II. Double Downdraft Carburetor for Models 220 a and 219

A. General

Models 220 a and 219 have a Solex double downdraft carburetor Type 32 PAATI. To all intents and purposes the double downdraft carburetor combines two separate carburetors in one housing. It has two 32 mm diameter suction canals each with its own main carburetion system and idle system. The accelerating pump and the starter mechanism, however, supply both suction canals of the carburetor together. The float chamber and the air intake occupy a central position (Fig. 07-0/11).

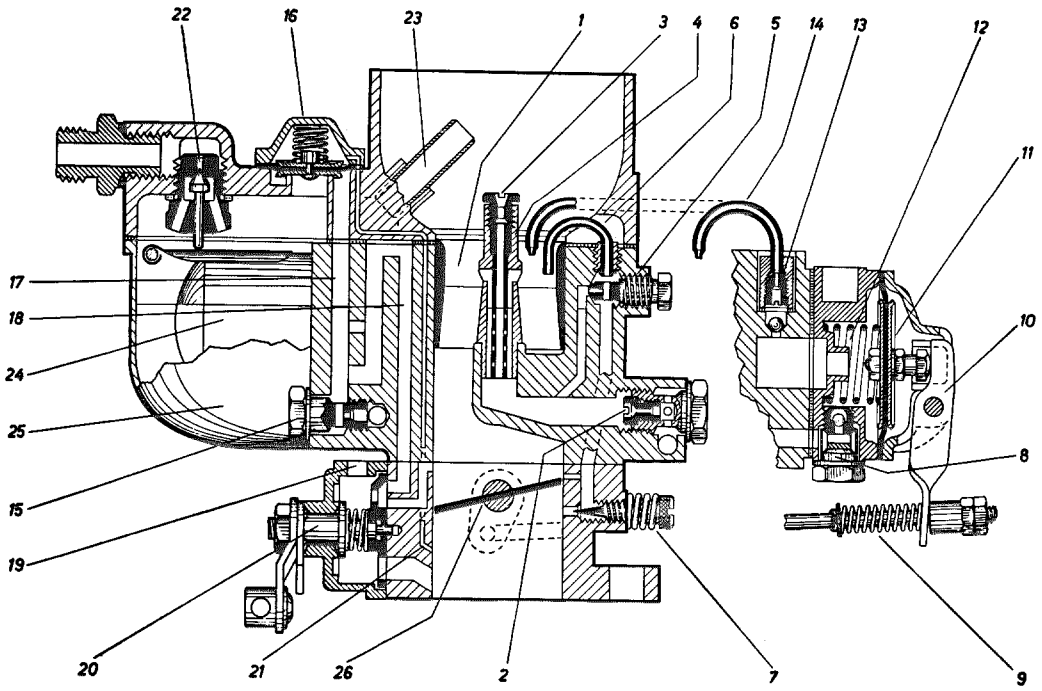

Fig. 07-0/11

Solex Carburetor Type 32 PAATI

1 Air horn
2 Main jet plug with main jet
3 Air correction jet
4 Mixing tube holder with mixing tube
5 Idle fuel jet
6 Idle suction tube
7 Idle mixture adjustment screw
8 Ball valve
9 Connecting rod with pressure spring and adjusting nuts
10 Pump arm
11 Pump diaphragm
12 Diaphragm spring
13 Fuel jet in injection tube
14 Injection tube
15 Starter fuel jet
16 Starter air valve
17 Air canal from starter air valve to fuel canal (18)
18 Fuel canal to starter system
19 Starter air bore
20 Starter rotary slide valve
21 Vacuum canal for starter air valve
22 Float needle valve
23 Vent tube for float chamber
24 Float
25 Float chamber
26 Throttle valve

Note: a) Fig. 07-0/11 shows the 1st version carburetor without grey cast-iron flange on the throttle valve section. The 2nd version carburetor with grey cast-iron flange has been installed in Model 220 a as a standard part as from Engine End No. 4502815.

b) The new version of the carburetor for Model 219 (installed as a standard part as from Engine End Nos. 10–9501619 and 11–9500384) (as from Solex Carburetor No. 3 908 566) has idle air jets instead of the idle suction tubes shown above (for details see Section F).

