

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number:

0 322 851
A2

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 88121696.4

(51) Int. Cl. 4: **F02M 1/10**

(22) Date of filing: 27.12.88

(30) Priority: 24.12.87 IT 6812887

(43) Date of publication of application:
05.07.89 Bulletin 89/27(84) Designated Contracting States:
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EP 0 322 851 A2 (57) A carburetor substantially comprising rotary cam means (10) for controlling simultaneous displacement, according to predetermined laws, of the mixture supply throttle (5) and air supply throttle (6), from a first position, wherein the engine is cold started, to a second position wherein the engine is at normal running temperature; which cam means (10) are set manually to the first position, and to the second position by means of an actuator (42) comprising a wax capsule.

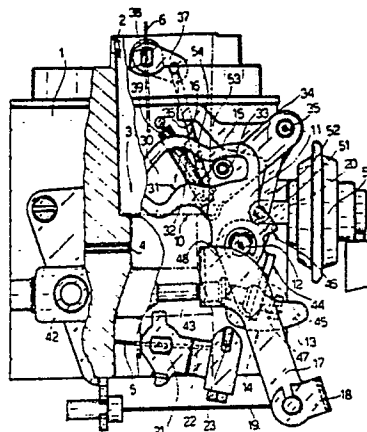


Fig.1

CARBURETOR FOR AN INTERNAL COMBUSTION ENGINE

The present invention relates to a carburetor for an internal combustion engine, featuring a simplified control procedure for ensuring efficient operation and resetting of the carburetor at cold and normal engine temperatures respectively.

The carburetor of an internal combustion engine is known to substantially comprise a choke tube supplied with fuel by a spray nozzle; a first throttle downstream from the choke tube, for regulating mixture supply to the engine; and a second throttle upstream from the choke tube for regulating the air supply.

When the engine is cold started, the second throttle must be closed, and the first opened just enough to supply the amount of mixture required for cold starting the engine. When the engine reaches normal running temperature, on the other hand, the second air supply throttle must be set wide open, whereas the opening on the first must be reduced from the cold starting to the idling speed position. Switching from the first to the second position must be made gradually, to prevent a sharp change in engine speed, and possible stalling of the engine.

The second throttle is connected, via an appropriate transmission, to a hand control knob by which it is set, by the driver, to the closed position, when cold starting the engine, and subsequently to the fully open position when the engine reaches normal running temperature.

Carburetors of the aforementioned type therefore demand a good deal of attention on the part of the driver, for ensuring gradual opening of the second throttle once the engine has been started.

Some carburetors provide for closing and gradually opening the second air supply throttle automatically, but these are invariably highly complex, require frequent revision, and are unreliable.

The aim of the present invention is to provide a carburetor for an internal combustion engine, designed to overcome the drawbacks typically associated with known carburetors of the aforementioned type.

With this aim in view, according to the present invention, there is provided a carburetor for an internal combustion engine, substantially comprising a choke tube supplied with fuel by a spray nozzle; a first throttle downstream from said choke tube, for regulating mixture supply to the engine; and a second throttle upstream from said choke tube, for regulating air supply to the same; characterised by the fact that it comprises:

rotary cam means designed to control, subsequent to rotation, simultaneous displacement, according

to predetermined laws, of said first and second throttles, from a first position, wherein the engine is cold started, to a second position wherein the engine is at normal running temperature; said cam means being set manually to said first position; at least a first actuator designed to move into a first position when the engine is cold started, and a second position when the engine is at normal running temperature;

so that, when said first actuator switches from said first to said second position, and said cam means are set manually to said first position, said cam means are switched from said first to said second position; whereas, when said actuator switches from said second to said first position, said cam means remain in said second position.

The invention will be described by way of example with reference to the accompanying drawings, in which :

Fig.s 1 and 3 to 5 show side views of the carburetor according to the present invention, in various operating positions;

Fig.2 shows a further side view of the Fig.1 carburetor.

The carburetor according to the present invention substantially comprises a body 1 in which is formed a vertical duct 2 housing a choke tube 3 supplied with fuel in known manner by a spray nozzle 4; a first throttle 5 downstream from said choke tube, and designed to regulate mixture supply to the engine; and a second throttle 6 upstream from said choke tube, and designed to regulate air supply to the same via duct 2.

The carburetor according to the present invention also comprises rotary cam means indicated as a whole by 10 and designed to control simultaneous displacement of throttles 5 and 6 according to predetermined laws and as described hereinafter.

Said means substantially comprise a lever 11 pivoting on a horizontal pin 12 secured to body 1. Said lever 11 presents a first arm 13 on which is formed a first cam 14 controlling said first throttle 5; and a second arm 15 on which is formed a second cam 16 controlling said second throttle 6. Said lever 11 also comprises a third arm 17 (overlapping arm 13 in Fig.1) the end 18 of which is connected mechanically to a manual control element, e.g. lead 19, whereby cam means 10 are set manually, as described hereinafter, into a first position (Fig.3) by turning lever 11 clockwise commencing from the Fig.1 position.

Lead 19 is connected to a knob (not shown) conveniently located on the vehicle dashboard.

Lever 11 is normally maintained in the Fig. 1 position by a spring 48 (Fig. 2) coaxial with pin 12 on which lever 11 pivots.

Throttle 5 is integral with a shaft 21 fitted with a lever 22, the end of which presents a cam follower 23 resting on the curved active profile (Fig.1) of cam 14. Cam follower 23 conveniently presents an adjuster 24 (Fig.2).

