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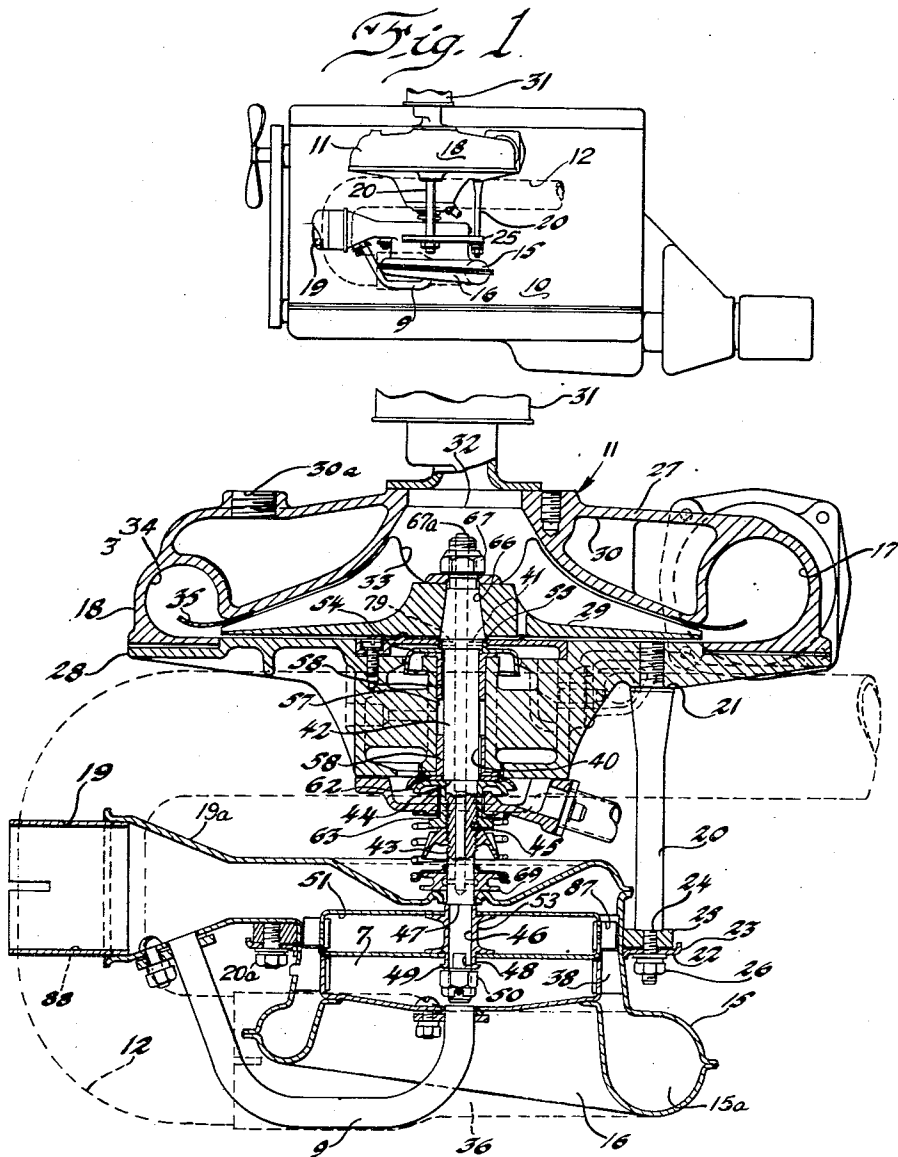
F. F. KISHLINE ET AL

