May 12, 1942. M. J. KITTLER ET AL 2,283,006

POWER CONTROL

Filed Aug. 17, 1938

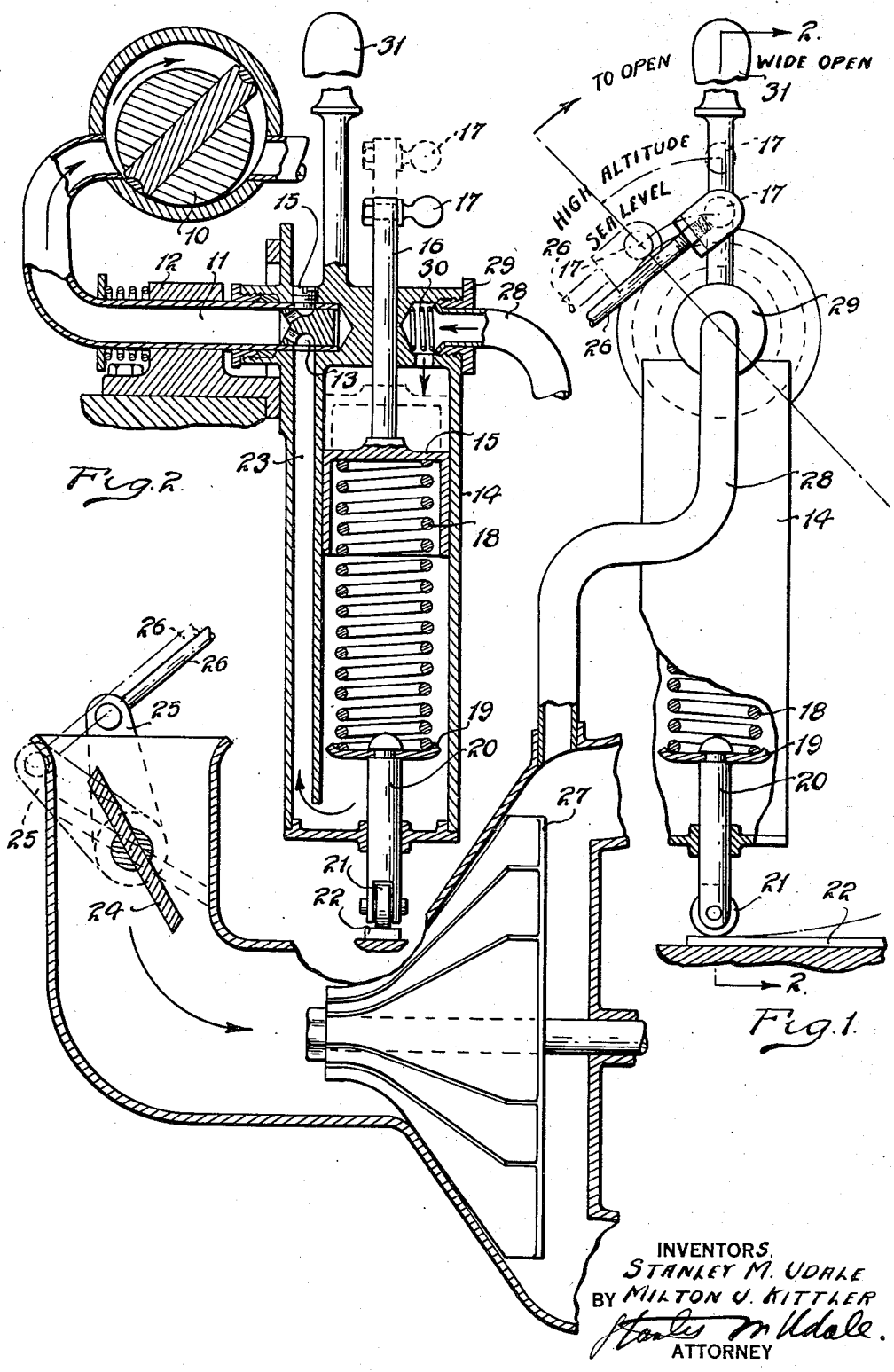


Fig. 2.

Fig. 1.

INVENTORS.
STANLEY M. UDALE
BY MILTON J. KITTLER
Stanley M. Udale.
ATTORNEY

Patented May 12, 1942

2,283,006

UNITED STATES PATENT OFFICE

2,283,006

POWER CONTROL

Milton J. Kittler and Stanley M. Udale, Detroit, Mich., assignors to George M. Holley and Earl Holley

Application August 17, 1938, Serial No. 225,392

4 Claims. (Cl. 123—103)

The object of this invention is to maintain the power of a supercharger engine substantially constant as the altitude increases.

In the drawing:

Figure 1 shows the preferred form of our invention.

Figure 2 shows a cross sectional elevation on plane 2—2 of Figure 1.

In the figures, 10 is a well known type of vacuum pump. The vacuum connection leads to a stationary tube 11 which is mounted on a support 12. This stationary tube 11 has a solid end in which there is a groove 13, this groove 13 serving to locate an oscillating cylinder 14 by means of a set screw 15. The tube 11 thus acts as a pivot for supporting the oscillating cylinder 14.

Inside the oscillating cylinder 14 is a sliding piston 15 connected to a piston rod 16 which carries the throttle ball-connection 17. The piston 15 is supported by a spring 18 which is supported by a spring holder 19 which rides on a rod 20 which carries a roller 21 which engages with a cam surface 22. The vacuum from the vacuum pump 10 is admitted to the under side of the piston 15 through a passage 23.

