July 28, 1942. K. KOLLMANN 2,290,884

BLOWER FOR INTERNAL COMBUSTION MOTORS

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FIG. 1.

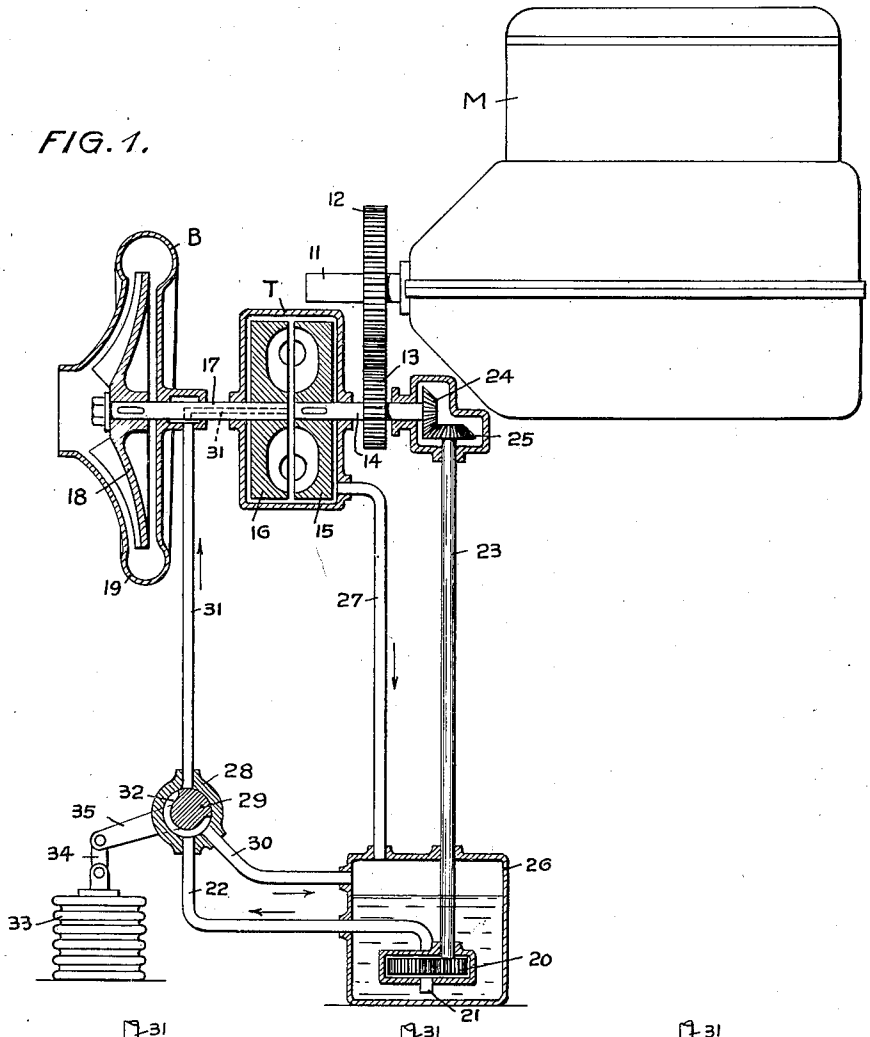


FIG. 2.

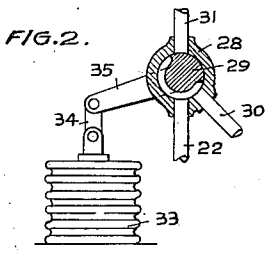


FIG. 3.

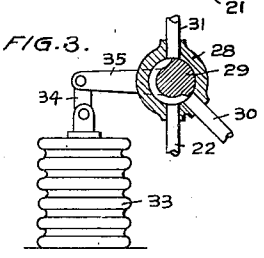
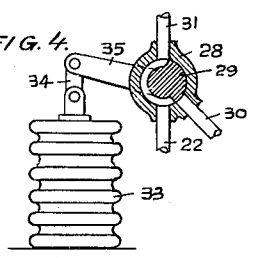


FIG. 4.



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FIG. 5.