The active profile of second cam 16 is formed by the edge of an enclosed opening 30 formed on arm 15. Cam means 10 also comprise a cylindrical cam follower 33 integral with a lever 34 pivoting on a pin 35 and the free end of which acts on one end of a connecting rod 36, the other end of which is hinged to a crank 37 integral with shaft 38 of throttle 6.

As shown clearly in Fig.1, the distance between profile portions 31 and 32 of cam 16 is greater than the diameter of cylindrical cam follower 33.

A helical spring 39 is connected to the free end of lever 34 for securing this in the clockwise-rotated position shown in Fig.1. A first actuator 42 (Fig. 3) for controlling cam means 10 substantially comprises a body housing a wax capsule which, as it increases in temperature, provides for axial displacement of a rod 43. Between rod 43 and lever 11 of cam means 10, there is inserted a lever 44 also pivoting on pin 12 and substantially comprising a tab 45 resting on a shoulder 46 of lever 11 for turning this anticlockwise. Tab 45 presents a threaded hole housing a screw 47, the end of which rests on the end of rod 43. Screw 47 is held permanently against the end of rod 43 by a spring 20 coaxial with pin 12 and designed to turn lever 44 clockwise.

The carburetor according to the present invention also comprises a second actuator 50 controlled by the vacuum inside the intake manifold on the engine, and substantially comprising a rod 51 to which is hinged a first arm 52 of a lever pivoting on pin 35. A second arm 53, substantially perpendicular to arm 52, rests on a bent portion 54 of connecting rod 36, as shown clearly in Fig.2. When actuator 50 is subjected, via an appropriate duct, to the vacuum inside the intake manifold on the engine, rod 51 turns arms 52 and 53 anticlockwise, so as to lower connecting rod 36.

The carburetor according to the present invention operates as follows.

When cold starting the engine, the components on the carburetor are arranged as shown in Fig.1, wherein rod 43 of actuator 42 is in the rightmost position, with screw 47 of lever 44 resting on the end, and lever 44 held in position by spring 20.

Before starting the engine, the driver operates the knob connected to lead 19, so as to turn lever 11 clockwise from the Fig.1 to the Fig.3 position,

wherein shoulder 46 of lever 11 contacts a respective shoulder on tab 45 of lever 44. Said so-called arming position of lever 11 is maintained by the friction on the transmission between the lead and control knob.

In the Fig.3 configuration, cam follower 33 is detached from active profile portion 32 of cam 16; lever 34 is turned into the fully clockwise position, wherein air supply throttle 6 is closed; and the active profile of cam 14 contacts cam follower 23 of lever 22. The active profile of cam 14 is so selected, and cam follower 23 so regulated, as to correspond, in the Fig.3 configuration, to a predetermined opening on throttle 5, enabling a fairly high engine speed as required for cold starting. Once the engine is started, actuator 50 is operated so as to turn arms 52 and 53 anticlockwise. On contacting bent portion 54 of connecting rod 36, arm 53 moves connecting rod 36 down, so as to open throttle 6 by a predetermined amount. Fig.4 shows the component configuration immediately following cold starting of the engine, wherein cam follower 33 contacts profile portion 31 of cam 16.

When the engine is started, a rich mixture is obviously produced by virtue of throttle 6 being closed (Fig.3); said throttle 6 subsequently being opened partially (Fig.4) to avoid flooding the engine.

As the engine temperature rises, rod 43 of actuator 42 moves gradually over to the right, so as to turn lever 44 which also turns lever 11. Initial rotation provides solely, by means of cam 14, for gradually closing throttle 5, the setting of air throttle 6 remaining unchanged. In fact, initial subsequent rotation of lever 11 from the Fig.4 to the Fig.5 position causes cam follower 33 to move from profile portion 31 on to upper profile portion 32.

As the temperature of the engine continues rising, and rod 43 moves further over to the right, lever 11 is turned further, thus causing upper profile portion 32 to act on cam follower 33, and so turn lever 34 clockwise for increasing the opening on air throttle 6, as shown in Fig.6.

Once the engine reaches normal running temperature, rod 43 is in the rightmost position shown in Fig.7, corresponding to a full turn of lever 11; and the combined action of upper profile 32 of cam 16 and cam follower 33 has further turned lever 34 so as to fully open air throttle 6.

Over the final stroke portion of rod 43 (Fig.7), the profile of cam 14 is conveniently detached from cam follower 23 of lever 22, so as to leave the opening of throttle 5 unchanged.

This marks the end of the cold start-up stage, in that air throttle 6 is fully open, and mixture throttle 5 set to minimum.

When the engine is turned off and cools down, rod 43 of actuator 42 moves back to the Fig.1

position by virtue of spring 20 turning lever 44 clockwise. The other parts on the device also return to the Fig.1 configuration.

The carburetor according to the present invention therefore provides for cold starting the engine by simply exerting pull on lead 19 for arming the cold starting components on the device, after which, the rest is performed fully automatically, with no assistance from the driver. This obviously provides for overcoming a major drawback typically associated with known types of carburetors on which gradual opening of the air throttle must be performed manually as the engine heats up. Notwithstanding the above advantage, the carburetor according to the present invention is highly reliable and of extremely straightforward, low-cost design.

Moreover, it also safeguards against mishandling, in particular, closure of the air throttle while the engine is still hot. This is achieved by means of rod 43 on actuator 42, which prevents any clockwise rotation of lever 11, regardless of the pull exerted on lead 19.