B. Starter Mechanism

The starter mechanism of the carburetor works in two stages on the rotary slide valve principle. The starter mechanism is actuated by a bowden cable with a pull knob on the instrument panel. If the starter knob is pulled right out, the starter mechanism is set at the "cold-start position". If the starter knob is pressed in about halfway, the starter mechanism is set at the "warm-up position". If the starter knob is pressed in completely, the starter mechanism is inoperative. Connecting the choke control is described in Job No. 30-6.

a) Cold-Start Position

(Starter knob pulled right out)

When the starter mechanism is in this position, the aperture (34) in the starter rotary slide valve (20) is in the center of the starter mixture canal (30) in the starter flange of the carburetor housing.

In the 1st phase of the cold start the partial vacuum obtaining in the suction tube exerts an influence on the starter system via the starter mixture canal (30) when the engine is being started. As a result fuel from the float chamber is drawn into the fuel canal (18) through the starter fuel jet (15). A certain amount of air enters at the same time through the notch in the carburetor cover which connects up with the float chamber; as a result, a kind of pre-mixture is present in the fuel canal (18) leading to the starter rotary slide valve.

The notch is designed primarily to prevent fuel from being drawn up by the siphon effect when the starter mechanism is inoperative and if the starter rotary slide valve should have a slight leak.

Through a graded bore in the fuel canal (18) the pre-mixture enters the starter mixing chamber (27) behind the rotary slide valve via the fuel slot (28) in the starter flange and the graded bore (33) in the slide valve (Figs. 07-0/12 and 07-0/13).

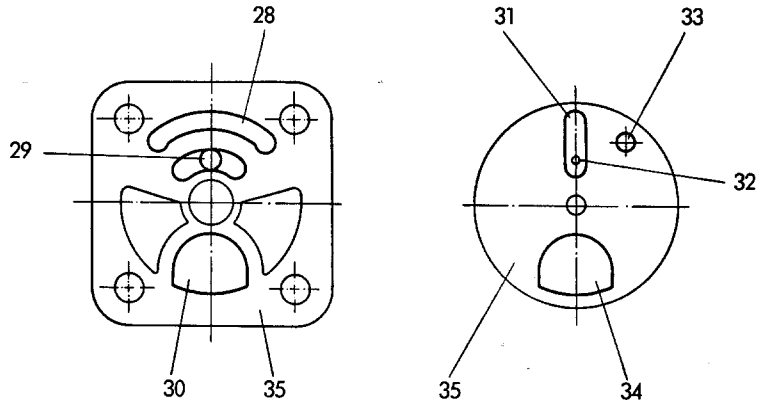

Fig. 07-0/12

Starter flange of carburetor housing

28 Fuel slot in starter flange for fuel canal (18)
29 Canal for additional air
30 Starter mixture canal
31 Chamber in starter rotary slide valve
32 Graded bore in starter rotary slide valve

Starter rotary slide valve

33 Graded fuel intake bore in starter rotary slide valve
34 Aperture in starter rotary slide valve for starter mixture canal (30)
35 Sealing surface

At the same time air is drawn from the suction canals of the carburetor through the canal (29). In the chamber (31) of the starter rotary slide valve this additional air mixes with the pre-mixture which enters the starter mixing chamber (27) via the graded bore (32) in the starter rotary slide valve. Here the mixture combines with the pre-mixture entering through the graded bore (33) in the starter rotary slide valve and the air entering through the starter air bore (19) in the starter housing which acts as a starter air jet. The fuel-air mixture which is now formed passes through the aperture (34) in the starter rotary slide valve and the starter mixture canal (30) into the two suction canals of the carburetor and together with the air streaming through the throttle valve gap forms the final start mixture. Fig. 07-0/13 shows the mode of action of the starter mechanism phase 1 when the engine is being started.