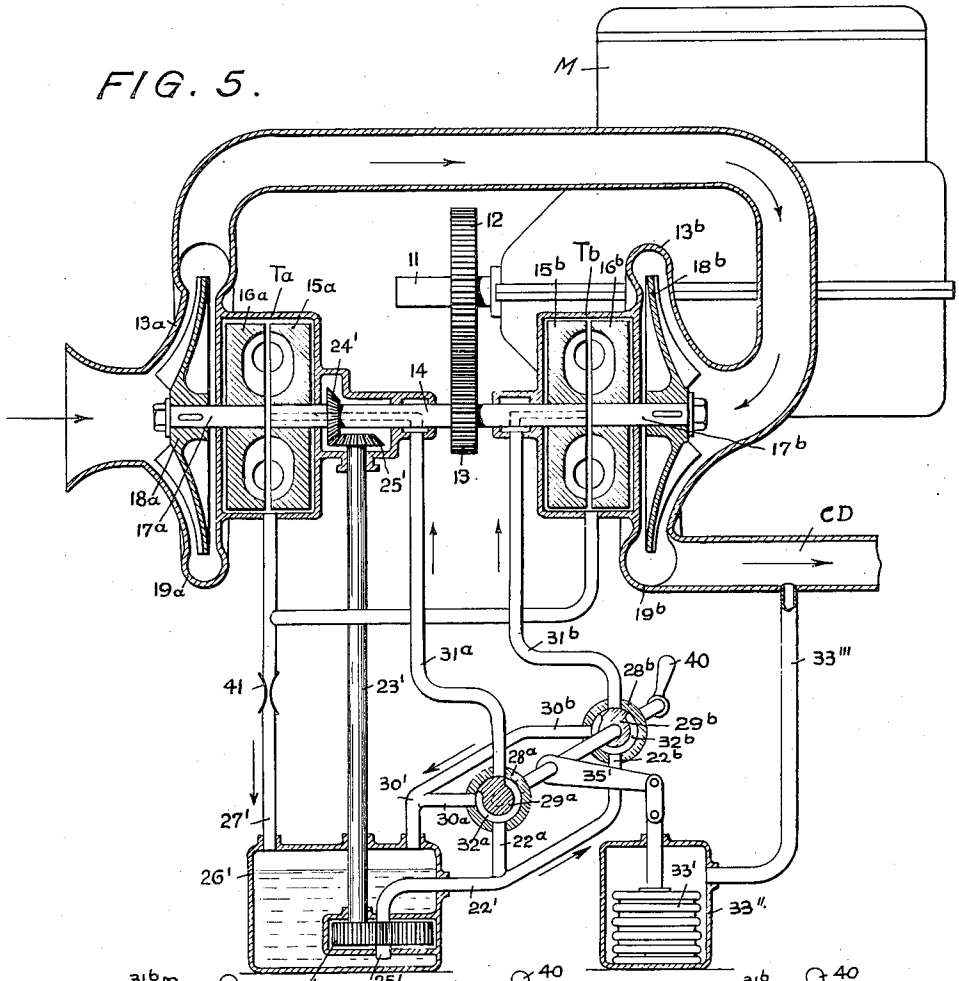


FIG. 6.

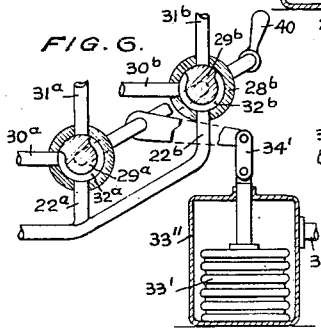


FIG. 7.

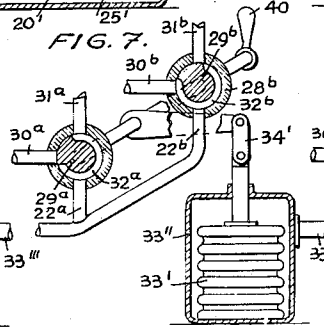
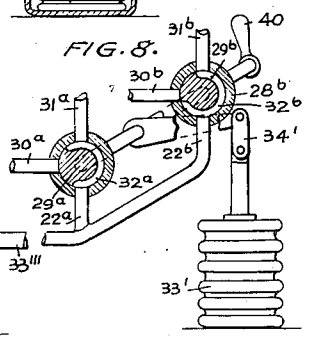


FIG. 8.



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BLOWER FOR INTERNAL COMBUSTION MOTORS

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11 Claims. (Cl. 123—119)

This invention relates to blowers for internal combustion motors. Such blowers are used for furnishing the combustion air or the cooling air for such motors.

An object of this invention is to provide improved super-charging means for internal combustion engines and particularly improved means for driving a super-charger or blower, as from the engine itself.

A further object is to provide improved means for controlling the application of the power to the super-charger or blower.