To those skilled in the art it will be clear that changes may be made to the carburetor as described and illustrated herein without, however, departing from the scope of the present invention. In particular, actuator 42 comprising a wax capsule may be replaced by any other type of actuator capable of controlling axial displacement of rod 43 as the temperature of the engine increases. Also, the profiles of cams 14 and 16 controlling throttles 5 and 6 may be of any shape other than that described by way of example herein.

Claims

1) - A carburetor for an internal combustion engine, substantially comprising a choke tube (3) supplied with fuel by a spray nozzle (4); a first throttle (5) downstream from said choke tube, for regulating mixture supply to the engine; and a second throttle (6) upstream from said choke tube, for regulating air supply to the same; characterised by the fact that it comprises:

rotary cam means (10) designed to control, subsequent to rotation, simultaneous displacement, according to predetermined laws, of said first (5) and second (6) throttles, from a first position, wherein the engine is cold started, to a second position wherein the engine is at normal running temperature; said cam means (10) being set manually to said first position;

at least a first actuator (42) designed to move into a first position when the engine is cold started, and a second position when the engine is at normal running temperature;

so that, when said first actuator (42) switches from

said first to said second position, and said cam means (10) are set manually to said first position, said cam means (10) are switched from said first to said second position; whereas, when said actuator (42) switches from said second to said first position, said cam means (10) remain in said second position.

2) - A carburetor as claimed in Claim 1, characterised by the fact that said first actuator (42) comprises an axially-sliding rod (43) controlled by a wax capsule.

3) - A carburetor as claimed in Claim 1 or 2, characterised by the fact that it comprises a second actuator (50) controlled by the vacuum inside the intake manifold on the engine, and connected to said second throttle (6) via a first mechanical transmission (52, 53, 16, 37) in such a manner as to open said throttle (6) by a predetermined amount, to avoid flooding when the engine is started.

4) - A carburetor as claimed in one of the foregoing Claims, characterised by the fact that said rotary cam means (10) comprise a first lever (11) pivoting on a pin (12) on said carburetor body (1), and having a first arm (13) on which is formed a first cam (14) for controlling said first throttle (5), a second arm (15) on which is formed a second cam (16) controlling said second throttle (6), and a third arm (17) the end of which is connected mechanically to a manual control element (19) whereby said cam means (10) are set to said first position; said first rotary lever (11) being subjected to the force exerted by a first spring (48) designed to maintain said cam means (10) in said second position.

5) - A carburetor as claimed in one of the foregoing Claims from 2 to 4, characterised by the fact that said cam means (10) also comprise a second lever (44) pivoting on said pin (12) and having a screw (47) resting on the end of said rod (43) of said first actuator (42), and a tab (45) resting on a respective shoulder (46) of said first lever (11); said screw (47) on said second lever (44) being thrust against the end of said rod (43) on said first actuator (42) by virtue of a second spring (20).

6) - A carburetor as claimed in Claim 5, characterised by the fact that the position of said screw (47) is adjustable in relation to said second lever (44).

7) - A carburetor as claimed in one of the foregoing Claims from 4 to 6, characterised by the fact that said first (11) and said second (44) levers are coaxial with said pin (12).

8) - A carburetor as claimed in one of the foregoing Claims from 4 to 7, characterised by the fact that the profile of said second cam (16) is formed by the edge of an enclosed opening

formed on said second arm (15) of said first lever (11); said active profile cooperating with a cylindrical cam follower (33) integral with a third rocking lever (34) connected to said second throttle (6) via a second mechanical transmission (36, 37).

9) - A carburetor as claimed in Claim 8, characterised by the fact that said second transmission (36, 37) comprises a connecting rod (36) hinged to one end of said third lever (34), and a crank (37) integral with the shaft of said second throttle (6) and hinged to said connecting rod (36).

10) - A carburetor as claimed in one of the foregoing Claims from 3 to 9, characterised by the fact that said first transmission (52, 53, 16, 37) mechanically connecting said second actuator (50) to said second throttle (6) comprises a fourth rocking lever having a first arm (52) connected to said second actuator (50), and a second arm (53) resting on said connecting rod (36) of said second transmission (36, 37) for controlling said second throttle (6).

11) - A carburetor as claimed in Claim 10, characterised by the fact that said third lever (34) is subjected to the force exerted by a third spring (39) designed to normally maintain said third lever (34) in a position corresponding to closure of said second throttle (6); said connecting rod (36) of said second transmission having a bent portion (54) supporting said second arm (53) of said fourth rocking lever.

12) - A carburetor as claimed in one of the foregoing Claims from 3 to 11, characterised by the fact that said active profile of said second cam (16) comprises at least two curved, opposed profile portions (31, 32), the distance between which is greater than the diameter of said cam follower (33); a first (31) of said profile portions supporting said cam follower (33) subsequent to activation of said second actuator (50), when said second throttle (6) is opened by said predetermined amount to prevent flooding; and a second (32) of said profile portions supporting said cam follower (33) for controlling subsequent opening of said second throttle (6).

13) - A carburetor as claimed in Claim 12, characterised by the fact that the distance between said two profile portions (31, 32) is sufficient to enable predetermined rotation of said first lever (11), during which, said third lever (34) is not rotated, and said cam follower (33) is detached from said first profile portion (31) on to said second profile portion (32).

14) - A carburetor as claimed in one of the foregoing Claims from 4 to 13, characterised by the fact that said first cam (14) is designed to contact a cam follower (23) on a fifth lever (22) integral with the shaft (21) of said first throttle (5).

