

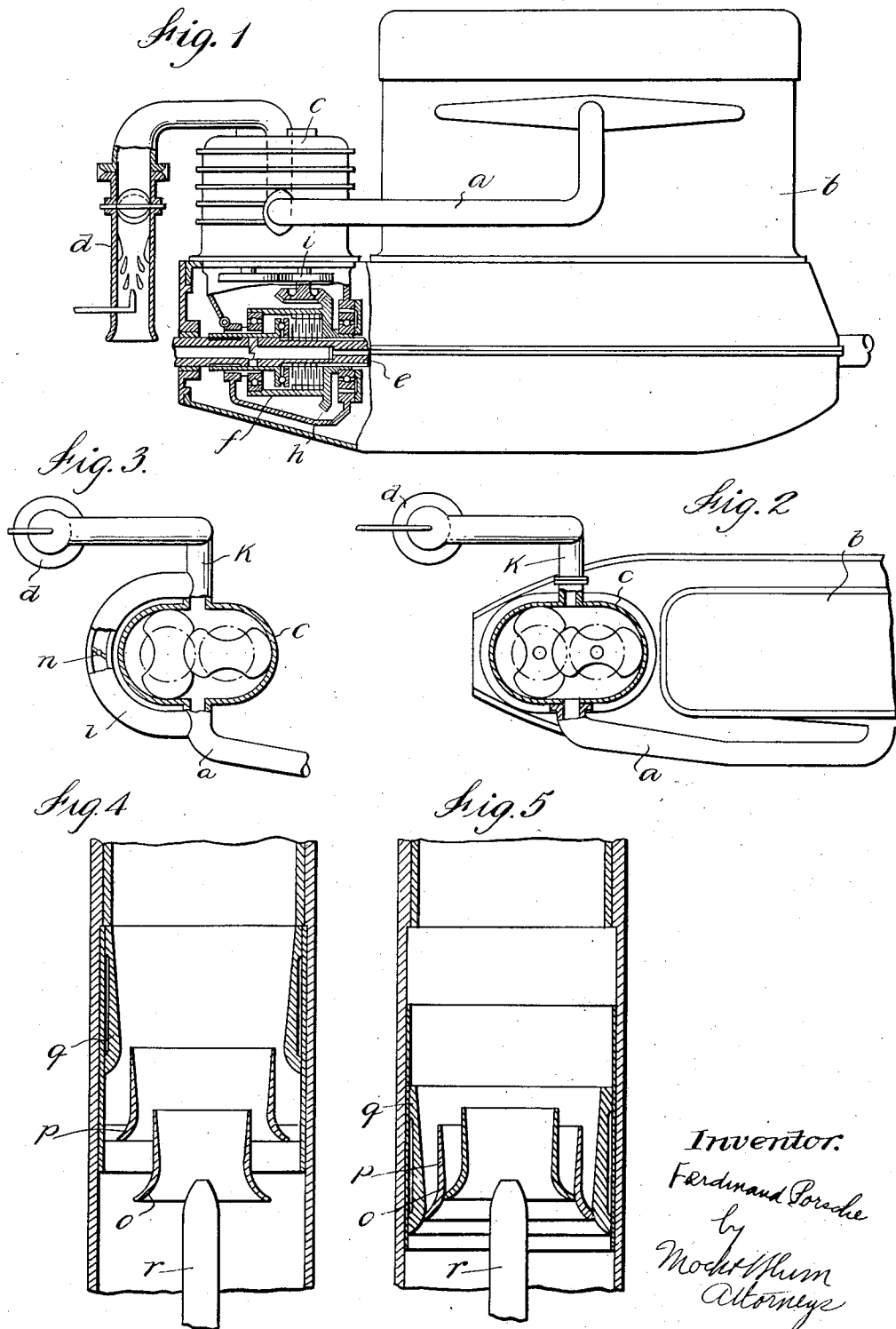
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CARBURETOR FOR SUPERCHARGING INTERNAL COMBUSTION ENGINES

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CARBURETOR FOR SUPERCHARGING INTERNAL-COMBUSTION ENGINES.

