heater. Stanley type vaporising burner, petrol, but easily convertible to paraffin, £8 or near offer. Also, ideal for use with the above in light chassis, "Milwaukee" steam car engine. Identical with the Locomobile engine, but with plain bearings, self-contained feed pump. £5 or near offer. Wanted. Steam car literature. Stanley throttle valve. --Cowper-Essex, Hawkshead, Ambleside.