2,777,632

SUPERCHARGER FOR INTERNAL COMBUSTION ENGINES

Filed April 7, 1953

5 Sheets-Sheet 1



INVENTORS
FLOYD F. KISHLINE
HARRY F. WOOD
BY

Carl J. Barber

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5 Sheets-Sheet 2

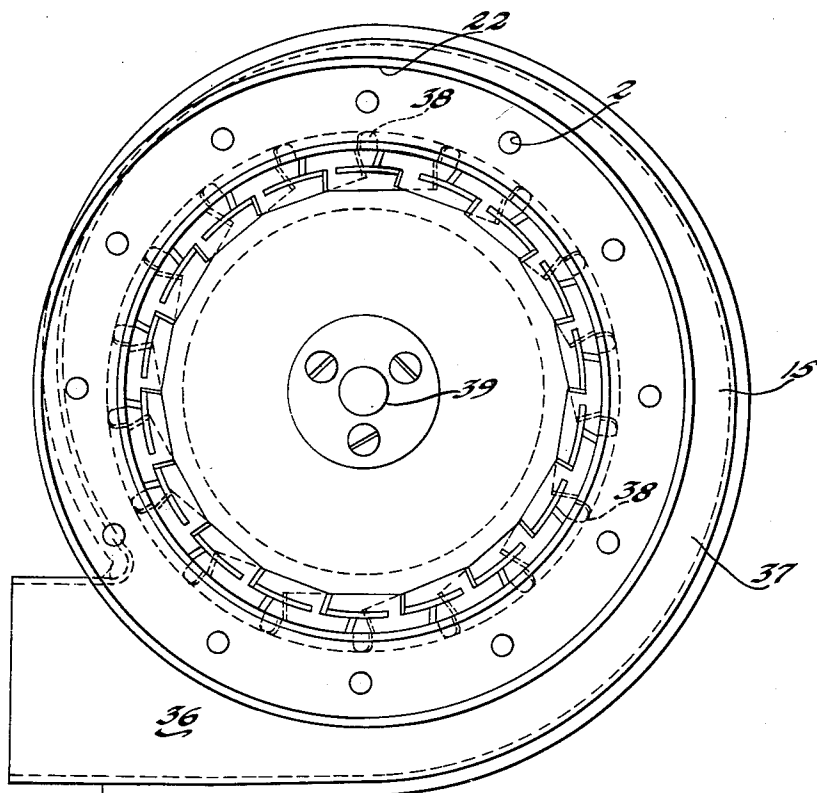


Fig. 3

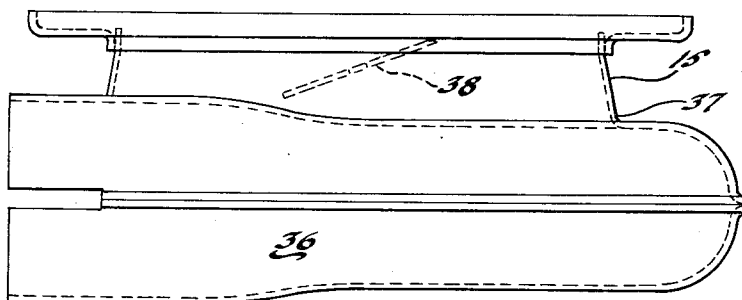


Fig. 4

INVENTORS
FLOYD F. KISHLINE
HARRY F. WOOD
BY

Carl J. Barber

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5 Sheets-Sheet 3

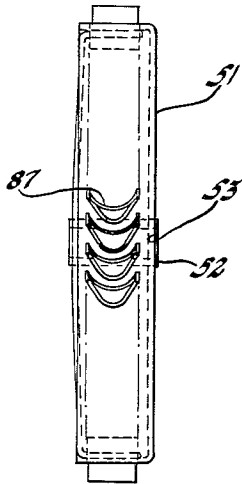


Fig. 5

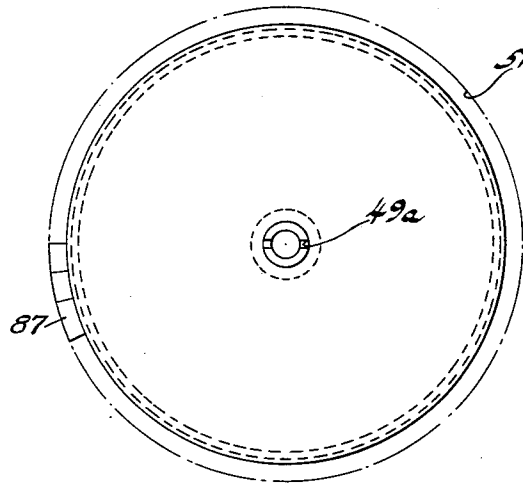


Fig. 6

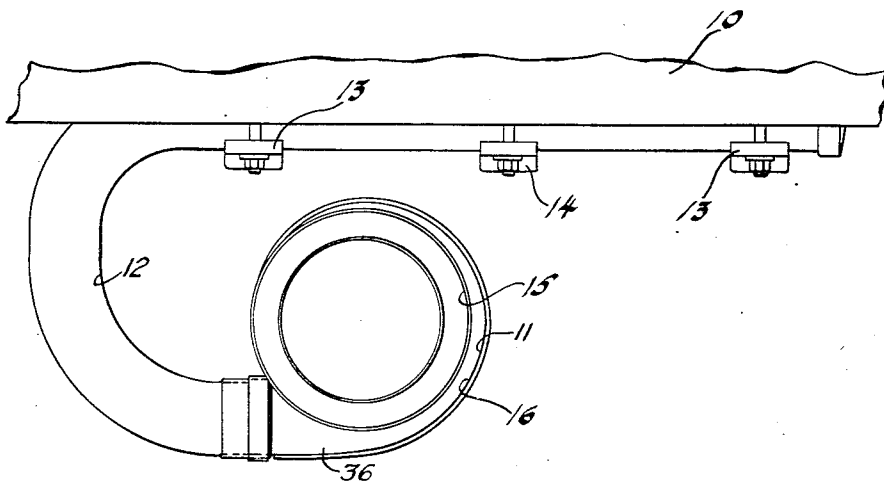


Fig. 7

INVENTORS
FLOYD F. KISHLINE
HARRY F. WOOD
BY
Carl J. Barber

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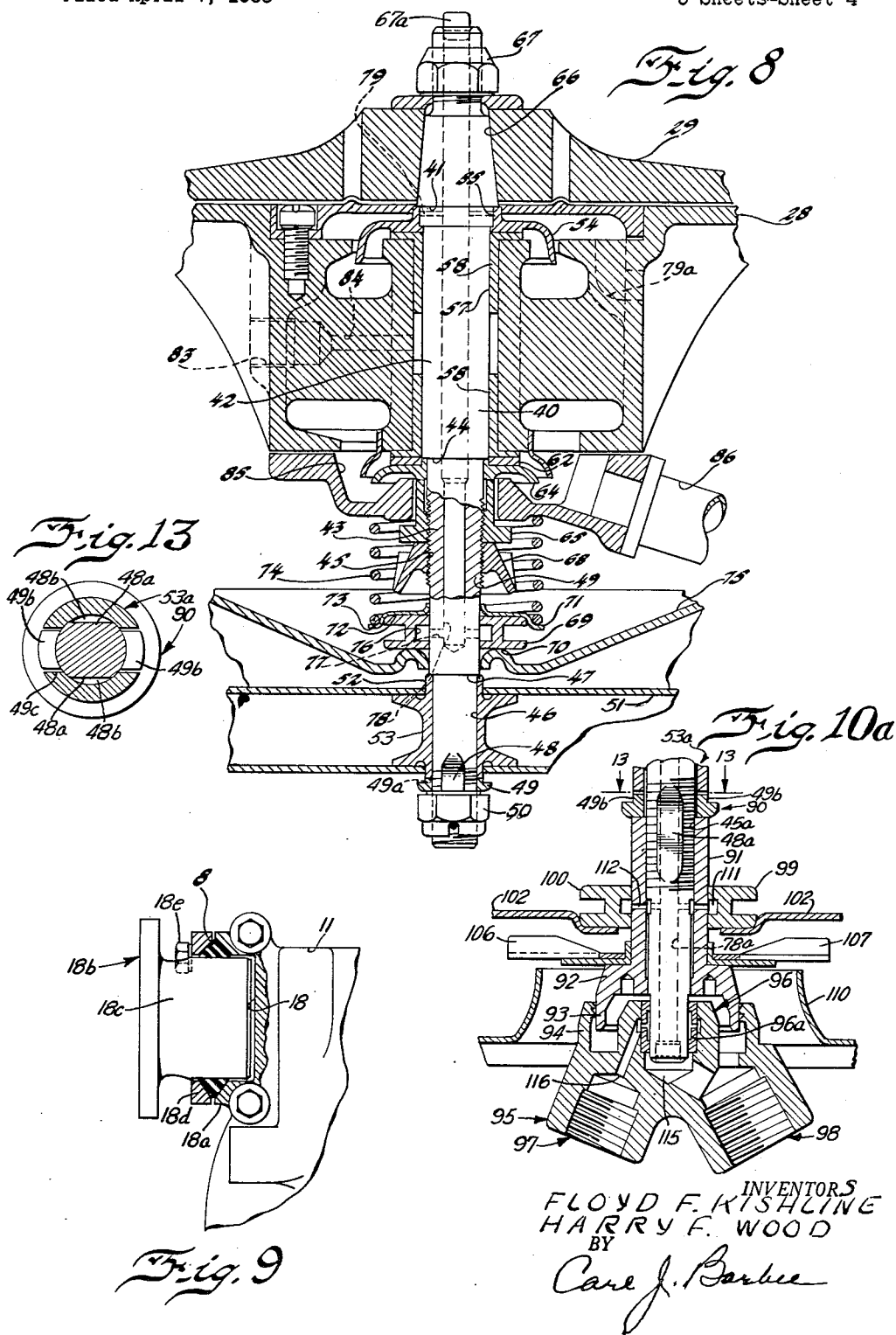
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INVENTORS