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In internal combustion engines in which the charge is introduced into the engine cylinders under a certain overpressure by means of a blower for the purpose of increasing the weight of the charge with a view to increasing the output, it has heretofore been usual to use for the formation of the explosive mixture carburetors of the usual construction in which the air nozzle for atomizing the liquid fuel is dimensioned for an air speed which results in the most favourable consumption of fuel for the speed of revolutions of the engine at which it most frequently runs.

When such carburetors are used for internal combustion engines charged under pressure it has been found that the efficiency of supply of the carburetor arrangement is very unfavourable and that, in consequence, the efficiency which is intended to be obtained by the charge being under pressure is far from being attained. The poor degree of efficiency of the carburetor must no doubt be attributed to the fact that, in consequence of the increased throttling resistances, resulting from the larger quantity of air which is being introduced, considerable losses occur. The object of the present invention is to remove these very considerable disadvantages in internal combustion engines with charge under pressure.

The invention depends for its novelty upon the fact that, in order to reduce the throttling resistances which are prejudicial to the degree of supply of the carburetor and consequently to the output of the internal combustion engine, the air nozzle is enlarged and formed in such a manner that it adapts itself in the most favourable manner and to the fullest extent to the conditions prevailing when working the engine with and without the blower.

The modification of the nozzle in accordance with the invention finds its justification in the following considerations and ascertained facts. An enlargement of the nozzle can be effected, without in any way prejudicing the formation of gas, if the carburetor is fitted in advance of the blower, in relation to the direction of the flow of the mixture, so that the blower draws in the air from the atmosphere through the carburetor.

In the charge under pressure, for instance,

there is drawn in a volume of air of approximately $1\frac{1}{2}$ times the amount of the volume of the cylinder of the engine swept by piston. If, therefore, for the engine with blower, a carburetor is used the nozzle of which has a cross section corresponding to that of a carburetor of an engine of the same size without blower, a volume of air $1\frac{1}{2}$ times as large must be drawn in through this narrow cross section in the same period of time (assuming an equal number of revolutions). The speed of flow is consequently considerably greater and the greater resistances thereby arising cause the losses which produce a diminution of the degree of supply.

In accordance with the present invention the cross section of the nozzle of the carburetor is increased to such an extent that $1\frac{1}{2}$ times the volume of cylinder swept by the piston is drawn into the carburetor approximately at the same velocity as such volume in the case of an engine of the same size without blower. The air nozzle of the carburetor may, however, be enlarged beyond the dimension which results from the increased volume of air drawn in when working with a blower. The further enlargement can be effected because the blower itself contributes to the mixing of the fuel with the air, so that it is not necessary for such a far reaching atomizing to take place in the air nozzle as is the case with a carburetor without blower or in carburetors through which the combustion air is forced.

The sucking of the combustion air through the carburetor by means of the blower is advantageous for the filling also, for the reason that the air reaches the carburetor in a cold and consequently in a dense condition.

In the accompanying drawing two examples of execution are represented in five figures:—

Figure 1 shows an internal combustion engine with blower and the carburetor placed in advance of the blower, the driving arrangement for the blower and the carburetor being shown in section.

Figure 2 is a plan of the same in which the blower is shown in section.

Figure 3 also shows a plan of the blower this example of execution being distinguished from that shown in Figure 2 by the fact that

the suction and pressure pipes are connected by a by-pass pipe furnished with a throttle valve.

Figure 4 shows on an enlarged scale a section through the carburetor according to Figure 1, the air nozzles being in the position which they assume when the cross section is fully opened.

Figure 5, in the same way as Figure 4, shows a section through the carburetor but with the air nozzles in the position which they assume when the surrounding air passages are shut off.

As shown by Figure 1 the pipe *a* for the admission of the mixture is connected in the well known manner with the working cylinders of the internal combustion engine *b*, and the pipe *a* is further connected with the blower *c*, of any well known or suitable type. The latter sucks the mixture through the carburetor *d*. The blower *c* is driven from the engine crank shaft *e* by a coupling *f* and toothed wheels *h* and *i*.

