

March 19, 1940.

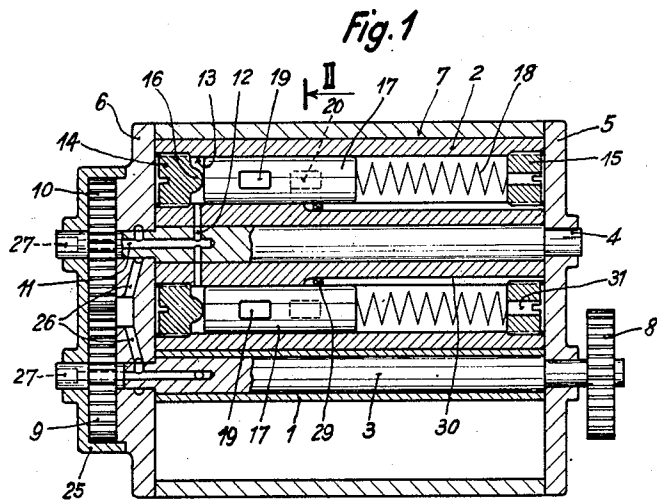
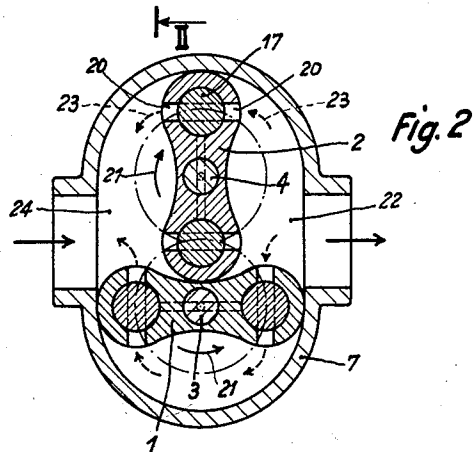
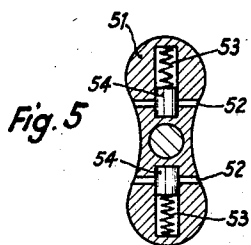
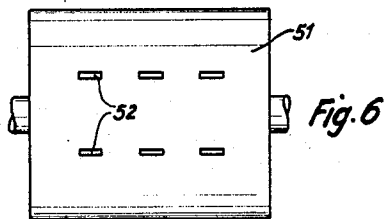
H. HEINRICH ET AL

2,194,196

CHARGING BLOWER FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 23, 1937

2 Sheets-Sheet 1



Inventors
 Hans Heinrich
 Werner Jensch
 Alfred Meyer
 by Roy F. Stinson
 their attorneys

March 19, 1940.

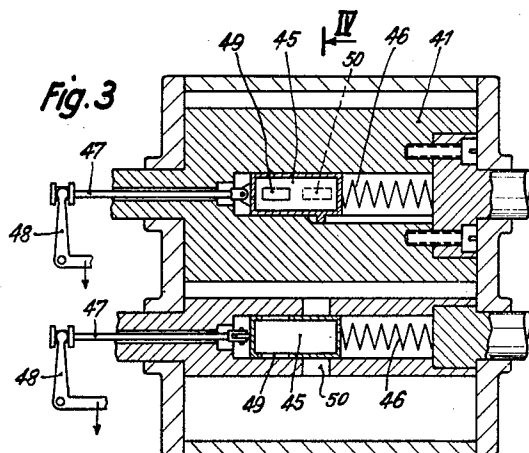
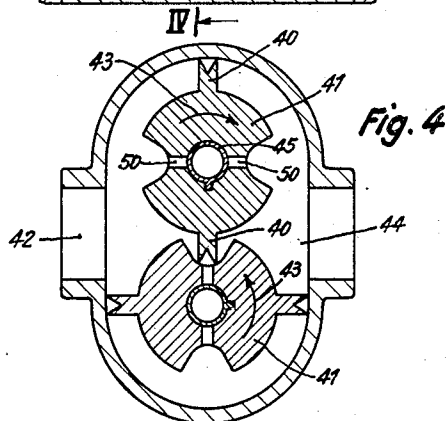
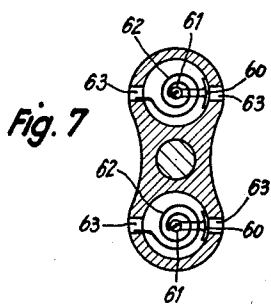
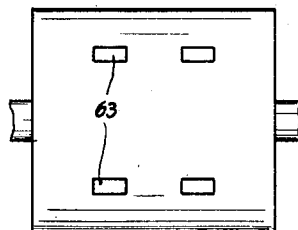
H. HEINRICH ET AL.