FLOYD F. KISHLINE
HARRY F. WOOD
BY
Care J. Barber

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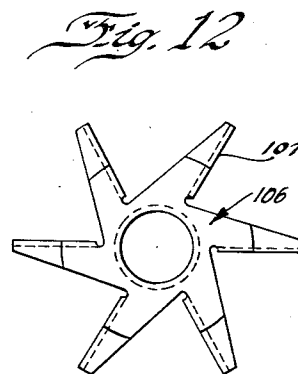
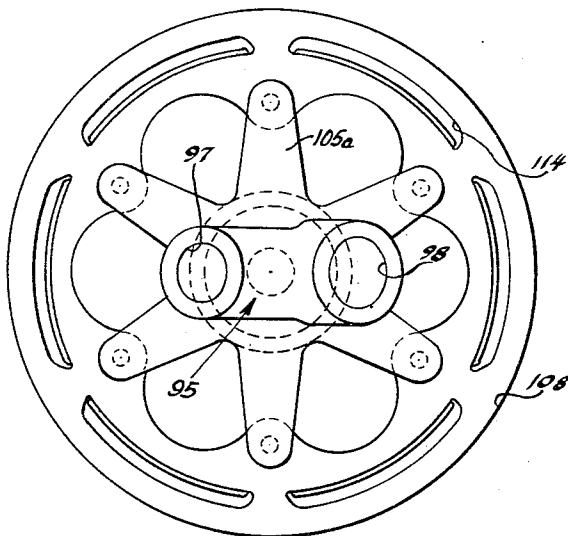
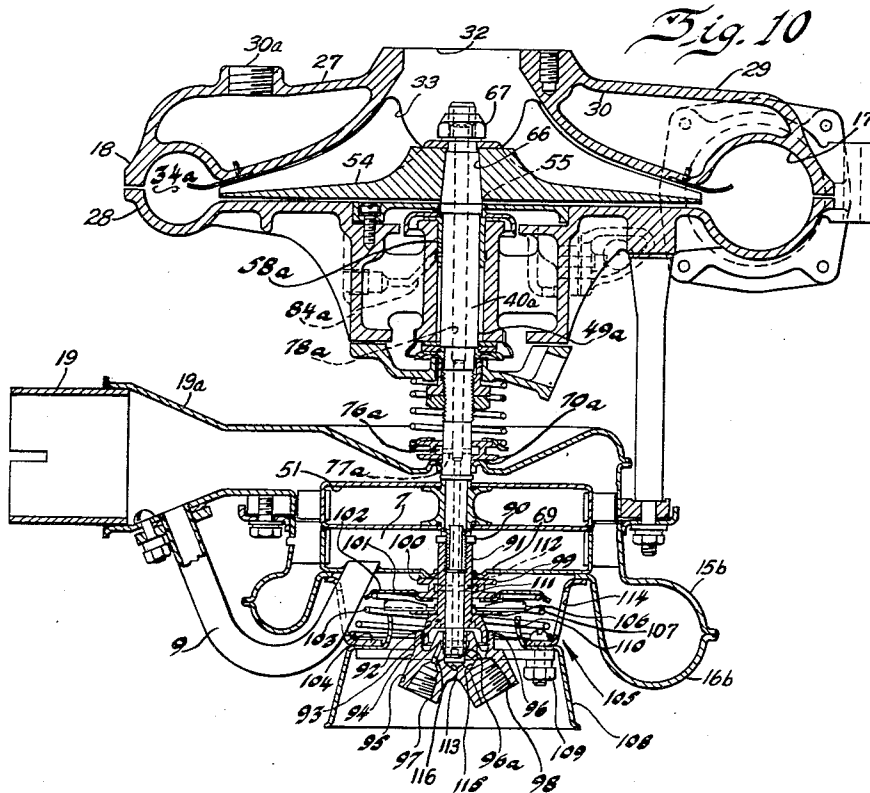
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INVENTORS
FLOYD F. KISHLINE
HARRY F. WOOD
BY
Carl J. Barber

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SUPERCHARGER FOR INTERNAL COMBUSTION ENGINES

Floyd F. Kishline and Harry F. Wood, Kenosha, Wis., assignors to American Motors Corporation, a corporation of Maryland

Application April 7, 1953, Serial No. 347,292

9 Claims. (Cl. 230—116)

This invention relates to internal combustion engines and more particularly to a mixing and turbo-supercharging device for internal combustion engines.