A more specific object is to provide power transmission means between the engine and supercharger so constructed and arranged as to provide a variable speed ratio between the engine and the super-charger.

A further object is to provide means for controlling said power transmission, said controlling means being preferably responsive to pressure.

A more detailed object is to provide a plurality of super-charger units preferably in series, together with separate transmission means for driving said units and a common control means for controlling said transmission.

Further objects and advantages of this invention will be apparent from consideration of the specification as illustrated by the accompanying drawings of possible embodiments of the invention, in which drawings:

Fig. 1 shows one illustrative embodiment of the invention in more or less schematic form;

Figs. 2, 3, and 4 show the control valve of Fig. 1 in several different positions of adjustment;

Fig. 5 illustrates a modification in which a plurality of blower units are employed;

Figs. 6, 7 and 8 show the valve mechanism of Fig. 5 in three different positions of adjustment.

Referring to Figs. 1 to 4 inclusive, M designates a motor of any suitable type such as an internal combustion engine. The letter B indicates generally a blower which may be of the centrifugal type shown or be of any other suitable type. The letter T indicates generally any suitable power transmission for controlling the transmission of power to the blower B. The form shown is of the type referred to variously as "Foettinger" or "fluid coupling" or "fluid flywheel". A transmission of this type is shown for example in United States Patent No. 1,881,082.

11 indicates a power shaft driven by said engine, upon which is mounted a gear 12 meshing with a gear 13 connected for driving the shaft 14 which is the power input shaft for the power transmission T. Connected for operation by shaft 14 is the impeller element 15 of the power transmission. Mounted for rotation adjacent to said impeller is the turbine element 16 arranged to receive fluid pumped by said impeller against and through the turbine. After the fluid has given up its energy to the turbine it is returned to the intake of the pump impeller. The action of said fluid causes the turbine element 16 to be rotated. This rotation is transmitted through shaft 17 to the impeller unit 18 of the blower B of which the housing 19 forms a part.

Suitable means are provided to supply oil or other working fluid to the transmission T. In the form shown this consists of a gear pump 20 having an intake conduit 21 and a delivery conduit 22. The pump is shown as being driven by shaft 23 suitably connected, as by bevel gears 24, 25, to the shaft 14 or other suitable driving member.

As shown, the pump is mounted in the sump 26. Conduit 27 connects the housing of the power transmission T with the sump so that leakage oil in said housing may drain back to the sump.

Suitable valve means are provided to cause the fluid delivered through conduit 22 to be delivered either to the transmission T or returned directly to the sump or partly to the transmission and partly to the sump. As shown in the drawings, this valve mechanism takes the form of a rotary valve comprising a housing 28 and a valve rotor 29. The valve housing is shown provided with three ports, one connected to conduit 22, one connected to a conduit 30 returning to the sump, and the third connected to conduit 31 leading to the transmission, being connected thereto through the bearing of the shaft 17 in the blower housing 19 and through an axial passage 31 in the shaft 17. The valve rotor is shown provided with a partial ring channel 32 serving to connect selected ones of the conduits 22, 30, and 31, with each other.

It will be noted that with the valve rotor in the position shown in Figs. 1 and 2, no fluid will be delivered to the transmission T. Since connection with conduit 31 is prevented, all the oil delivered through conduit 22 is returned to the sump through conduit 30. If the valve rotor is moved in a clockwise direction to the position shown in Fig. 3, both conduits 30 and 31 are partly open so that some of the oil delivered by the pump 20 is transmitted to the transmission T and the balance thereof is returned directly to the sump.

In the position of the valve rotor shown in Fig. 4, the connection to the return conduit 30 is

entirely closed and all of the fluid is delivered through conduit 31 into the transmission.

The percentage of slip in a transmission of the Foettinger type varies inversely with the amount of working fluid therein. In the position shown in Figs. 1 and 2, the transmission will be substantially without fluid so that practically no rotation is imparted to the blower impeller. In the position of the valve shown in Fig. 3 the transmission will be partly filled with fluid and the impeller 18 will be rotated at an intermediate speed. In the position shown in Fig. 4, the transmission will be entirely filled so that it will operate the impeller 18 at maximum speed.