2,194,196

CHARGING BLOWER FOR INTERNAL COMBUSTION ENGINES

Filed Dec. 23, 1937

2 Sheets-Sheet 2



Inventors
Hans Heinrich
Werner Zuech
Alfred Meyer
by Roy F. Steward
their attorney

UNITED STATES PATENT OFFICE

2,194,196

CHARGING BLOWER FOR INTERNAL COMBUSTION ENGINES

Hans Heinrich, Werner Zeuch, and Alfred Meyer,
Stuttgart, Germany, assignors to Robert Bosch
Gesellschaft mit beschränkter Haftung, Stuttgart,
Germany

Application December 23, 1937, Serial No. 181,410
In Germany December 31, 1936

10 Claims. (Cl. 230—141)

The present invention relates to charging blowers for internal combustion engines, in which a variable proportion of the medium sucked in by the charging blower, is fed to the internal combustion engine, in dependence upon the speed of the engine, the remainder being branched off before it reaches the internal combustion engine.

It is known to regulate a blower delivering a fuel-air mixture, by a centrifugal governor driven by the internal combustion engine, in such a manner that at high speed the entire compressed mixture is conducted to the internal combustion engine, whilst at low speeds a part of the compressed mixture flows back from the pressure side of the blower to the suction side through a bye-pass pipe opened by the centrifugal governor.

In contrast to this, according to the present invention, the blower has a high output at low speeds of the internal combustion engine, so that, at these low speeds, high performances may be obtained. In the case of such a blower, however, the output would, at high engine speeds rise to an inadmissible degree. The purpose of the invention is to obviate this drawback and to limit the output of the blower at high speeds to an extent which is beneficial for the operation of the internal combustion engine. According to the invention, this problem is solved in a simple manner by the provision of a control member within the blower, dependent on the engine speed and adapted to enlarge the passage areas connecting the suction chambers and the pressure chambers with increasing engine speeds. For this purpose, by means of this control member, the cross-sectional areas of passage apertures arranged in the piston itself are enlarged on increasing engine speed, and by means of these apertures a part of the medium sucked in can flow from the commencement of the compression stroke from the pressure chamber into the suction chamber of the blower corresponding to the free cross sectional area of the apertures. As the result of this arrangement only so much of the medium sucked in as is intended to flow to the internal combustion engine at the moment need be brought to the full compression pressure. Accordingly, the new blower has a smaller duty than if the entire amount sucked in by the blower had to be compressed to the full pressure. In addition to this substantial advantage, the novel construction embodying this invention is particularly distinguished further by its simplicity and its reliability.

Several examples of construction of the inven-

tion are shown in the accompanying drawings with reference to which the invention is more particularly described, and in which—

Figure 1 is a longitudinal section through a rotary piston or gear type of blower.

Figure 2 is a section on the line II—II of Fig. 1.

Figure 3 is a longitudinal section through a modified form of construction of a rotary piston or gear type of blower.

Figure 4 is a section on the line IV—IV of Fig. 3.

Figures 5 and 6 are a cross section and a side elevation respectively of a further modified form of piston construction.

Figures 7 and 8 are a cross section and a side elevation respectively of a still further modified form of piston.

In Figures 1 and 2 is shown a rotary piston or gear type of blower, of which the two pistons or gears 1 and 2 are rigidly connected with their shafts 3 and 4, which are mounted in end walls 5, 6 of a casing 7. The shaft 3 is driven directly or indirectly by a gear wheel 8 from an internal combustion engine (not shown). The drive of the shaft 4 is from the shaft 3 and is effected by a pair of gear wheels 9, 10, one of which is secured on the shaft 3 and the other on the shaft 4.

The left hand end of each of the shafts 3 and 4 has a longitudinal bore 11 and a cross bore 12 in communication therewith. The cross bores 12 are extended through the piston wall and communicate with relatively large longitudinal bores 13 in the rotary pistons 1 and 2, the ends of which are formed by covers 14, 15 screwed into the piston. The cover 14 has a protuberance 16, against which a slide valve 17 fitting into the longitudinal bores 13 bears under the influence of a spring 18. By increasing the fluid or gas pressure in the bores 11 and 12 and in the part of the bores 13 situated to the left of the slide valves 17, the slide valves 17 can be displaced to the right against the action of the springs 18 (Fig. 1).