It is an object of this invention to provide a supercharging device for internal combustion engines having improved characteristics of strength, rigidity, and simplicity of design.

In general the supercharging apparatus of the present invention is of the centrifugal type and is interposed between the carburetor and intake manifold of an otherwise conventional internal combustion engine.

The present invention is characterized by having a blower assembly consisting of a lower blower and upper blower housing and a turbine wheel housing assembly consisting of a nozzle box, stator vanes, a balancing tube and an outlet casing. A turbine wheel is arranged to be actuated by the exhaust gases of the engine and an impeller is rotated by movement of said turbine wheel sucking the fuel and air from a carburetor and violently discharging said fuel and air into an intake manifold.

A further object of the invention is to provide a centrifugal type of turbo-supercharger for use on an internal combustion engine which is of relatively simple construction, inexpensive to manufacture and install, and thoroughly efficient and reliable in operation and otherwise well adapted for which it is designed.

The invention possesses other objects and features of advantage, some of which with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawings accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawings and description may be adopted within the scope of the invention as set forth in the claims.

Referring to the drawings:

Figure 1 is a view in side elevation of a conventional in-line type of internal combustion motor equipped with our improved turbo-supercharger.

Figure 2 is a transverse vertical sectional view showing the turbo-supercharger.

Figure 3 is a top plan view of the nozzle box.

Figure 4 is a side view of the nozzle box.

Figure 5 is an end view of the turbine wheel.

Figure 6 is a bottom plan view of the turbine wheel.

Figure 7 is a plan view showing the connection between the engine, exhaust gas conduit, and the nozzle box.

Figure 8 is an enlarged transverse vertical sectional view of a part of Figure 2.

Figure 9 is a fragmentary enlarged view partly in cross-section of the connection between the blower housing and the cylinder head manifold inlet.

Figure 10 is a view similar to Figure 2 but modified with respect to the turbine wheel assembly.

Fig. 10a is an enlarged fragmentary sectional view of the lower portion of the apparatus of Fig. 10.

Figure 11 is a bottom view of the structure shown in Figure 10.

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Figure 12 is a plan view of the rotor shaft air agitator used with the construction as disclosed in Figure 10.

Figure 13 is a detail sectional view taken on the line 13—13 of Fig. 10a.

In the construction shown in the drawings, a conventional type of cylinder in-line internal combustion motor 10 is shown provided with the improved turbo-supercharger generally designated at 11 mounted adjacent the crank case thereof. Viewing Fig. 7 the exhaust pipe 12 is secured longitudinally along the cylinder block 10, the interior of said pipe being in communication with the cylinder chambers for receiving the exhaust gases therefrom. Suitable clamping devices 13 and 14 are used for securing the exhaust pipe to the motor block and the free open end of said pipe is secured to and communicates directly with the open end of nozzle 36 which forms a portion of the turbine wheel housing 15—16.

The upper part of the supercharger is connected directly to the intake manifold (not shown) of the engine coupling the discharge passage or port 17 in the upper blower housing 18 with the intake passage or port of an intake manifold. This juncture may be effected in the manner shown in Fig. 9 wherein the blower housing 18 has an outlet hub 18a which telescopes loosely onto the cylindrical hub portion 18c of the fitting identified generally as 18b, the open end of which communicates with the intake manifold of the engine. A rubber ring 8 encircles the hub 18c and is compressed into tight sealing engagement with the external surface of said hub by means of compression ring 18d. The compression ring is tightened by means of bolts 18e which threadedly engage the hub 18a. The rubber ring absorbs vibration caused by the rotating parts of the supercharging device. It is to be understood that speeds as high as 25,000 R. P. M. are attained by the turbine wheel and impeller.

An exhaust passage 19 is arranged in the upper part of the nozzle box 15 to exhaust the spent exhaust gases in the usual manner after such gases have carried out their intended function in the turbine wheel housing 16 as will be described hereinafter. There is a possibility of exhaust gas escaping into the chamber 7 and building up a pressure against the bottom surface of the turbine wheel which could produce a high axial thrust force on the shaft. Thus tube 9 is provided to establish communication between the exhaust end 19a of the turbine housing 15—16 and chamber 7 for relieving any pressure which might otherwise build up in said chamber. The coupling 19 may be connected to a conventional exhaust pipe (not shown) which normally extends from the engine to the rear end of an automotive vehicle.

The relationship existing between the turbo-supercharger's turbine and blower housings, as designated above, relative to exhaust connections and that of the intake manifold provide suitable and rigid support for the turbo-supercharger adjacent said motor 10.

The turbo-supercharger, per se, comprises the pair of generally vertically disposed blower housing 18 and turbine wheel housing 16 primarily referred to. These housings are arranged in spaced relation and in line with one another and secured by bolt members 20. These members are strategically spaced in circular relationship with respect to the centers of said housings. Each bolt is threaded at each end with one end flaring outwardly to provide a shoulder 21 adjacent a threaded end.

The bolt 20a is threaded into the ring 25 to assist the bolts 20 in anchoring the housing 16 to the housing 15, it being understood, however, that the bolts 20 also anchor the lower housing assembly 15—16 to the upper housing assembly 18.