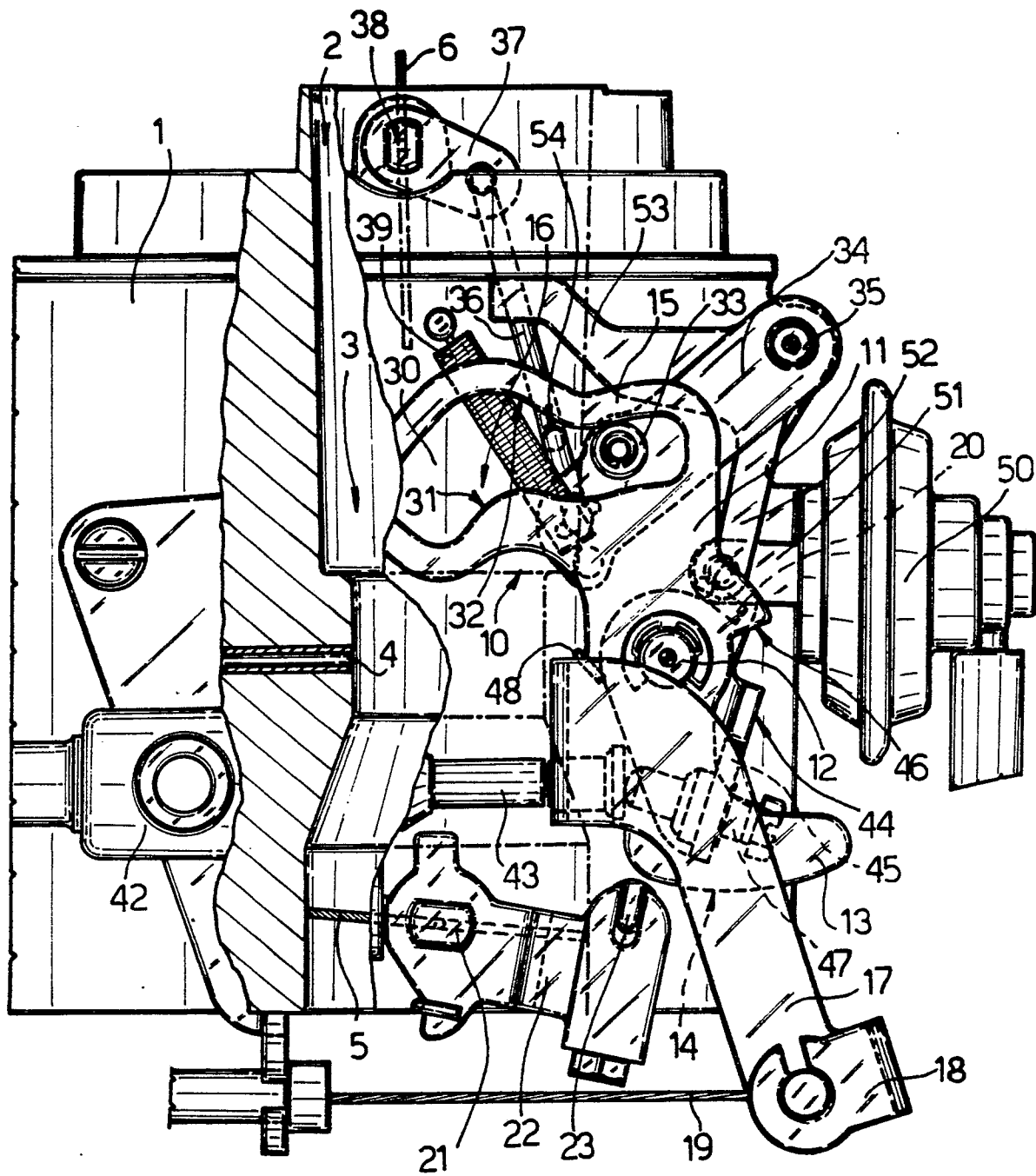
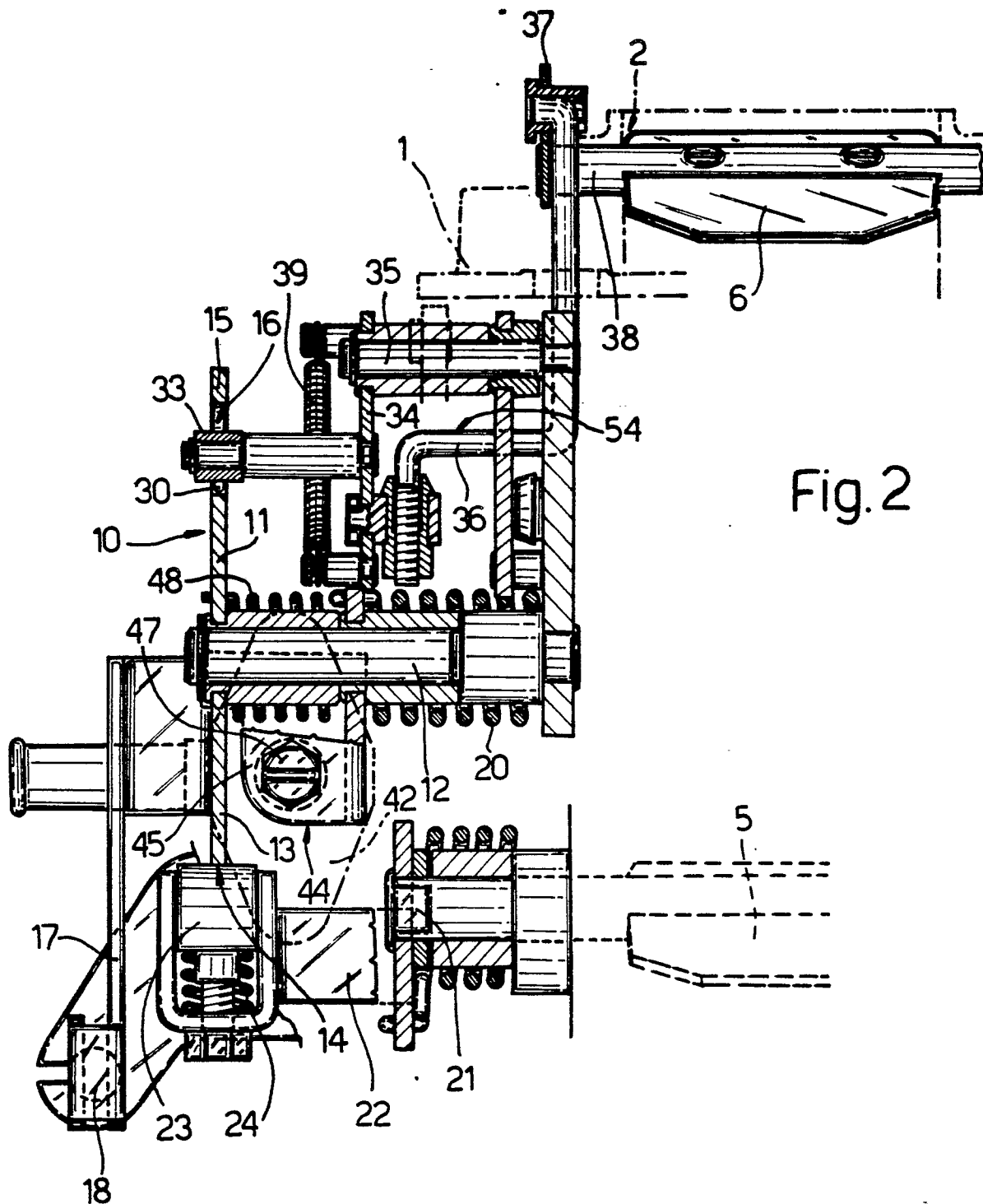