In each of the slide valves 17, there is disposed, transversely relative to its axis, an opening 19, which, on movement of the valves 17 to the right, is adapted to coincide partly or completely with corresponding openings 20 in each of the rotary pistons 1, 2. In the position shown in Fig. 1, the openings 20 are covered by the right hand portion of the slide valve 17. If the openings 19, 20 more or less coincide on movement of the slide valve 17 to the right, then they more or less open the passage through the rotary

piston for the medium being pumped. In the open position it is possible, on the rotation of the pistons 1, 2, for instance in the direction of the arrow 21, for a medium already compressed into the compression chamber 22 of the casing to return into the suction chamber 24 thereof, in the direction of the arrow 23 through the coinciding openings 19, 20. If the openings 19, 20 are so dimensioned that, on complete coincidence, exactly as much air or fuel-air mixture flows back as is delivered by the rotary pistons, no compression work at all is performed by the blower, but only a small amount of delivery work.

The bore 11 is attached to a governor, which, with an increasing engine speed, increases the fluid pressure in the bores 11, 12, 13. In the example of construction according to Fig. 1, the governor consists of the pair of gear wheels 9, 10 enclosed in a pump casing 25 and this pair of gear wheels 9, 10 is driven by the gear wheel 8 in dependence on the engine speed as has already been mentioned above. The gear wheels 9, 10 are provided with a cover 25. To the gear pump 9, 10, 25, there is applied in known manner, from a reservoir not shown, for instance, oil which, with an increasing engine speed flows in greater quantity and under greater pressure through passages 26 to the bores 11, 12, 13. Since in the example of construction shown according to Fig. 1, the left hand ends of the bores 11 are completely closed or strongly throttled by plugs 27, the slide valve 17 can move, to the degree in which the engine speed rises by a correspondingly larger amount to the right in Figure 1 against the action of the spring 18. Thus, with an increasing engine speed the openings 19, 20 which are controlled by the movement of the slide valve 17, are also automatically opened to an increasing extent. The following is the result:

As soon as the internal combustion engine has a small load, and consequently adjusts itself to an increased speed, a portion of the medium sucked in by the blower is automatically and in dependence on the extent of the increase in speed conducted through the openings 19, 20 back into the suction chamber, instead of the already high engine speed being still further increased in a disadvantageous manner owing to the increased output of the blower which is now running more rapidly. In this matter it is of particular advantage that the medium pushed along the casing walls by the rotary pistons 1, 2 does not need to be brought to the full blower pressure only just before the return, but can escape again through the partially or completely opened openings 19, 20 previous to this to an extent corresponding to the progress of the delivery stroke. Thus no work worth mentioning needs to be performed for delivering and compressing the part of the charging air not flowing to the internal combustion engine.

In carburettor engines, in the event of the blower being arranged between the carburettor and the internal combustion engine and thus serving for delivering the fuel-air mixture, it is appropriate to conduct the returning part of the mixture to the suction side of the blower again. Naturally, however, in cases where the blower has only to deliver air, the openings 19 in the slide valve could be so formed that the portion of the air returning at high speeds escapes into the atmosphere.

In order that the slide valve 17 may not be able to rotate in the bore 13, but only be displaced longitudinally, it is provided with a pin

29, which slides along in a longitudinal groove 30 in the piston. The slide valve 17, can of course, also be constructed as a pipe to diminish the weight or for other reasons, and to improve the sliding it can be guided in a bush of a material particularly suited for this purpose inserted in the piston. The number of the openings 19, 20 in the slide valve and the pistons may likewise be as desired.

For returning the oil or the charging air which might possibly pass between the slide valve 17 and the bore 13 on the side located on the right in Fig. 1 of the slide valve 17, a small passage opening 31 in the closing cover 15 is employed.