The turbine housing 15 has a circular flange 22 secured thereto and arranged entirely around the outside and has its free edge 23 curved upwardly to form a cup. This

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flange is provided with spaced openings to receive the other threaded end of bolt 20. Attention is directed to the fact that the end of the bolt 20 adjacent said flange is reduced at the threaded end to provide a shoulder 24 to receive a washer 25 which is interposed between said shoulder 24 and said flange. In operation, the flaring end of said bolt 20 projects upwardly with its adjacent end threaded and anchored securely in the upper blower housing 18 with shoulder 21 bearing directly against housing 18 while the other end of bolt 20 passes through an opening in the flange 22 and is secured thereto by suitable fastening elements 26.

The upper blower housing consists of an impeller housing made up of two parts, one designated by the numeral 27 comprising a complementary cover which is secured to the impeller mounting section 28. The cover 27 and section 28 together form a suitable enclosure for the impeller 29 of the supercharger.

The cover 27 of the impeller housing is provided with a water jacket opening 30 of varying cross-sectional area and the point where the water jacket has the greatest cross sectional area is located adjacent to the place where the impeller suction pressure is the lowest. Water from the internal combustion motor cooling system pump is supplied to the water jacket 30 by a feed pipe 30a of well known application.

Any suitable type of carburetor, whether of side draft or down draft, may be used. For purposes of illustration herein, a down draft carburetor 31, as shown in Figure 1, is mounted on top of the impeller housing so as to discharge its fuel downwardly through the central opening 32 provided in the impeller housing cover 27 so that the fuel is drawn downwardly on to the top surface of the impeller 29 from which it is thrown outwardly by the impeller blades 33 into the annular chamber 34 which is formed beyond the outer peripheral edge of the impeller in the housing 18. It will be noted the annular chamber increases in diameter progressively, the largest cross sectional dimension being at the discharge outlet hub 18a. Thus the volume of the fuel charge is greatest as it nears the discharge outlet preparatory to entering the intake manifold of the engine. As the fuel mixture is thrown into the annular chamber from the impeller, such chamber being of generally cylindrical cross section causes the fuel mixture to tend to swirl while at the same time attempting to progress circumferentially toward the discharge outlet 18a. A diffuser 35 in the form of a circular disc anchored to housing 18 helps to break up the swirling tendency of the fuel mixture and to effect discharge of a larger volume of fuel mixture at outlet 18a upon each revolution of the impeller.

The exhaust gases from the engine are utilized for driving the supercharger shaft 40 and such gases travel through the exhaust pipe 12 and thence through the inlet portion 36 and on into the annular chamber 15a of housing 15-16 within which the turbine wheel is mounted. Housing 15-16 has spaced stator vanes 38 disposed equally around a common center 39. These vanes are formed in the top of said housing and receive the full charge of the exhaust gases passing through the annular chamber 15a and direct same into the buckets 37 for effecting rotation of the turbine wheel.

A vertically disposed impeller shaft 40 extends from the upper and lower housings and comprises one end 66 frusto-conical in shape. The shaft is slightly reduced in diameter adjacent said frusto-conical end to provide a shoulder 41 the purpose of which will be explained as the description proceeds. This portion of the shaft which is slightly reduced in diameter and constitutes the first reduced extension, designated by the numeral 42 constitutes a substantial portion of the shaft. Again the shaft is reduced in diameter to provide a second shaft reduced extension designated by the numeral 43. This second extension in cooperation with the first extension provides a shoulder 44 the purposes of which will also

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be explained later. This second extension is provided with an externally threaded section 45 intermediate its ends. The shaft is further reduced in diameter at 46 extending to the free end of the shaft. This constitutes the third reduced extension and this third extension together with the second extension provide a shoulder 47, the purpose also of which will be explained later.

The shaft 40 has a pair of flat spots 48 on diametrically opposite sides thereof, one of which is shown in Figs. 2 and 8, and the drive plate 49 has corresponding flat spots (not shown in Figs. 2 or 8 but shown in Fig. 13) formed in the otherwise circular bore therein, thereby establishing driving engagement from plate 49 to shaft 40. The plate in turn has a pair of axially extending diametrically opposed dogs formed thereon which project into corresponding notches (shown in Fig. 6 and indicated by dotted lines in Fig. 8) identified by the numeral 49a formed in the wheel hub 53 thereby establishing driving engagement from the wheel to the plate 49. A more specific description of these driving connections is set forth hereinafter with reference to the form of the invention shown in Figs. 10 through 13.

A turbine wheel 51 is arranged on said shaft having a center diameter slightly greater than the diameter of the third extension but sufficiently free to pass on said third extension. One end 52 of the hub 53 of said wheel butts up against the shoulder 47 with the other end keyed or otherwise secured through slots 49a as explained hereinbefore to the driving plate 49. It will be seen therefore that even though the turbine wheel originally is freely mounted on the third extension 46, nevertheless because of its keyed relationship with the driving plate 49, the turbine wheel turns with the shaft 40.

A cup-shaped bearing plate 54 is arranged on the first extension 42. This plate has a flange 55 extending upwardly from the top surface of the plate 54 and butting against the shoulder 41.

The lower part of the impeller housing is provided with a concentrically disposed bore 57 in which spaced bushings 58 are pressed. The free end of each of the bushings overlaps the upper and lower edge of the bore with said overlap pressed firmly against the edge of the bore. In operation, the flat overlap adjacent the upper edge of the bore provides a flat bearing surface for the inner face of the cup-shaped bearing plate 54. A so-called floating washer 62 is mounted on said shaft and butts against the overlap adjacent the lower edge of the bore. This washer is held in position through a cup-shaped bearing plate 64, see Figure 8. The center or hub portion of the cup-shaped plate 64 butts against shoulder 44 and is held in position by a nut 65.

The top edge of plate 64 does not bear strongly against the floating washer 62, rather, taking in consideration the bearing relationship of the cup-shaped plate 54 and cup-shaped plate 64 and the impeller shaft 40, there is a play of about .006 of an inch vertically of the impeller shaft. This lessens the friction that would be generated and accordingly the possible burning out of the bearing portions of the cup-shaped bearing plates as would be the fact if they were strongly held against the faces or edges of the bushings 58.