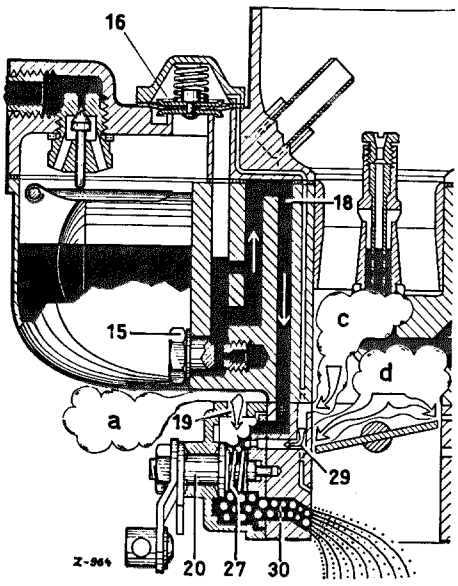

Fig. 07-0/13

Cold start — phase 1
When starting the engine
(Starter air valve closed)

a) Starter air entry
c) Additional air entry from suction canals
d) Main air entering through throttle valve gap

15 Starter fuel jet
16 Starter air valve
18 Fuel canal
19 Starter air bore
20 Starter rotary slide valve
27 Starter mixing chamber
29 Canal for additional air
30 Starter mixture canal

As soon the engine has started, the 2nd phase of the cold start begins. The increase in engine speed brings about an effective partial vacuum beneath the throttle valves. This partial vacuum exerts a pull on the spring-loaded side of the diaphragm of the starter air valve (16) via the vacuum canal (21) (see Fig. 07-0/14).

As a result of the partial vacuum effect the starter air valve (16) opens and admits more air into the starter system from the float chamber via the air canal (17) and the fuel canal (18). This additional air immediately leans out the start mixture after the engine has started, thus ensuring the proper running conditions for the engine. Fig. 07-0/14 shows the mode of action of the starter mechanism after the engine has started.

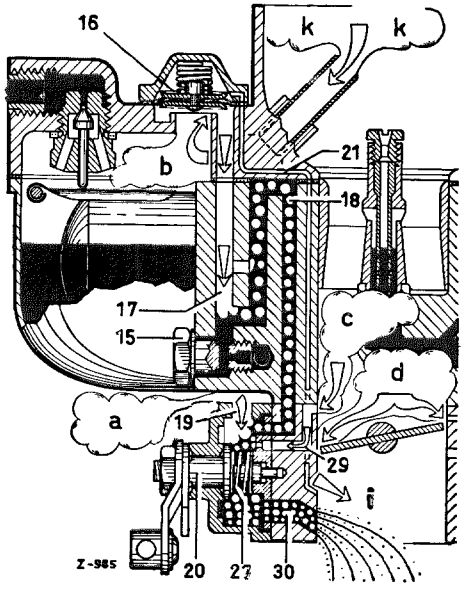

Fig. 07-0/14

Cold start — phase 2
After the engine has started
(Starter air valve opened)

a) Starter air entry
b) Additional air entry via the starter air valve
c) Additional air entry from suction canals
d) Main air entering through throttle valve gap
i) Partial vacuum
k) Air entry into float chamber
15 Starter fuel jet
16 Starter air valve
17 Air canal from starter air valve to fuel canal (18)
18 Fuel canal
19 Starter air bore
20 Starter rotary slide valve
21 Vacuum canal to starter air valve
27 Starter mixing chamber
29 Canal for additional air
30 Starter mixture canal

b) Warm-Up Position

(Starter knob pushed halfway in)

As soon as the engine has warmed up a little, the starter knob can be pushed in halfway. As a result, the starter rotary slide valve is turned toward the right via the starter lever; the graded bore (33) in the slide valve is covered by the sealing surface (35) on the starter flange (see Fig. 07-0/12). Since the starter mixing chamber (27) is no longer connected with the fuel canal (18) by the bore (33), but only by the fine-graded bore (32) in the starter rotary slide valve, the amount of fuel admitted is greatly decreased and the start mixture is leaned out further. Fig. 07-0/15 shows the mode of action of the starter mechanism during warming-up.