Fig.1



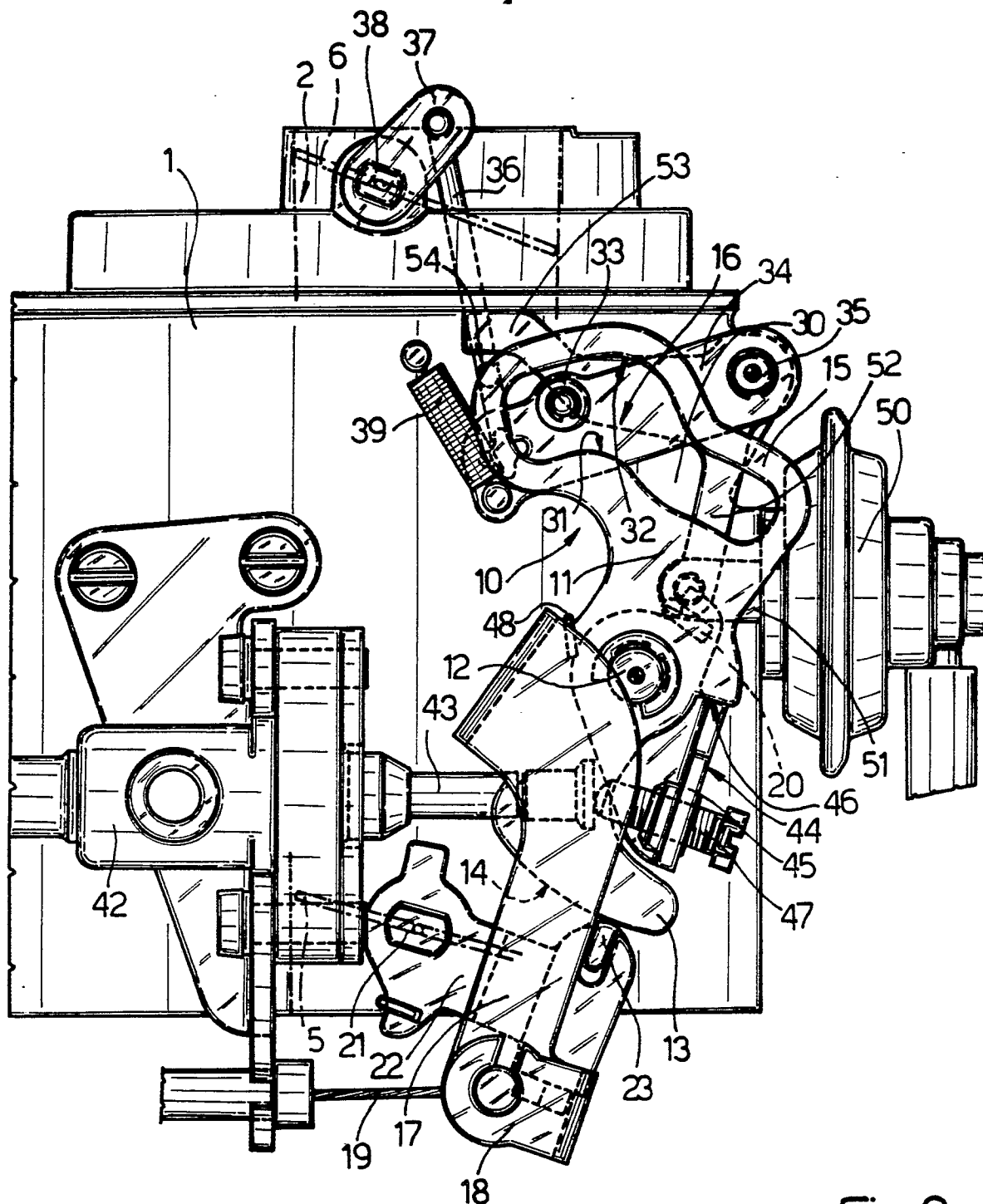


Fig.3