The valve rotor 29 may be adjusted by hand or other suitable means. In the form shown, this consists of a barometric bellows 33 connected as by link 34 and on 35 to the valve rotor. It will be readily understood that if the motor M is utilized in an airplane or the like, the means shown will serve admirably to control automatically the operation of the super-charger blower in accordance with the atmospheric pressure. While on or near the ground the bellows is collapsed to the position shown in Figs. 1 and 2. As a higher altitude is reached and the atmospheric pressure drops, the bellows expands partially to about the position shown in Fig. 3 so that the transmission T is partly filled with working fluid and the super-charger blower is therefore operated at intermediate speed. As the altitude is gradually increased, the valve will gradually be shifted toward the position shown in Fig. 4, thus the speed of the blower is gradually increased until it is operating at full effective speed.

Figs. 5 to 8 inclusive show a more elaborate form of the invention wherein a plurality of super-charger blowers are independently operated through a corresponding plurality of transmissions, which transmissions in the form shown are controlled by a common valve mechanism.

In these figures the reference numerals 14', 20', 22', 23', 24', 25', 26', 27', 30', 33', 34', 35', represent parts corresponding respectively to those of Fig. 1 numbered 14, 20, 22, 23, 24, 25, 26, 27, 30, 33, 34, and 35, it being noted however that in each case they are associated with both blowers and their operating and control mechanisms. Ba and Bb represent two blowers connected, as shown, in tandem by means of conduit C which is connected from the delivery side of the blower Ba to the intake side of blower Bb. CD indicates the delivery conduit from blower Bb. Ta and Tb represent transmissions or fluid couplings for the respective blowers which are constructed preferably like transmission T. The numerals 15a, 16a, 17a, 18a, 19a, 22a, 28a, 29a, 30a, 31a, and 32a, represent parts related to blower Ba corresponding respectively to the parts 15, 16, 17, 18, 19, 22, 28, 29, 30, 31, and 32 of Fig. 1, whereas 15b, 16b, 17b, 18b, 19b, 22b, 28b, 29b, 30b, 31b, and 32b, represent parts related to blower Bb corresponding respectively to the parts 15, 16, 17, 18, 19, 22, 28, 29, 30, 31, and 32 of Fig. 1.

It will be noted that the valve members 29a and 29b are connected together by means of a shaft which carries the lever 35' operated through link 34' by means of the barometric device 33' and also that the valves (as shown) are adjusted out of phase so that upon rotation in a counterclockwise direction, as by the operation of handle 40 or the expansion of bellows 33', oil will be supplied first to transmission Ta and then to Tb.

In the position of the parts shown in Figs. 5 and 6, oil will be supplied to neither transmission. Upon the occurrence of counterclockwise motion to the position shown in Fig. 7, a full supply of oil will be delivered to conduit 31a and thence to transmission Ta, whereas no oil whatever will be delivered to conduit 31b. It will, of course, be obvious that in a position of the valve intermediate that shown in Fig. 6 and Fig. 7, part of the oil will be delivered to transmission Ta whereas the balance will be returned directly to the sump through conduits 30a and 30b. It will also be understood that suitable throttling elements will be placed in the conduit 30b (assuming that the normal hydraulic resistance does not suffice) to assure that the oil delivered by pump 30' will not all be discharged through conduit 30b when the valves are in position shown in Fig. 7, but that an adequate supply of oil will be delivered through conduit 31a to fill transmission Ta.

Upon further counterclockwise rotation of the valves to the position shown in Fig. 8, it will be seen that conduit 31a will remain open but that conduit 31b has also been opened whereas conduit 30b is closed. Therefore, all of the fluid is delivered to the two transmissions Ta and Tb.

It will be seen therefore that with this arrangement, it is possible to gradually increase the drive ratio of one blower Ba whereas the other blower Bb remains stationary and that thereupon the first blower may continue operation at full speed whereas the second blower is gradually accelerated from zero to maximum running speed so that a wide range of rate of air supply is made available. It will be understood, however, that a single valve (as in Fig. 1) may be used to supply fluid gradually to the two transmissions of Fig. 5.

It will be noted that in Figs. 5, 6, and 7, the barometric bellows 33' is not subjected to atmospheric pressure but to the pressure existing in the delivery conduit CD. This is effected by enclosing the bellows within an air-tight housing 33'' and connecting the said housing with the conduit CD, as by means of a conduit 33'''. As a result thereof, the blowers are controlled for operation in such a way as to produce a uniform pressure in the conduit CD so that an adequate supply of air to the engine may be assured irrespective of the pressure of the surrounding atmosphere. In Fig. 8, this housing and connection to conduit CD is omitted to show that the form of device shown in Fig. 5 may, if desired, be placed under control of the pressure of the atmosphere.