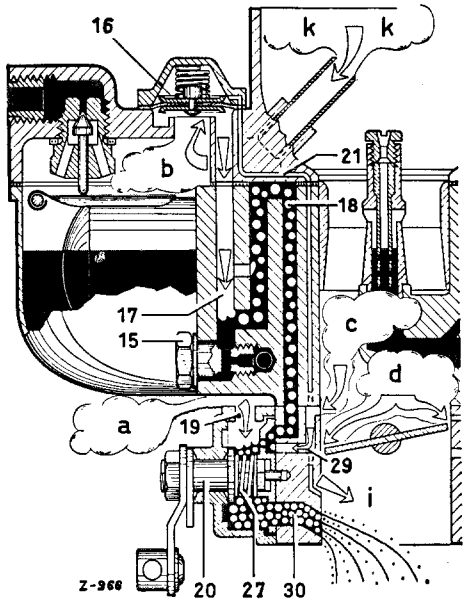

Fig. 07-0/15

Warm-up position
(Starter air valve opened)

a) Starter air entry
b) Additional air entry via the starter air valve
c) Additional air entry from suction canals
d) Main air entering through throttle valve gap
i) Partial vacuum
k) Air entry into float chamber
15 Starter fuel jet
16 Starter air valve
17 Air canal from starter air valve to fuel canal (18)
18 Fuel canal
19 Starter air bore
20 Starter rotary slide valve
21 Vacuum canal to starter air valve
27 Starter mixing chamber
29 Canal for additional air
30 Starter mixture canal

c) Driving Away with Starter Knob Pulled Out

When the car is driven away with the starter knob pulled out, the partial vacuum in the suction canals is shifted upward by the opening of the throttle valves. As a result, the supply of start mixture from the canal (30) decreases. This is compensated for by the start mixture drawn in via the additional air canal (29) so that the supply of start mixture to the engine remains unaffected.

If as a result of quick acceleration from low engine speed the throttle valves are opened still further, the partial vacuum suddenly drops. The starter air valve (16), which had opened as soon as the engine started, now closes again, so that the starter system produces a rich start mixture for the change-over just as it did at starting. As soon as the engine reaches sufficient speed, the starter air valve, actuated by the partial vacuum which is increasing again, once more opens and leans out the start mixture. By this automatic action of the starter air valve the cold engine is supplied with a correctly proportioned start mixture suitable for all conditions and a satisfactory change-over to the main carburetion system is ensured when the starter knob is pulled. Fig. 07-0/16 shows the mode of action of the starter mechanism when the car is being driven away.

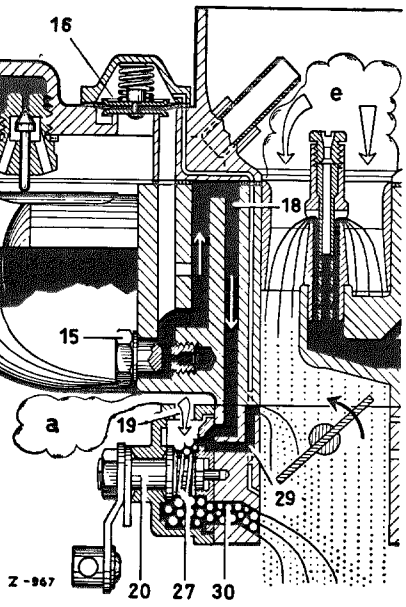

Fig. 07-0/16

Change-over with starter mechanism in action
(Starter air valve closed)

a) Starter air entry
b) Main air supply

15 Starter fuel jet
16 Starter air valve
18 Fuel canal
19 Starter air bore
20 Starter rotary slide valve
27 Starter mixing chamber
29 Canal for additional air
30 Starter mixture canal

Note: As a rule the car should be driven away with the starter mechanism in the "warm-up position". However, at very low temperatures the car can be driven away with the starter mechanism in the "cold-start position".

d) Starter Mechanism Inoperative

(Starter knob pushed right in)

When the starter knob is pushed right in, the starter rotary slide valve is turned to the right to a point where both the graded bore (33) and the graded bore (32) and the fuel slot (31) in the starter rotary slide valve are completely covered (see Fig. 07-0/12). The starter mixture canal (30) is also closed. The starter system is now out of action.