The impeller 29 is in the form of a disc having a lower plane side, and an upper side provided with radially disposed, axially extending fins or blades 33 which are of decreasing height from the hub of the impeller outwardly.

The tapered end 66 of the shaft and the complementary hole formed in the impeller hub are disposed at a relatively steep angle so that tightening of the nut 67, by which the impeller is secured to the impeller shaft, will not exert an undue bursting strain on the impeller. However, the angle and fit of the impeller on the tapered shaft is such that when the nut 67 is securely tightened, the impeller is driven substantially entirely from its fric-

tional fit on the shaft rather than through any keyways through which the shaft and impeller may be connected.

A locking nut 68 is threaded on the second reduced extension 43 of the impeller shaft and is drawn tightly up against nut 65. This construction is used to insure that the bearing plate 64 is drawn upwardly on the shaft as far as possible and held thereon without slipping vertically.

It becomes very important that none of the exhaust gases which might escape from the supercharger, pass into the passenger compartment of the vehicle to injure the health of the occupants. To insure against such escape we provide a seal 69. This seal encircles the impeller shaft and is forced down on the annular hub 70 circumscribing the opening in the top of the turbine housing. To insure an extremely tight fit at all times we provide a cup-shaped bearing plate 71 arranged around the free edge 72 of said seal. This plate has a circular flange 73 extending entirely around said plate 71 and seats one end of a coil spring 74 which also encircles the impeller shaft and is positioned between the underside of oil reservoir 85a and said seal.

There is a possibility that some of the exhaust gases could seep along the shaft adjacent said seal, therefore said seal is provided with an internal annular groove 76 which is in communication with openings 77 in the shaft which in turn communicates with axial bore 78 in the shaft which runs entirely to the upper end of the shaft. A plug 67a closes off the upper end of bore 78 but we provide openings 79 adjacent the top of cup-shaped bearing plate 54 and such openings are in communication with a passage 79a (shown in dotted lines in Fig. 8) which opens to the atmosphere.

The shaft rotates at tremendous speeds and proper lubrication is of major importance. To provide adequate lubrication, we provide pressure lubrication of well known design wherein the oil is forced through port 83 and passageway 84 against the shaft 40. The oil may then progress along the shaft 40 between the bushings 58 and form proper lubricating film at all necessary points. It is understood that use of pressure lubrication entails a comparatively large quantity of oil and therefore escaping oil may be collected in a reservoir 85 which constitutes the interior of the lower blower housing. This reservoir empties into a conduit 86 in direct communication with the oil return to the engine.

The turbine 51 is mounted directly above the nozzle box 15 having equally spaced buckets 87 disposed about its circumferential surface. These buckets are in direct communication with the stator vanes 38 and receive the full charge of the exhaust gases passing through the stator vanes. The force of such gases against the buckets 87 causes the turbine wheel to rotate and such rotation actuates the impeller shaft 40 and accordingly imparts rotative movement of the impeller blade. How fast the impeller blade is moved rotatively is determined by the velocity of the exhaust gases from the engine.

As the turbine wheel revolves there is constant dissipation of the exhaust gases from the buckets and this spent gas is received into the exhaust passage 19 which then allows the gases to exhaust into the atmosphere.

Attention is directed to Figures 10 through 13 wherein we have modified the structure of Figures 2 and 8. The most prominent change is directed to the turbine wheel but we do have several other minor changes. In Figures 10 and 11 we provide only one bushing 58a which is unlike the two spaced bushings 58 in Figures 2 and 8. The passage 34a is arranged to direct oil therefor direct to the bushing 58a for lubricating purposes and, other than the rearrangement of the passage 34a and the use of only one bushing, the manner of supplying lubricant and the return of such lubricant remains the same as previously described relative to Figures 2 and 8.

The passage 78a in the impeller shaft 40a is in com-

munication with the internal groove 76a formed in the seal 70a through port 77a but instead of being closed by a plug at the top of the shaft, such passageway 78a is open whereby the escaping exhaust gas may flow directly into the collecting chamber 34a and may tend to heat the fuel mixture as it is drawn from the carburetor. This heating is minor because only small amounts of such exhaust gas escapes through passage 78a. Because of this particular arrangement no ports 79 are provided to dissipate exhaust gas through ports 82 in the impeller as in Figures 2 and 8. Therefore, ports 79 and 82 of Figures 2 and 8 are not used.

Providing the impeller shaft with an internal opening serves another useful purpose. Instead of having a solid shaft to collect and hold heat, such passageway enables the heat generated by the revolving parts to more rapidly dissipate such heat flow from hot region to supporting bearings.

The turbine wheel housing as disclosed in Figure 10 is directed specifically to a new form of bearing mounting including means to receive lubricant from the engine pump and inject this lubricant, under pressure, to a bushing in which the lower end of impeller shaft 40a rotates and then arrange to return this lubricant back again to the engine reservoir.

The impeller shaft 40a extends through the turbine wheel 51, said shaft having a threaded portion 45a onto which the internally threaded sleeve member 91 is threaded. The upper end of said sleeve member engages the underside of drive plate 90. The driving connections from the turbine wheel to the impeller shaft is accomplished in the same manner as in the apparatus of Figs. 2 and 8. The drive plate has a pair of axially extending diametrically opposed driving lugs 49b which project into corresponding diametrically opposed notches 49c formed in the lower end of the turbine wheel hub 53a thereby establishing driving engagement between the wheel hub and the drive plate. The drive plate in turn has an axial bore therethrough with segmental portions 48b formed in said bore for engagement with the diametrically opposed flat surfaces 48a which are formed on the impeller shaft. Driving engagement is thus established between the drive plate and the impeller shaft. The details of the driving connections are shown in Figs. 10a and 13.