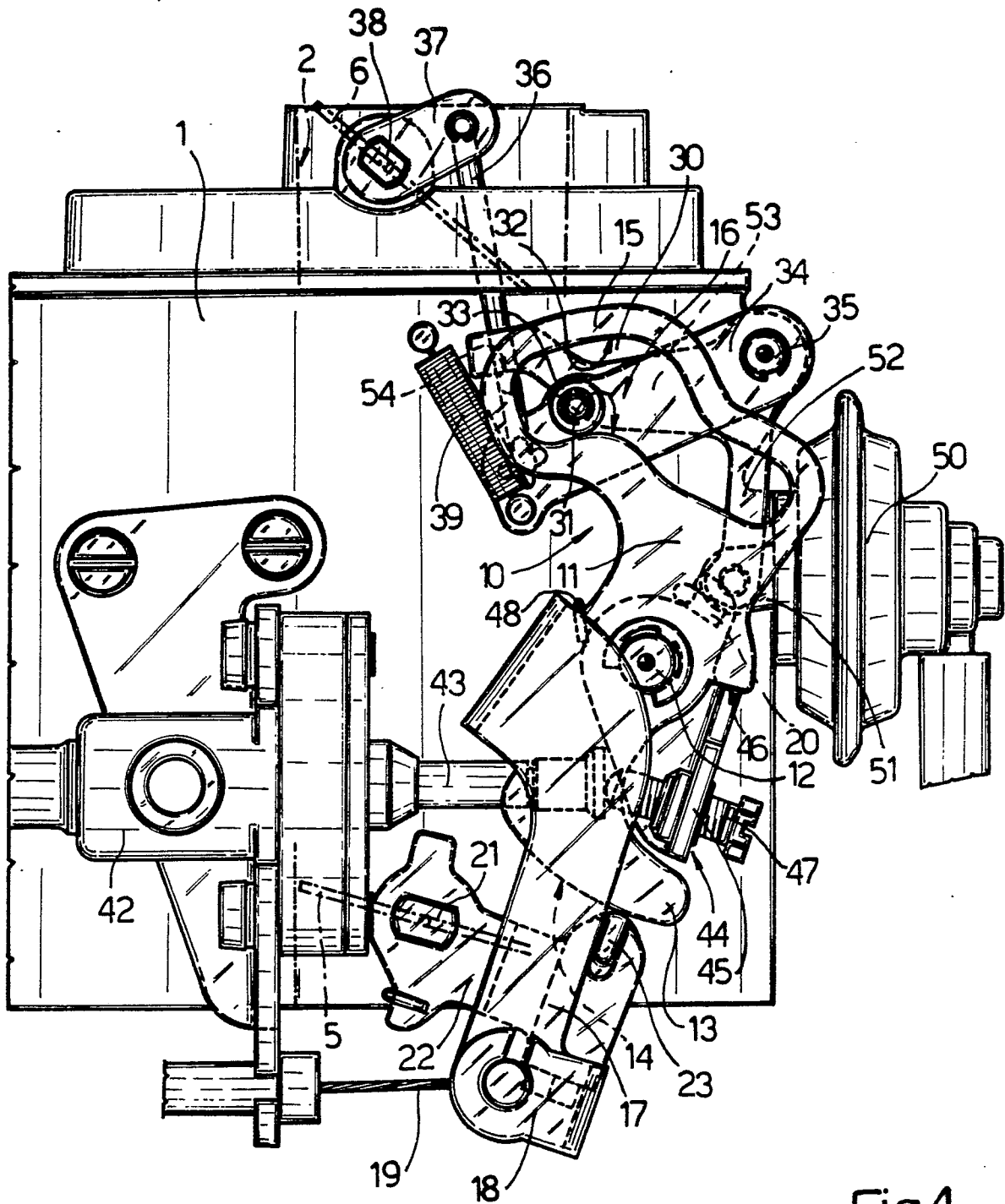


Fig.4

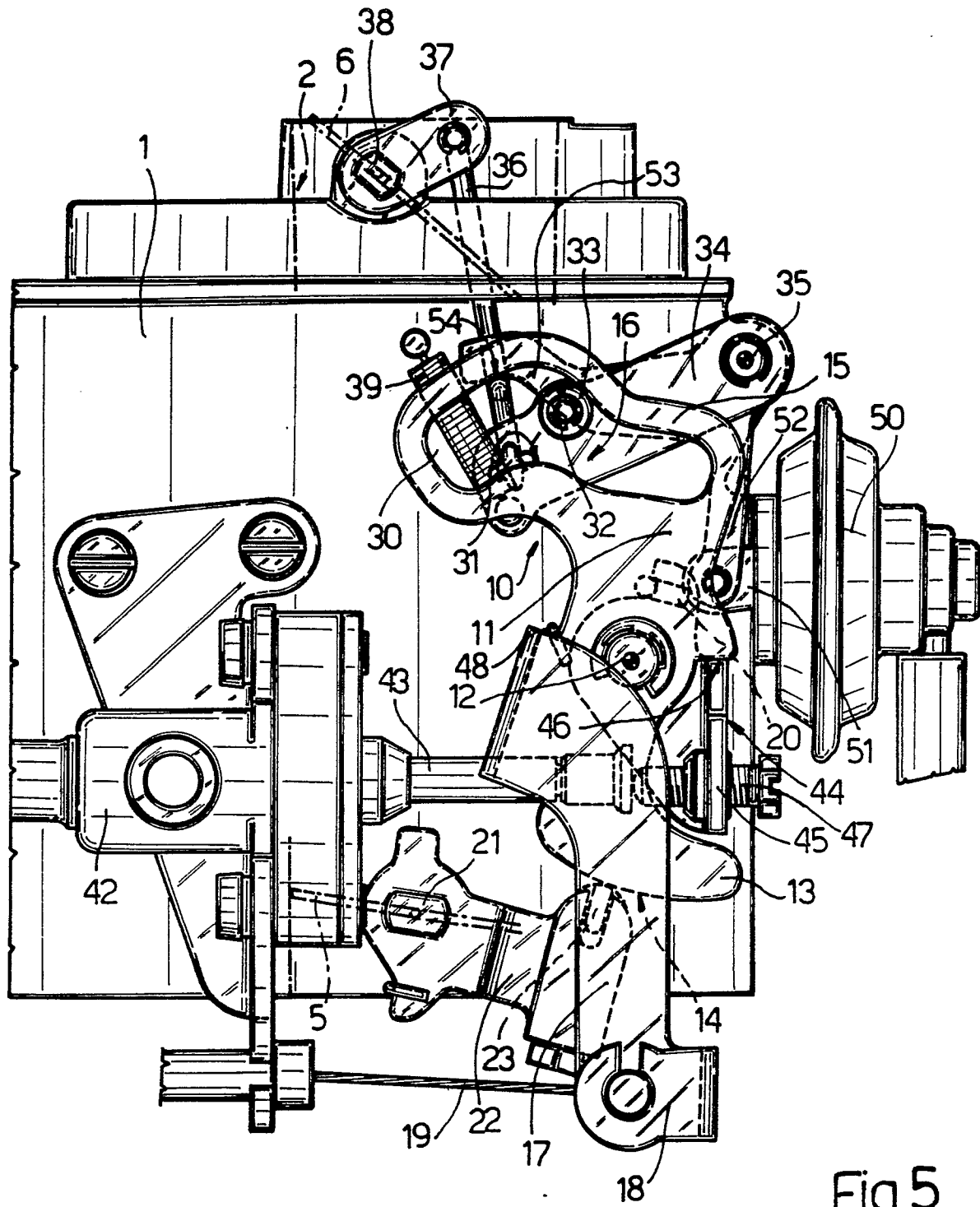