In order to prevent fuel from being drawn from the starter system, when the starter mechanism is inoperative, but if the starter rotary slide valve is not quite tight, a notch as described in Section a) has been made in the carburetor cover. This notch connects the float chamber with the fuel canal (18). For that reason only air and no fuel can be drawn in when there is a slight leak in the starter rotary slide valve.

C. Idle System

Each of the suction canals of the carburetor has its own separate idle system. For this reason the carburetor has two idle fuel jets, two idle suction tubes (or idle air jets) and two idle mixture adjustment screws.

a) Idle – Phase 1

The fuel which is drawn in via the idle fuel jet (5) is mixed with the air from the idle suction tube (6) (or the idle air jets), forming a mixture which passes into the idle canal (36). In the idle position a further supply of air for the idle mixture enters through the by-pass slot (37) (or the by-pass bores) above the throttle valve and then passes into the suction canal through the idle mixture bore (38) and combines with the air streaming through the throttle valve gap to form the final idle mixture (Fig. 07-0/17).

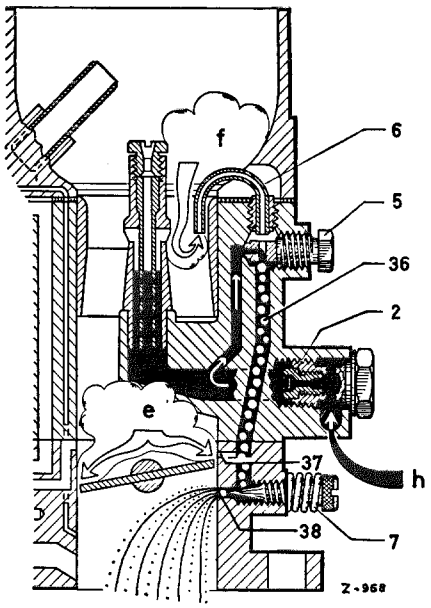

Fig. 07-0/17

Idle — phase 1

e) Main air supply
f) Entry of idle air
h) Fuel feed

2 Main jet plug with main jet
5 Idle fuel jet
6 Idle suction tube
7 Idle mixture adjustment screw
36 Idle canal
37 By-pass slot
38 Idle mixture bore

The cross-section of the idle mixture bores can be varied by means of the idle mixture adjustment screws (7). The idle mixture is leaned out when the idle mixture adjustment screw is turned in and is enriched when it is backed out.

The idling speed is adjusted by means of the idle adjustment screw on the throttle valve lever (see Job No. 01-3, Section K).

b) Idle – Phase 2

When the throttle valve is being slightly opened, idle mixture emerges both through the idle mixture bore (38) and the by-pass slot (37) (or the by-pass bores). The by-pass openings now serve to ensure a proper change-over to the main carburetion system (see Fig. 07-0/17).

Note: a) Up to Engine End Nos. 10 95 01618 and 11 95 0083 the carburetor had two idle suction tubes and a by-pass slot in each suction canal. As from Engine End Nos. 10 95 01619 and 11 95 00384 the carburetor has two idle air jets and in each suction canal two by-pass bores and a compensating bore below the air horn (see Section F).

b) In the right-hand suction canal of the carburetor at the same height as the by-pass slot or the by-pass bores as the case may be, but slightly offset to one side, there is a bore which leads to the threaded union on the throttle valve housing and which serves as a connection for the vacuum line to the distributor.

c) Recent carburetors have a bore on the carburetor flange for the connection of a vacuum tester; the bore is closed by a grub screw.

D. Main Carburetion System

The working principles of the main carburetion system are the same on the Solex double downdraft carburetor Type 32 PAATI as on the single downdraft carburetor.