The bottom of sleeve member 91 is provided with an enlarged skirt or outwardly and downwardly extending member 92 having the downwardly extending portion 93 freely rotatable within an annularly internally serrated head section 94 of bearing retainer member 95. The bearing retainer member includes an annular groove 94a adjacent the head portion 94 which functions as a lubricant reservoir and a hub portion 96 has an axial bore into which sleeve bearing 96a is pressed. The sleeve bearing is, of course, stationary with the bearing retainer member 95 and accommodates the lower end of the shaft 40a, thus providing a bearing support for the shaft which is axially spaced from the upper bearings 58a. The lower part of said retainer includes a lubricant ingress port 97 and an exhaust port 98 for lubricating the lower end of the shaft and the bearing 96a.

A seal 99, similar to seal 70a encircles the sleeve 91 and bears up against the bottom 100 of the turbine wheel housing. This seal is held in the above operative position by a spring retainer 101 which is provided with a circular dish-shaped outer ring 102 to accommodate one end of a coil spring 103, with the other end of this spring nesting within an inwardly turned flange 104 constituting the open ended lower portion of the housing 105. This housing 105 is secured to the turbine wheel housing in any suitable manner as by welding.

Resting on the top of skirt 92 and encircling and secured to a portion of the sleeve 91 is an air agitator fan

106 to which is attached equally and centrally spaced blades 107.

A cup-shaped air shield 108 is secured to the housing 105 by means of the multi-legged bracket 105a (see Fig. 11) and spaced fastening elements 109. The upper part of the air shield is provided with a curved upwardly flaring extension 110 which assumes the function as an air diffuser for air sucked up through the open ended air shield from the outside and acts as a cooling medium in the unit. Windows 114 are spaced equally about the housing 105 and are used to expel the air after passing through the unit.

The seal 99 is provided with an internal annular groove 111 which communicates with a passage 112 leading directly into passage 78a of the shaft. Any escaping exhaust gas below the turbine wheel housing may thus be collected and delivered through the top of the impeller shaft 40a.

The bearing retainer member 95 is provided with an ingress port 116 communicating directly with passage 97 and an exhaust port 115 communicating directly with exhaust passage 98. In operation, therefore, lubricant is delivered under pressure from an engine pump (not shown) into passage 97 where it is forced through port 116 directly against the shaft to provide sufficient lubricant for the moving shaft. The lubricant then escapes through the port 115 into passage 98 and then back to the engine reservoir, not shown.

It is thought that the construction, manipulation, utility, and advantages of this invention will now be apparent to those skilled in this art without a more detailed description thereof.

The present embodiment of the invention has been described in considerable detail merely for the purpose of exemplification since in actual practice it attains the features of the invention and the above description.

It will be apparent that changes in the details of construction, and in the combination and arrangements of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed or sacrificing any of its advantages.

Having thus described our invention, what we claim is:

1. A supercharger comprising a lower turbine wheel housing and an upper blower housing, said upper housing including a complementary cover, an impeller, an impeller holder and a lower cover, said complementary cover and the upper part of said holder forming an impeller enclosure, said holder provided with a centrally vertically disposed bore, a bushing inserted within said bore and having a free end overlapping the end of said bore and pressed down on the end of said bore, said holder having an opening in the bottom for communication with the interior of said holder, said lower cover closing said opening and in conjunction with said holder forming a reservoir, a turbine wheel disposed in said turbine wheel housing, said impeller having a bore therein, an impeller shaft, said shaft including three distinct sections of different diameters, one of said sections rotatable within the bushing in said holder, one end of said shaft mounting said impeller, said turbine wheel mounted on and rotatable with the opposite end of said shaft, a driving plate secured to said opposite end of the shaft and engaged with said wheel, said impeller rotated by movement of said wheel.

2. A supercharger comprising a lower turbine wheel housing and an upper blower housing, said upper housing including a complementary cover, an impeller, an impeller holder and a lower cover, said complementary cover and the upper part of said holder forming an impeller enclosure, said holder provided with a centrally vertically disposed bore, spaced bushings inserted within said bore and having their free ends overlapping the adjacent ends of said bore and pressed down on said ends of said bore, said holder having an opening in the bottom for communication with the interior of said holder,

a cup-shaped bearing plate arranged on said shaft and associated with one of said bushing overlapping end, a second bearing plate arranged on said shaft and indirectly associated with the other bushing overlapping end, said lower cover closing said opening and in conjunction with said holder forming a reservoir, a turbine wheel disposed in said turbine wheel housing, said impeller provided with a bore, an impeller shaft, said shaft including several distinct sections of different diameters, one of said sections rotatable within the bushings in said holder, one end of said shaft mounting said impeller, said turbine wheel mounted on and rotatable with the opposite end of said shaft, a driving plate secured to said opposite end of the shaft and engaged with said wheel, said impeller rotated by movement of said wheel.

3. A turbo-supercharger comprising a lower turbine wheel housing and an upper blower housing, said upper housing including a complementary cover, an impeller, an impeller holder and a lower cover, said complementary cover and the upper part of said holder forming an impeller enclosure, said holder provided with a centrally vertically disposed bore, spaced bushings inserted within said bore and having a free end overlapping the end of said bore and pressed down on the end of said bore, said holder having an opening in the bottom for communication with the interior of said holder, spaced bearing plates arranged on said shaft on each end of said bore, one of said plates directly associated with one overlapping bushing end, the other indirectly associated with the other overlapping bushing end but separated therefrom by a floating washer, said last mentioned bearing plate held in position by any suitable means on said shaft, said lower cover closing said opening and in conjunction with said holder forming a reservoir, said turbine wheel housing including a turbine wheel, said impeller provided with a bore, an impeller shaft, said shaft including several distinct sections of different diameters, one of said sections rotatable within the bushings in said holder, one end of said shaft mounting said impeller, said turbine wheel rotatable on the opposite end of said shaft, a driving plate secured to said opposite end of the shaft and engaged with said wheel, said impeller rotated by movement of said wheel,