The invention includes the application of the blower according to which the blower is running without interruption during the working of the internal combustion engine and conveys the charge into the internal combustion engine, as well as the application of the blower, in which the blower from time to time only, during the working of the internal combustion engine, conveys the charge into the internal combustion engine, whilst, when the blower is out of action, the charge reaches the engine through a by-pass through the suction effect of the working pistons.

By way of example an arrangement for the application of the blower as last mentioned is shown in Figure 3. A branch pipe *l* connects the suction pipe *k* of the blower *c* with the pressure pipe *a* of the blower. A throttle valve *n* is inserted in the said branch pipe and this valve is kept shut whilst the charge is passed through the blower and is opened when the blower is shut off. The quantity of air which is introduced into the engine in consequence of the previous compression amounts to approximately one and a half times the volume of cylinder swept by piston of the engine. In order, therefore, to introduce this volume under approximately the same speed as the volume of cylinder of an engine of the same size without blower, the cross section of the nozzle of the carburetor in advance of the blower may be larger in correspondence with the larger volume of air. The cross section of the carburetor in this case may be further increased in consequence of the fact that the vapourizing of the fuel is assisted by the rotary blower and because it is, therefore, not necessary to maintain the speed in the air nozzle of the carburetor as great as in carburetors for engines of the same size without blower.

In Figures 4 and 5 a carburetor of special

construction is represented. This carburetor has, for instance, three different air nozzles *o*, *p* and *q*. The air nozzle *o* which surrounds the mouth of the fuel nozzle *r* is so dimensioned that the air must pass through the same with the greatest speed. The surrounding nozzles *p* and *q* are of larger sections, so that the speeds of the current of air decrease by stages. In consequence of the fact that a portion of the volume of air which is sucked in always passes the mouth of the fuel nozzle at a speed sufficient for the proper atomizing, it is possible to conduct the air currents through the larger nozzles at a slower speed. In consequence of this arrangement the total cross section for the air streaming through, which is formed by the several nozzles, may be larger than in the case of carburetors for an engine of the same size but fitted with one air nozzle only. If such a carburetor is, however, connected with the suction piping of the blower it will be possible to make the cross section of the nozzle considerably larger than in carburetors of the known pattern for engines of the same size without blower. It is not impossible to triple the area of cross section as compared with the known carburetors. In consequence of this, the resistance to the current becomes of course considerably smaller and the filling is accordingly better.

In order that a carburetor with several air nozzles may also be used with good effect for working without the blower, the nozzles *p* and *q* are, for instance, inserted in the casing of the carburetor in such a manner that they can be shifted relatively to each other and to the nozzle *o*.

In Figure 5 the nozzles are drawn in the position which they assume, for instance, in the state of rest. In that case the surrounding ducts are shut off, so that, when the engine is started, the combustion air streams in only through the nozzle *o*. The further nozzles *p* and *q* may be of different weights, so that, with the increasing suction effect, they are lifted automatically one after the other and thus increase the air cross section accordingly.

The arrangement of nozzles for carburetors of internal combustion engines with blower above described is to be considered as an example of execution for realizing the invention. The shape, number and arrangement of the nozzles can be selected as may appear most suitable and details of construction may be varied as found desirable.

What I claim is:—

In combination, an engine, a carburetor, a branched mixture conduit from said carburetor to said engine, a supercharger in one of said branches, means for selectively subjecting the carburetor to the suction of the supercharger or of the engine, through said respective branches, and suction opened air

valves cooperating to occlude the air intake of the carburetor, said air valves being responsive, the one, to a range of sub-pressures up to the maximum engine-induced suction, and the other, to a range of sub-pressures extending beyond said maximum, whereby the cross-sectional capacity of the carburetor air intake is automatically increased upon the selective use of the supercharger to avoid throttling of the air inducted by said supercharger. 10

In testimony whereof I affix my signature.

FERDINAND PORSCHE.