Fig.5

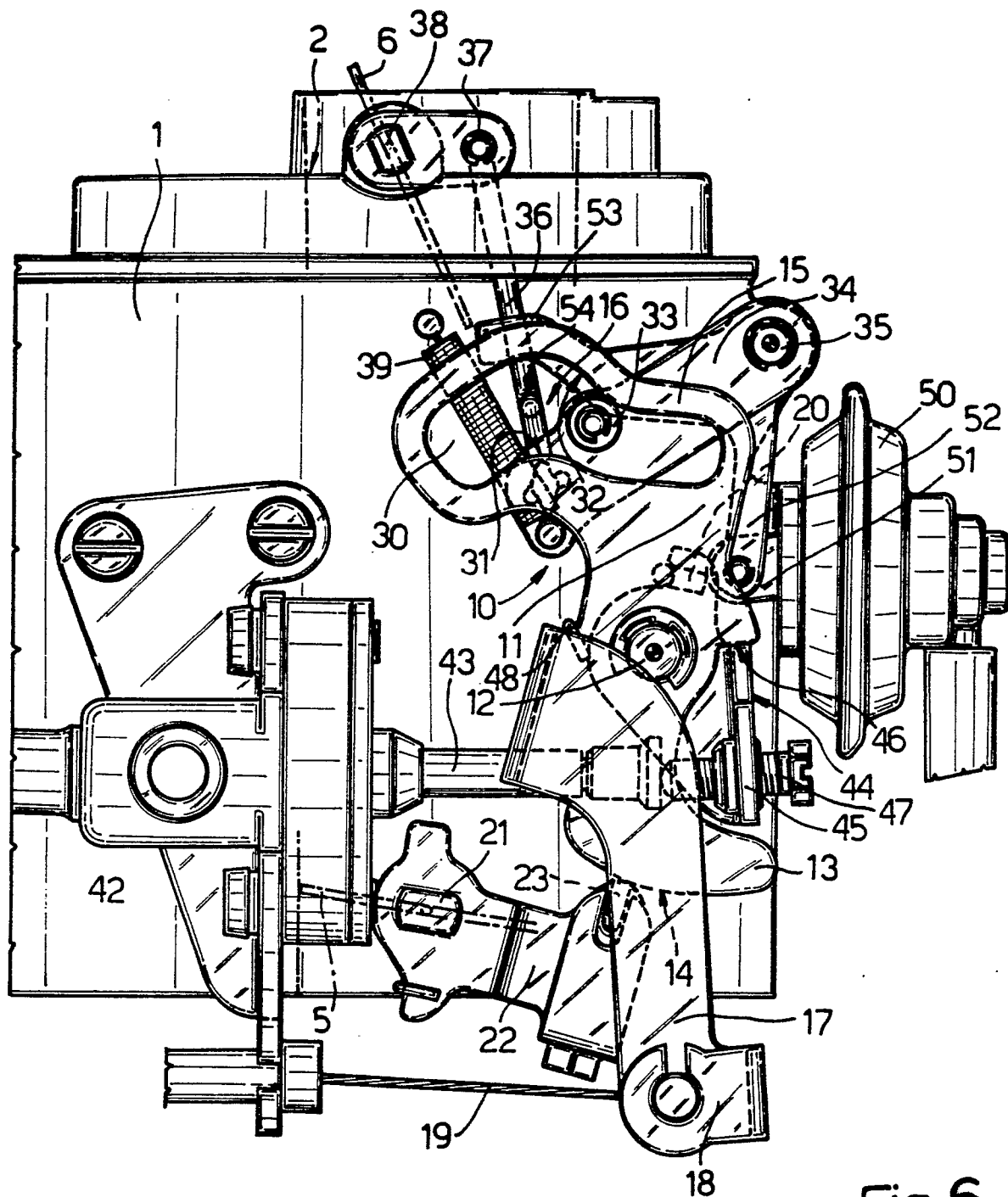