4. A turbo-supercharger comprising a lower turbine wheel housing and an upper blower housing, said upper housing including a complementary cover, an impeller, an impeller holder and a lower cover, said complementary cover and the upper part of said holder forming an impeller enclosure, said holder having a bottom opening, said lower cover closing said opening and in conjunction with said holder forming a reservoir, a turbine wheel in said lower housing, said impeller provided with a bore, an impeller shaft, said shaft including several distinct sections of different diameters, one of said sections rotatable within said holder, a pressure lubrication device mounted in said reservoir for directing fluid against said section within said holder, said fluid received in the reservoir and expelled through an opening in the lower cover, one end of said shaft mounting said impeller, said turbine wheel mounted on and rotatable with the opposite end of said shaft, a driving plate secured to said opposite end of said shaft and engaged with said wheel, said impeller rotated by movement of said wheel.

5. A turbo-supercharger comprising a lower turbine wheel housing and an upper blower housing, a turbine wheel in said lower housing, an impeller enclosed in said upper housing, said impeller having a frusto-conical bore, an impeller shaft having one end mounting said impeller, a driving plate mounted on the shaft and having driving engagement with the turbine wheel and the shaft, said impeller rotated by movement of said wheel, a sealing washer surrounding the shaft and bearing against said lower housing, said washer provided with a groove on its inside surface, said shaft provided with an internal longitudinal passageway, an opening in said shaft provid-

ing communication with said groove and said passageway, the end of said passageway remote from said sealing washer communicating with said upper housing.

6. A turbo-supercharger comprising a lower turbine wheel housing and an upper blower housing, a turbine wheel in said lower housing, an impeller enclosed within said upper housing, said impeller provided with a bore, an impeller shaft having one end mounting said impeller, a driving plate secured to the opposite end of the shaft and having driving engagement with said turbine wheel, said impeller rotated by movement of said wheel, a sealing washer provided with an internal groove surrounding the shaft and bearing against said lower blower housing, said shaft provided with an internal longitudinal extended passageway, ports intersecting opposite ends of said passageway and open exteriorly of said shaft at one end of the passageway with a port communicating with said groove, the other end of the passageway with another port communicating with the atmosphere.

7. A turbo-supercharger comprising a lower turbine wheel housing and an upper blower housing, a turbine wheel in said lower housing, an impeller enclosed within said upper housing, said impeller provided with a bore, an impeller shaft having one end mounting said impeller, the said turbine wheel mounted on the opposite end of said shaft, a driving plate mounted on the opposite end of the shaft and having driving engagement with the shaft and the wheel, said impeller rotated by movement of said wheel, a sealing washer encircling said shaft and supported in said lower housing, a coil spring encircling said shaft and interposed between said upper blower housing and said washer, said spring forcing said washer against said lower housing, said shaft provided with an internal longitudinally extended passageway, ports intersecting opposite ends of said passageway and open exteriorly of said shaft, one end of the passageway with a port communicating with said groove, the other end of the passageway with another port communicating with the atmosphere.

8. A turbo-supercharger comprising a lower turbine wheel housing and an upper blower housing, said upper housing including a complementary cover, an impeller, an impeller holder and a lower cover, said complementary cover and the upper part of said holder forming an impeller enclosure, said holder provided with a centrally vertically disposed bore, spaced bushings inserted within said bore and having free ends overlapping the opposite ends of said bore, said holder having an opening in the bottom for communication with the interior of said holder, an impeller shaft having one end mounting said impeller, spaced bearing plates arranged on said shaft on each end of said bore, one of said plates directly associated with one overlapping bushing end, a floating washer interposed between the other plate and the overlapping bushing end, means for holding said last mentioned bearing plate in position on said shaft, said lower cover closing said opening and in conjunction with said holder forming a reservoir, a turbine wheel in said turbine wheel housing, said shaft including several distinct sections of different diameters, one of said sections rotatable within the bushings

in said holder, said turbine wheel mounted on the end of the shaft opposite from the impeller end, a driving plate on the shaft and having driving engagement with the wheel and the shaft rotated by exhaust gas delivered from said exhaust port, said impeller rotated by movement of said wheel, the last mentioned bearing plate arranged to intermittently bear against said floating washer.

9. A turbo-supercharger comprising a lower turbine wheel housing and an upper blower housing, said upper housing including a complementary cover, an impeller, an impeller holder and a lower cover, said complementary cover and the upper part of said holder forming an impeller enclosure, said holder provided with a centrally vertically disposed bore, spaced bushings inserted within said bore and having free ends overlapping the opposite ends of said bore and pressed down on the respective ends of said bore, said holder having an opening in the bottom for communication with the interior of said holder, an impeller shaft having one end mounting said impeller, spaced bearing plates arranged on said shaft at each end of said bore, one of said plates directly associated with one overlapping bushing end, a floating washer interposed between the other plate and the other overlapping bushing end, said last mentioned bearing plate held in position by a nut threaded on said shaft, said lower cover closing said opening and in conjunction with said holder forming a reservoir, a turbine wheel in said turbine wheel housing, said impeller shaft including several distinct sections of different diameters, one of said sections rotatable within the bushings in said holder, said turbine wheel fixed to the end of the shaft opposite from the impeller end, a driving plate secured to said opposite end of the shaft and drivingly engaged with said wheel and said shaft, said impeller rotated by movement of said wheel, the last mentioned bearing plate arranged to intermittently bear against said floating washer, a sealing washer provided with an internal groove surrounding the shaft and bearing against said lower blower housing, said shaft provided with an internal longitudinally extended passageway, ports intersecting opposite ends of said passageway and open exteriorly of said shaft at one end of the passageway with a port communicating with said groove, the other end of the passageway with another port communicating with the atmosphere.

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