In its standard form the double downdraft carburetor has a float and a float needle valve in the carburetor cover. The float chamber is ventilated through the tube (23) in the carburetor cover. For each of the carburetor suction canals there is an air horn, a main jet and a mixing tube holder with mixing tube and air correction jet (see Fig. 07–0/11).

From the float chamber the fuel flows into the mixing tube holder (4) through the main jet screwed into the main jet plug (2). If the throttle valve is opened beyond the idle position, phase 2, the partial vacuum moves upward and fuel is drawn from the outlet bores of the mixing tube holder and mixes with the air entering through the air intake branch of the carburetor cover.

When the vacuum effect increases at higher engine speeds the fuel level in the mixing tube holder decreases and compensating air enters through the air correction jet (3) and passes through the small bores in the mixing tubes and combines with the fuel flowing through the main jet to form a mixture. With increasing engine speed the proportion of air in the mixture increases so that overenrichment of the fuel-air mixture is prevented and the engine receives a more or less uniform mixture over the whole speed range (Fig. 07–0/18).

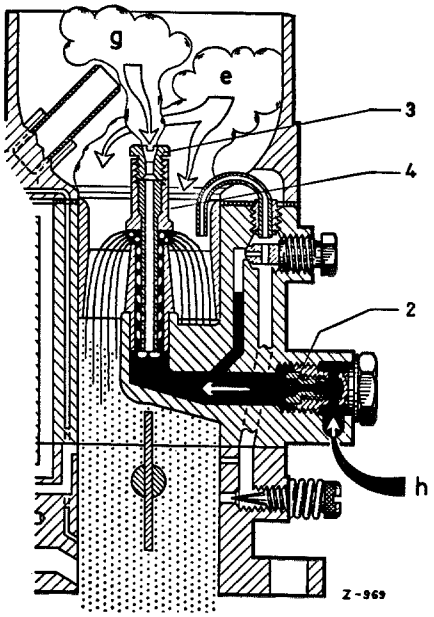

Fig. 07–0/18

Main carburetion system
(Throttle valve in full-load position)

e) Main air entry
g) Entry of compensating air
h) Fuel feed

2 Main jet plug with main jet
3 Air correction jet
4 Mixing tube holder with mixing tube

E. Accelerating Pump

The accelerating pump No. 92 is a so-called "neutral" pump, i. e. the engine can draw in fuel from the pump system via the injection tubes according to the degree of depression prevailing in the suction tube.

The main purpose of the accelerating pump, however, is to spray extra fuel into the mixing chambers of the suction canals when the accelerator pedal is depressed, in order to achieve a smooth speed build-up and good acceleration.

The pump arm (10) of the accelerating pump is connected to the throttle valve shaft by the adjustable connecting rod (9). When the throttle valves are closed, the diaphragm (11) is pressed outward by the diaphragm spring (12). Since the pump chamber is connected to the float chamber via the ball valve (8), it is filled with fuel.

When the accelerator pedal is depressed, the pump arm (10) is moved by the connecting rod (9). During this operation the pump arm presses the diaphragm inward so that the fuel in front of the diaphragm is injected via the two ball valves located below the bracket for the injection tubes (14), via the fuel jets (13) and the injection tubes.

During the injection the ball valve (8), which operates as a check valve, is closed. When the accelerator pedal is released, the diaphragm spring (12) presses the diaphragm (11) back. The ball valve (8) now operates as a through-way valve, whereas the ball valves below the bracket for the injection tubes (14) operate as check valves and prevent air from the carburetor suction canals from entering the pump system. (Fig. 07-0/19).