Fig. 6

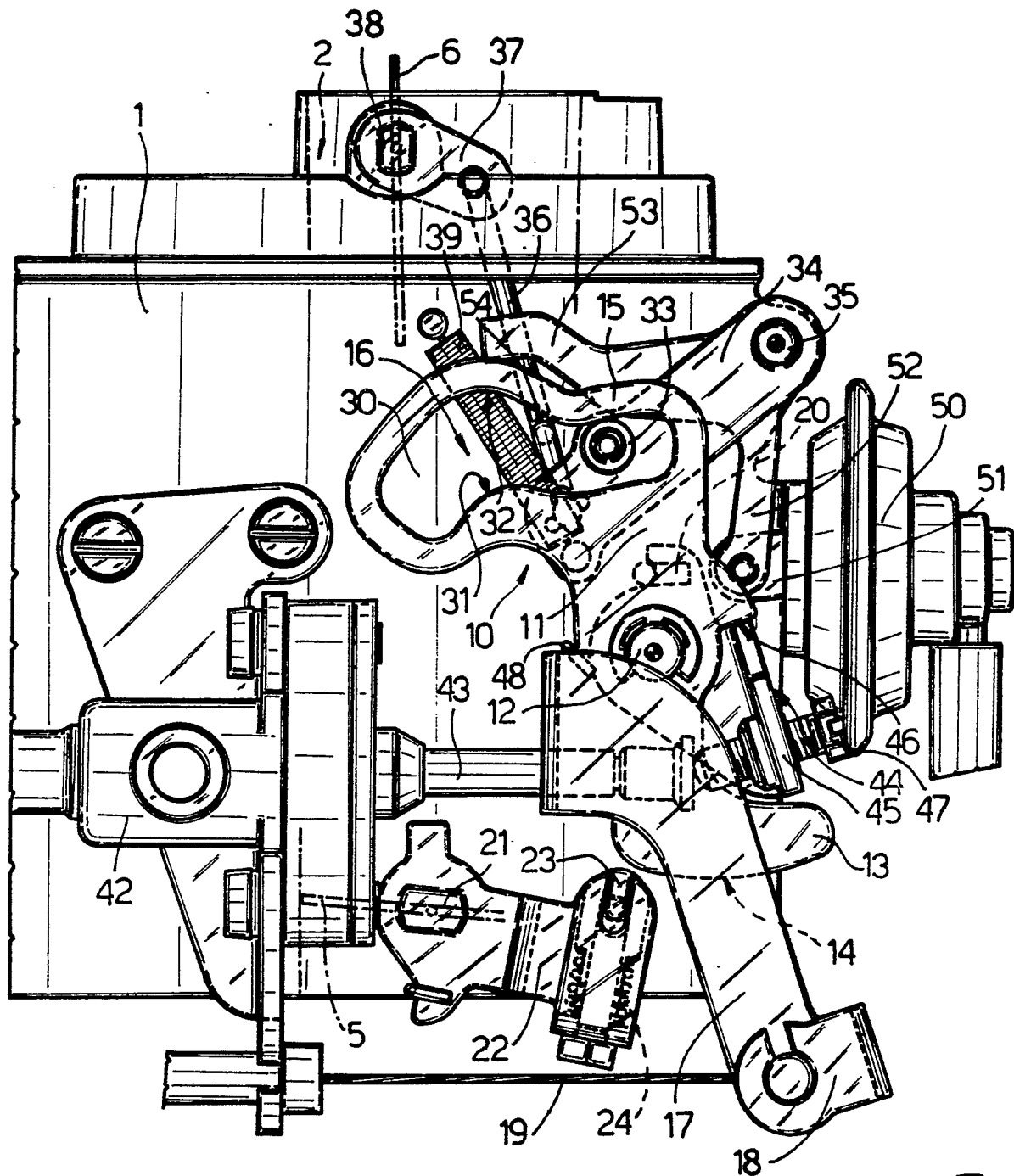


Fig. 7