In Figs. 3 and 4 is shown another form of construction of the blower. In this, air or a charging mixture is delivered by the rotary pistons 41 having projections 40, from the suction side 42 of the blower, which is revolving in the direction of the arrow 43, to the pressure side 44. In the interior of each piston 41 a slide valve 45 is guided so as to be longitudinally displaceable and this slide valve can be moved to the left in Fig. 3 by a spring 46 and to the right by a rod 47. At the outer end of the rod 47 there engages a crank lever 48, which, on an increased engine speed is rotated in a clockwise direction by a governor not shown, for instance a centrifugal governor. Since there is provided in the slide valve 45 a cross bore 49 and in the piston 41 a cross bore 50, and these cross bores can be caused to coincide with each other on the displacement to the right of the slide valve 45, in this form of construction also an increasing part of the amount of air sucked in will return through the passages 49, 50 with an increasing engine speed in order to avoid overcharging when on a small load.

In Figs. 5 and 6 is shown a further form of construction of a rotary piston 51 for a charging blower. In the piston are disposed openings 52, which can be closed or blocked according to the position of control of slide valves 54 loaded by a spring 53. The weights of the control slide valve 54 and the strength of the springs 53 are in this case so proportioned that the control slide valves 54, on reaching a desired speed of the internal combustion engine and of the piston 51 driven by it, are flung outwards. In this way they free more or less the openings 52 and prevent the overcharging of the internal combustion engine, as soon as this attains a high speed as a result of a small load.

In a corresponding manner to that in which the control slide valves 54 in the example of construction in Figs. 5 and 6 are flung outwards with an increasing speed of the piston 51, in another mode of construction of the rotary piston according to Figs. 7 and 8, parts serving as control slide valves 60, which parts are rotatable about a stud 61 and can be kept in the inoperative position shown by a spring 52, are also flung outwards on an increased speed of the internal combustion engine by centrifugal force, in order automatically to free to a greater extent passage openings 63 for the return of the compressed medium.

We declare that what we claim is:

1. In a charging blower for internal combustion engines, a rotary piston separating the suction and compression chambers and having apertures opening into the working faces of the piston and immediately connecting said chambers, and means located in said rotary piston for automatically increasing the effective size of said apertures as the speed of the engine increases.

2. In a charging blower for internal combustion engines, a rotary piston separating the suction and compression chambers and having apertures opening into the working faces of the piston and immediately connecting said chambers, a control member located in said piston for automatically increasing the effective size of said apertures as the speed of the engine increases, and speed-responsive means for operating said control member.

3. In a charging blower for internal combustion engines, a rotary piston separating the suction and compression chambers and having apertures opening into the working faces of the piston and immediately connecting said chambers, and means carried by said piston for automatically closing said apertures when said engine is at a standstill, or operating at a low speed, and for opening and increasing the effective size of the apertures as the engine speed increases.

4. In a charging blower for internal combustion engines, a rotary piston having variable apertures therein connecting the suction and compression chambers, a slide valve in said piston to cover and uncover said apertures, means consisting of gear wheels, to rotate said piston, a casing for said gear wheels and means consisting of a pump, constituted by said gear wheels and casing to operate said slide valve.

5. In a charging blower for internal combustion engines, a rotary piston having apertures therein connecting the suction and compression chambers and means comprising a fluid pump, to vary said apertures in dependence upon the engine speed and operable to increase the effective size of said apertures as the speed of the engine increases.

6. In a charging blower for internal combustion engines, a rotary piston having apertures therein connecting the suction and compression

chambers, weighted pistons controlling said apertures and adapted to be centrifugally operated to increase the effective size of said apertures as the speed of the engine increases, and springs controlling said weighted pistons.

7. In a charging blower for internal combustion engines, a rotary piston separating the suction and compression chambers and having apertures opening into the working faces of the piston and immediately connecting said chambers, and speed responsive means for varying the effective size of said apertures and for connecting said apertures to atmosphere.

8. A charging blower for internal combustion engines, having a rotary piston provided with openings in the working faces thereof forming a direct connection between the suction and delivery sides of said blower and means for automatically increasing the free effective cross sectional area of said connection as the speed of the engine increases.

9. In a charging blower for internal combustion engines, a rotary piston having apertures therein directly connecting the suction and compression chambers, a valve in said piston to control said apertures, and speed-responsive means for operating said valve, said valve being operable to increase the effective size of said apertures as the speed of the engine increases.

10. In a charging blower for internal combustion engines, a rotary piston having apertures in the working faces thereof directly connecting the suction and compression chambers, and speed-responsive means controlling said apertures and operable to increase the effective size of said apertures as the speed of said engine increases.

HANS HEINRICH.
WERNER ZEUCH.
ALFRED MEYER.