It is to be noted that in most forms of the device shown, oil is continuously applied to the transmissions T, Ta and Tb, while operating, so that the supply of oil not only provides the operating medium but circulates therethrough and carries away the heat which may be developed there. As shown in Fig. 5, an adjustable or fixed throttling member 41 may be inserted in the return conduit 27' to prevent too great a return flow from the transmissions to the sump and thus assure that the transmissions will remain properly filled, i. e., in proportion to the amount of oil delivered to them.

It will be noted that the constructions shown and described will serve admirably to accomplish the objects stated above. It is to be understood, however, that the constructions disclosed above are intended merely as illustrative of the invention and not as limiting as various modifications

therein may be made without departing from the invention as defined by a proper interpretation of the claims which follow.

I claim:

1. In combination, an internal combustion motor, a plurality of blowers for supplying air to said motor, a corresponding plurality of fluid couplings between said motor and said respective blowers, a pump for supplying fluid under pressure, conduits for delivering fluid from said pump to said fluid couplings, return conduits from said couplings to a sump for said fluid, a valve for each coupling to control the amount of fluid delivered by said pump to and through each fluid coupling whereby the supply of fluid in said fluid couplings and the slip of said fluid couplings may be varied and a common means for operating said valves.

2. In combination, an internal combustion motor, a plurality of blowers connected in tandem for supplying air to said motor, a corresponding plurality of fluid couplings between said motor and said respective blowers, a pump for supplying fluid under pressure, conduits for delivering fluid from said pump to said fluid couplings, return conduits from said couplings to a sump for said fluid, valve means to control the amount of fluid delivered by said pump to and through one of said fluid couplings, whereby the supply of fluid in said fluid coupling and the slip of said fluid coupling may be varied from zero to maximum while the other coupling is inactive and then to supply fluid to said second fluid coupling until said second fluid coupling is also operating at maximum speed.

3. In combination, an internal combustion engine, a pair of blowers for supplying air under pressure to said engine, a first means for controlling the speed of one blower, a second means for controlling the speed of the second blower, and control means correlated and interconnected with said first and second means for starting and increasing the speed of the one blower, while maintaining the other blower inactive, and for starting and increasing the speed of the second blower without affecting the speed of the first blower.

4. The combination according to claim 3 wherein said first and second means respectively include fluid transmission devices.

5. The combination according to claim 3, in combination with a conduit for serially connecting said blowers.

6. The combination according to claim 3, in combination with a conduit for serially connecting said blowers, said second blower being positioned intermediate said engine and said first blower.

7. In a supercharged internal combustion engine having two serially connected superchargers for supplying a fluid under pressure to said engine, the method of maintaining the pressure of said fluid constant despite a decrease in absolute pressure of the source of fluid, by starting and gradually increasing to its maximum the speed of the supercharger most remote from the engine, as measured along the serial path of said fluid, independently of the speed of the engine, and then starting and gradually increasing to its maximum the speed of the supercharger nearest the engine, independently of the speed of the engine.

8. In combination, an internal combustion engine, a pair of blowers for supplying air under pressure to said engine, means for starting and increasing the speed of one blower while maintaining the other blower inactive, means for starting and increasing the speed of the second blower without affecting the speed of the first blower, a single device for effecting control of the two blower controlling means, and a mechanism responsive to atmospheric pressure for controlling said device.

9. In combination, an internal combustion engine, a pair of blowers for supplying air under pressure to said engine, means for starting and increasing the speed of one blower while maintaining the other blower inactive, means for starting and increasing the speed of the second blower without affecting the speed of the first blower, a single device for effecting control of the two blower controlling means, and a mechanism responsive to the pressure of the supplied air for controlling said device.

10. The combination according to claim 1, in which the said common means is responsive to atmospheric pressure for operating one of said valves to increase the flow of fluid delivered by said pump to one of said fluid couplings upon a predetermined decrease in atmospheric pressure, and operating another valve to increase the flow of fluid delivered by said pump to another of said fluid coupling upon a further predetermined decrease in atmospheric pressure.

11. In combination, an internal combustion engine, a pair of blowers for supplying air under pressure to said engine, a first means for controlling the speed of one blower, and a second means for controlling the speed of the second blower, a pressure-responsive device correlated and interconnected with said first and second means for increasing the speed of the one blower upon a predetermined decrease in atmospheric pressure and increasing the speed of the second blower upon a further predetermined decrease in atmospheric pressure.

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