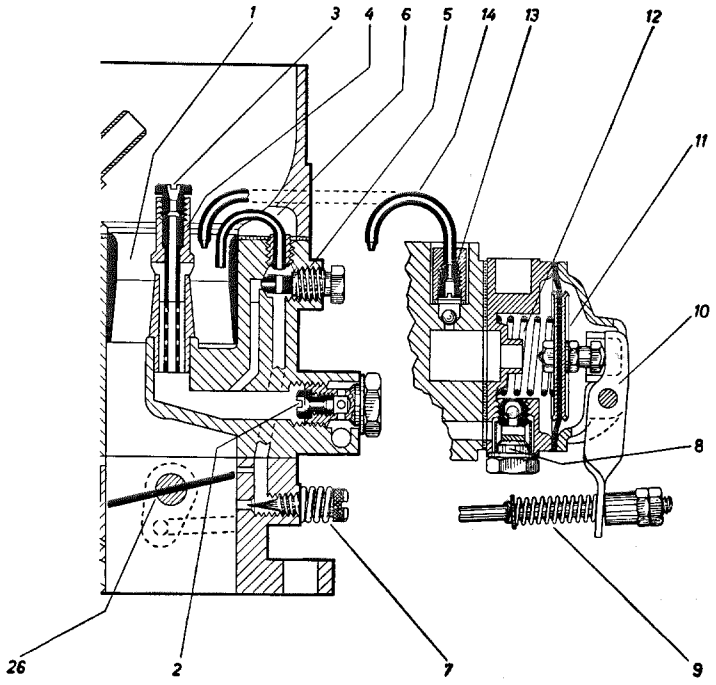

Fig. 07-0/19

1 Air horn
2 Main jet plug with main jet
3 Air correction jet
4 Mixing tube holder with mixing tube
5 Idle fuel jet
6 Idle suction tube
7 Idle mixture adjustment screw
8 Ball valve
9 Connecting rod with pressure spring and adjusting nuts
10 Pump arm
11 Pump diaphragm
12 Diaphragm spring
13 Fuel jet in injection tube
14 Injection tube
26 Throttle valve

Note: a) Instead of the conventional pump jets the double downdraft carburetor is provided with fuel jets (13) in injection tubes (14).

b) This version of the neutral accelerating pump carries no plate valve as a stop for the diaphragms.

Extra fuel from the pump system, in accordance with the vacuum in the air horns, is effected without operating the pump arm of the accelerating pump.

The injection amount for both injection tubes should be 1.3–1.5 cc/stroke together. Changes can be made by setting the adjusting nuts on connecting rod (9). Turning the nuts down will increase the pump stroke and thereby the injection amount, turning the nuts out will decrease stroke and amount.

The nuts may be tightened only to the point where pump arm (10) lifts from the diaphragm, because otherwise the injection will not start immediately when the throttle valves open. A change of the fuel jets (13) in the injection tubes (14) would not change the injection amount, but only the period of the injection. The connecting rod and the pump arm should move without sticking.

For adjustment of injection amount on the accelerating pump refer to Job No. 01–3, Section H.

F. Technical Specifications of Solex Double Downdraft Carburetor Type 32 PAATI

Carburetor	**Models 220 a and 219** (up to engine end No. 10–9501618 and 11–9500383)	**Model 219**
Air horn "K"	24	
Main jet "Gg"	0130	0125
Air correction jet "a"	170	165
Mixing tube "s"	0	
Mixing tube holder (reserve)	4.8	
Idle fuel jet "g"	47.5	50
Idle suction tube	1.8	—
Idle air jet "u"	—	1.1
Accelerating pump	No. 92 (neutral)	
Injection amount cc/stroke	1.3–1.5	
Fuel jet in injection tube	0.5	
Injection tube	low (0.5 graded)	
Starter fuel jet "Gs"	150	
Starter air bore in starter housing, mm ⌀	5.5	
Float needle valve	2.0	
Float weight (float of nylon) g	7.2	
Fuel level mm	13–15	15.5–17.5
Angle of inclination of throttle valves	8°	
Bore in throttle valves, mm ⌀	1.5	
By-pass slots mm	0.9 × 3.45	—
By-pass bores mm ⌀	—	1.25 and 0.7
Stabilizing hole, mm ⌀	—	1.5

Note: Model 220 a up to engine end No. 55 05551 with a float of brass having a weight of 21 g. Float of nylon has been installed as a standard part as from engine end No. 55 05552.