The carburetor as such is not shown. It is merely indicated by the throttle valve 24 which is operated by a lever 25 connected by a link 26 with the ball-connection 17. The throttle valve 24 admits mixture to the supercharger 27 which supplies compressed charge through the pipe 28 to the upper side of the piston 15. The pipe 28 twists in the oscillating cylinder 14 and is held in place by a bushing 29 and by a spring 30.

The hand control lever 31 is integral with the oscillating cylinder 14 and is so arranged that as the oscillating lever 31 moves 45° to the left in Figure 1, the path of the ball end 17 is at right angles to the link 26, so that when the throttle lever 31 is in the idle position it does not make any difference what the atmospheric pressure is or what the pressure in the supercharger is, as the valve 24 will be in the closed position in any case.

It is only when the throttle lever 31 is moved over to the right that the variations of pressure in the supercharger are effective to close the throttle or to permit the throttle to open as the altitude decreases or increases.

Operation

Assume that the plane is taking off at an airport within a few thousand feet of sea level. When the throttle 24 is opened wide, the supercharger 27 will create a pressure in the engine cylinders which will be beyond the strength of the engine. In order to protect the engine from the excessive power which is produced under the abnormal circumstances of flying close to the earth, it is necessary to reduce this power so that when the plane reaches the normal altitude, two or three miles in the air, the engine can then develop its maximum power.

The vacuum pump 10 creates a vacuum which acts on the under side of the piston 15 and compresses the spring 18. On the top of the piston 15 the pressure is applied through the pipe 28 corresponding to the pressure created by the supercharger 27. The ball joint 17 is moved towards the center around which the throttle lever 31 rotates. Hence the effective stroke of the throttle lever is reduced. If the throttle lever is in the idling position, approximately 45°, the motion of the ball joint 17 away from and towards the center of rotation does not influence the idling position of the throttle 24. However, as the throttle lever 31 is moved to the wide open position, the corresponding position of the throttle 24 is determined by the pressure of the supercharger.

The characteristic of all compression springs is that as they are compressed, their resistance increases arithmetically with the degree of compression. Hence, when flying under normal conditions, two or three miles in the air, the ball joint 17 rises and the spring 18 expands and a lower pressure is needed to balance the spring pressure against the supercharger pressure. Therefore, as the plane ascends to normal altitudes, the supercharger pressure decreases. This decrease in the supercharger pressure is necessary because if the spring 18 were replaced by a weight and pulley so that the same supercharger pressure is maintained at normal altitudes as at sea level, there would be a large increase of power at altitude due to the fact that the back pressure would diminish and therefore, there would be a greater filling of the cylinder, a greater quantity of mixture would enter the engine, and therefore, a greater amount of power would be developed at normal altitudes than at sea level.

Obviously it is desirable that an engine develop the same power at sea level as at normal altitudes, and if there is any deviation it should be such that maximum power is developed at sea level for obvious reasons. In other words, the desirable engine specification calls for either constant power or one or two percent loss of

power at normal altitudes. The characteristic of the spring 18, therefore, corrects for the fall in back pressure at altitude, and it is therefore possible for the engine manufacturer to comply with the specification supplied by the plane manufacturer.

When the throttle lever is set at half open, it is desirable that the compression of the spring 18 be reduced so that the engine automatically maintains a lower supercharger pressure than it maintains at wide open throttle. The roller 21 (Fig. 1) follows the cam 22. Hence the spring abutment 19 descends in the cylinder 14 when the throttle lever is rotated counter-clockwise, and reduces the pressure on the spring 18 and therefore, the device maintains a lower pressure when the throttle lever is in half open position than when in wide open position.

What we claim is:

1. In a manually operated throttle control for a supercharger airplane engine, means for obtaining a continuous vacuum, an oscillating cylinder, a piston therein, means for applying the vacuum to the underside of the piston, means for applying the supercharger pressure to the upper side of the piston, a piston rod connected to said piston, a throttle connection located on said piston rod, a compression spring engaging with said piston so as to balance the absolute pressure of said supercharger pressure, means for oscillating said cylinder, said cylinder being so mounted that when the throttle is in the closed position, the movement of the piston in response to supercharger pressure does not move the throttle, and when the oscillating cylinder is moved into the position to open the throttle, the degree of opening the throttle is determined by the absolute pressure in the supercharger so that any excess of supercharger pressure causes the throttle to close slightly.

2. In a device as set forth in claim 1 in which means are provided for increasing the compression of the spring as the throttle lever is moved from the closed position into the open position.

3. In combination with a manually operated throttle control for a supercharged engine, control means comprising a manually operated member, a link having an adjustable connection therefor, a piston connected to both the manually operated member and to the link, a spring adapted to move the piston so as to completely open the throttle when the manually operated member is in its wide open position, means directly responsive to the absolute pressure developed by the supercharger acting on the piston to increase the strain on the spring so that at sea level the supercharger pressure is higher when the piston is in equilibrium and the throttle is partly closed, than at altitude when the throttle is wide open and the piston is in equilibrium at a lower supercharged pressure with a partially released spring, the means for positioning the piston being a spring which opposes the action of the pressure in the supercharger, and means whereby the strength of this opposition increases as the manually operated throttle control is moved from the idle position into the open throttle position.

4. In a supercharged airplane engine a vacuum pump, a manually operated throttle control lever having a variable length, piston and cylinder means incorporated in said throttle control lever, a passage connecting one end of the cylinder with the vacuum pump, a passage connecting the other end of the cylinder with the supercharged pressure, spring means for balancing the piston, said spring means being adapted to balance the piston when the throttle is partly closed at a higher supercharged pressure when at sea level than at altitude when the throttle is wide open and the strain on the spring is partially released.

MILTON J. KITTLER.
STANLEY M. UDALE.