ABSTRACT: The pulse generator according to the invention comprises a piston pump with a suction space and a compression space, the piston comprising two movable portions, with limited movability relative one another and of concentric relationship, forming between themselves an overflow passageway from the suction space to the compression space, and coacting surfaces in both portions controlling the overflow through said passageway.
HYDRAULIC PULSE GENERATOR

For a certain type of atomizing carburetor the fuel has to be supplied with a pulsating pressure to an atomizing nozzle. The pressure surge thereby transferred via the fuel to a resilient valve body in the opening of the atomizing nozzle produce in the valve body variations, which are prerequisite for correct atomization during operation. A carburetor of this type is described in greater detail in Swedish Pat. Nos. 224,579 and 305,980.

The fuel supply to such an atomizing carburetor is effected by a pulse generator, which in principle operates as a piston or diaphragm pump. For every pressure stroke this pump sends an amount of fuel to the atomizing nozzle of the carburetor. Tests have shown that the pressure surge produced in the pipe and/or passageways between pulse generator and carburetor must be hard and distinct. The pressure surges then act like a hammer blow on the resilient valve body in the atomizing nozzle opening. Practical tests further have shown that it was not possible by pulse generators of conventional construction to effect sufficiently hard and distinct pressure surges, and that as a result thereof the atomizing carburetor did not operate in an entirely safe and stable manner at varying operation conditions. This problem had been observed when the pulse generator was mounted in a vehicle where the correct operation of the pulse generator was disturbed by vibrations. Operation also is negatively affected by an inclined mounting of the pulse generator.

The present invention, which has as its object to eliminate such disadvantages, relates to a hydraulic pulse generator comprising a block with cylinder bore and, operating therein, a piston on one side of which is formed a compression space between the piston head and cylinder head, and on the other side of which is formed a suction space. A piston rod and push mechanism impart a short reciprocating motion to the piston so as to compress the liquid medium in a compression stroke and during a return stroke, fill the compression space with such liquid.

An embodiment of the invention follows with reference to the accompanying drawing whose sole figure is a longitudinal sectional view through a pulse generator according to the invention.

The pulse generator comprises a pump housing 1, the interior of which is a cylindrical hollow space 2. The upper part of said housing defines a cylinder head wherein there is provided a stop valve 3 with associated spring 4 and an aperture 5 for connection to a pipe leading to the not-atomizing carburetor. Within the space 2, a piston 6 is reciprocably mounted. Said piston comprises two portions, one outer annular portion 7 and one substantially cylindrical inner portion 8. At the upper edge, said outer and inner piston portions are so fitted one within the other that upon downward motion of the inner portion a cone-shaped gap 9 is formed between said piston portions. A shoulder 10 on the inner piston portion and a shoulder 11 on the outer piston portion define the width of said cone-shaped gap when the piston is moving downwards. The outer piston portion includes a number of passageways 12, through which said gap, and thereby the compression space 13, communicate with the suction space 14. For centering the inner piston portion, a guide 15 rising upwardly from the bottom of the housing is provided. The piston portion 8 is secured by a screw means 16 to a piston rod 17 running in a hollow space 18 in said guide 15. In the upper portion of guide 15 and on the piston rod 17, respectively, shoulders 19, 20 are provided, between which a helical spring 21 is mounted for effecting the return stroke of the piston. The compression stroke of the piston is effected by a not-shown cam or eccentric acting upon a pressure shoe 22 and via said shoe and the rod 23 which includes abutment 24, acts upon the washer springs 25 which act upon the bushing 26 which acts upon the endpiece 27 of the piston rod 17. This power transmission renders the length of the piston stroke variable and a function of the pressure produced in the compression space 13. This pressure, on the other hand, can be adjusted by lessening or increasing the compression of the washer springs 25.

The pump housing of the pulse generator includes two openings, whereof one, the inlet 28, opens tangentially and the other, the return outlet 29, opens radially in the upper suction space of the pump housing. A pipe connection 30 in the outlet opening extends a distance into said suction space 14.

The pulse generator operates as follows.

The piston just having arrived at its uppermost position, the gap 9 is closed entirely and the piston is located at such a height in the cylinder that the lower end of the piston contacts the cylinder roof. Thereby the compression space 13 practically is zero. At the beginning of the return stroke of the piston, at the beginning only the inner piston portion 8 is moving while the outer piston portion 7 is retained in its uppermost position, due to the friction between portion 7 and the housing wall. The gap 9 is thereby opened and the liquid in the suction space 14 is free to flow upwardly into the compression space 13 via the passageways 12 and the gap 9. When the shoulder 10 on the inner piston portion abuts the shoulder 11 on the outer piston portion, gap 9 is maximum and said outer portion is caused to follow the inner portion to the lowestmost position of the piston while simultaneously the compression space entirely becomes filled with liquid from the suction space. During the subsequent compression stroke of the piston, again at the beginning only, the inner portion is moving upwardly until gap 9 has been closed entirely. During this phase no appreciable pressure increase takes place in the compression space because said space via the gap 9 communicates with the suction space 14. As the gap 9 is closed, the outer piston portion is caused to participate in the continued motion upwardly, and the liquid in the compression space 13 is forced past the stop valve 3 to the outlet opening 5 from which the liquid via a pipe can be led to the atomizing nozzle of the carburetor or another similar device.

The liquid is supplied to the suction space 14 of the pulse generator by a separate pump, which all the time supplies a quantity of liquid considerably exceeding that pumped by the pulse generator to the carburetor. This liquid excess serves to flush away steam or gas bubbles, which easily form in volatile liquids such as gasoline, from the suction space of the pulse generator where they otherwise detrimentally would affect the pump operation. Due to the fact that the inlet to the suction space of the pulse generator is positioned tangentially and the mouth to the return outlet is located as far as possible inwardly to the center of the suction space, the suction space acts as a separator and thereby renders possible an effective separation and removal of gas bubbles found in the suction space. The liquid thus flowing back through 30, 29 can be directed, for example, to the gasoline tank of the fuel car or to the container or means where gas or vapor bubbles following along can be separated.

The advantages of the pulse generator described above are obvious. The simplest shape of the eccentric or cam effecting the piston movement is the circular shape. This implies that the piston speed becomes a sine function, i.e., the piston speed will be at maximum when the driving eccentric is at an angle of 90° in relation to the longitudinal axis of the piston. It is then suitable so to adjust the distance between the shoulder 10 on the inner piston portion and the shoulder 11 on the outer piston portion that the gap 9 during the upward movement of the piston is closed at that moment when the piston moves at maximum speed. Hereby the pressure increase in the compression space will take place extremely rapidly and be given the nature of that hard and distinct hammer blow which, as mentioned before, is of decisive importance for the function of the means. It was found by practical tests that at a total piston speed of 39 mm., and if said distance between shoulder 10 and shoulder 11 is 0.35 mm., better results have been achieved with the atomizing carburetor according to the invention than they heretofore have been achievable with known pulse generators.

What I claim is:

1. A hydraulic pulse generator, comprising: a block having a cylindrical bore therein and a head at one end of said bore, a piston reciprocably fitted within said bore, a compression
space being defined between one side of said piston and said head, a suction space being defined between the other side of said piston and the corresponding other end of said bore, a liquid inlet leading into said suction space, said piston comprising an inner and outer portion, the outer portion being slidingly fitted against the longitudinal wall of said bore, said inner portion being fitted within said outer portion whereby one is axially displaceable to opposed first and second positions relative to the other, a seat defined by respective cooperating surfaces of said inner and outer piston portions, said surfaces being sealingly seated against each other with said piston portions being in said first position, and said surfaces being spaced apart to define a liquid passage therebetween with said piston portions being in said second position, said liquid passage communicating said suction space with said compression space, a rod means for reciprocatingly driving said inner piston portion, abutment means restricting the axial displacement of said piston portions apart from each other and thereby defining the maximum spacing apart of said seating surfaces, said suction space being annular and concentric with said inner piston portion, said liquid inlet opening tangentially into said annular suction space, and a liquid outlet conduit extending radially outwardly from the vicinity of the central area of said suction space.

2. The pulse generator of claim 1, said cooperating surfaces being frustoconical.

3. The pulse generator of claim 1, including a discharge passage in said head leading from said compression space, a valve closing said discharge passage, yieldable biasing means urging said valve to a closed position, said valve being arranged to be urged to an open position by pressure within said compression space.

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