April 29, 1947. O. W. SCHEY ET AL 2,419,598

FUEL INJECTION IMPELLER FOR SUPERCHARGERS

Filed June 6, 1945 2 Sheets-Sheet 1

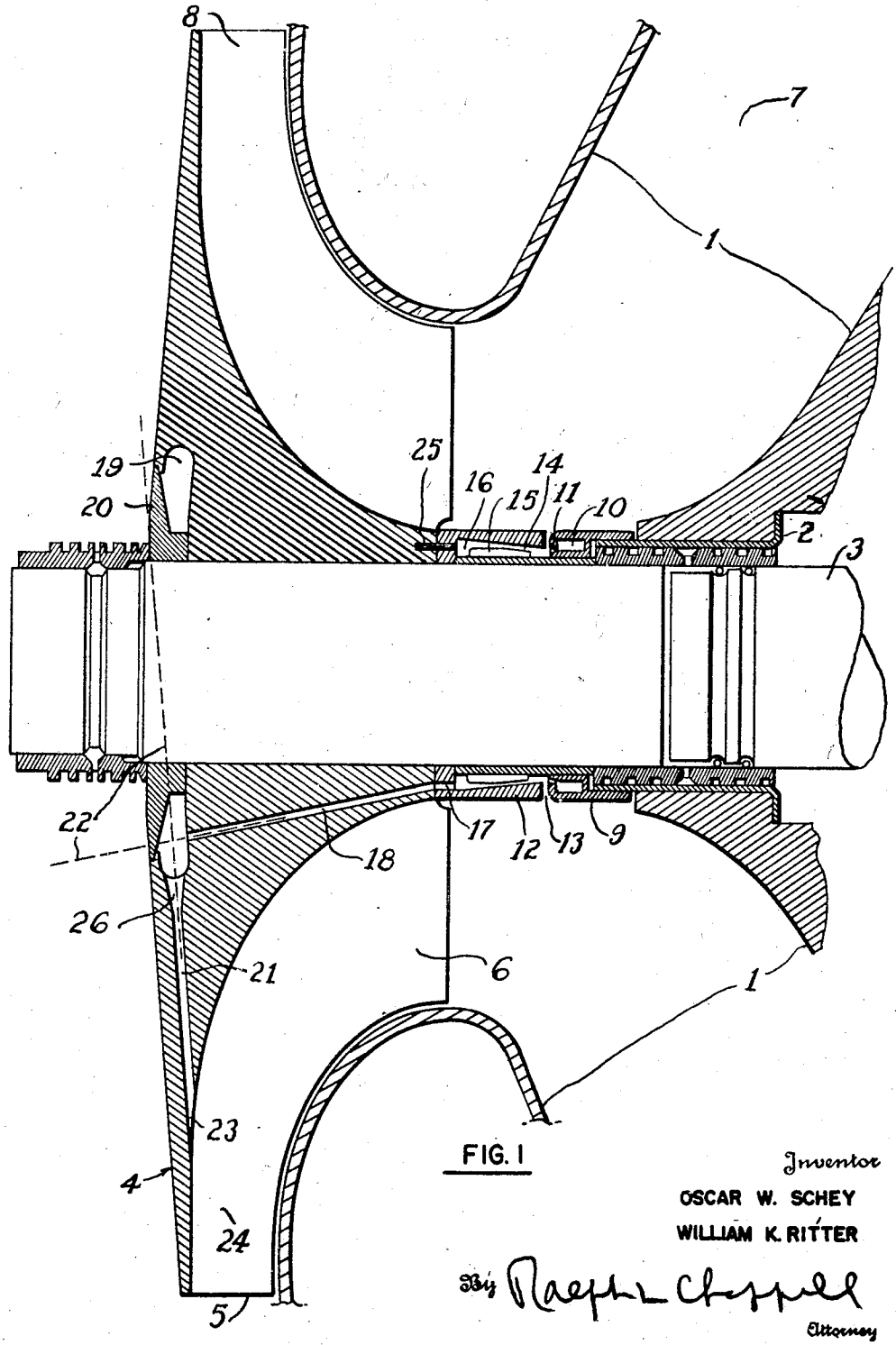

FIG. 1

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FUEL INJECTION IMPELLER FOR SUPERCHARGERS

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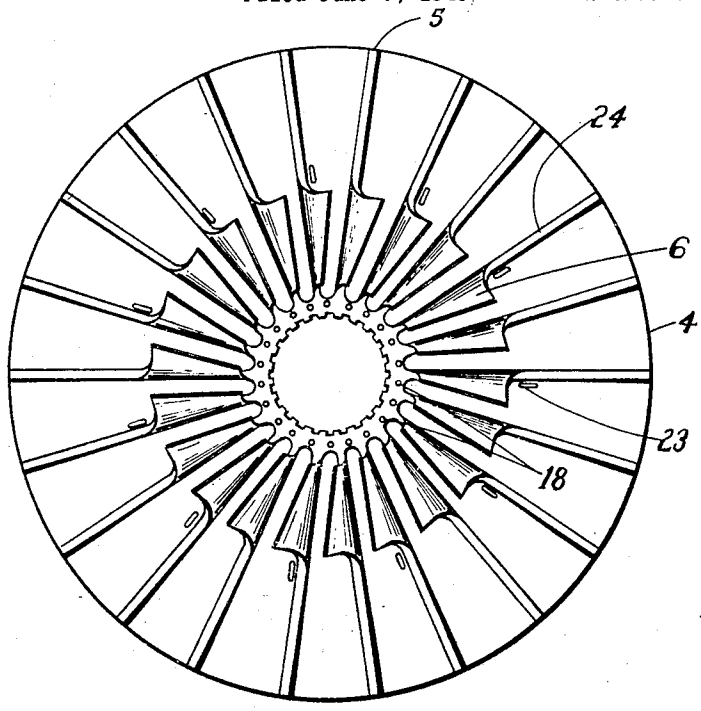

FIG. 2

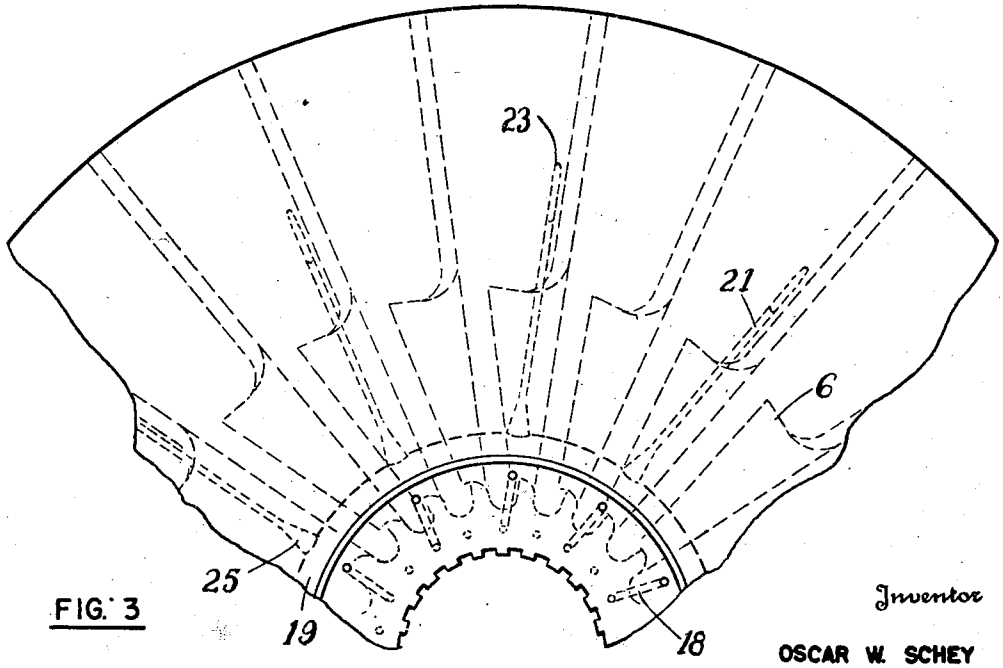

FIG. 3

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FUEL INJECTION IMPELLER FOR SUPERCHARGERS

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2 Claims. (Cl. 261—90)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates to an improvement in fuel injection impellers for centrifugal superchargers.

It has been the practice to inject fuel into the air-stream either from stationary jets affixed to the housing of the impeller whereby the combined fuel and air was pulled into the intake portion of the impeller, or to inject the fuel into the air-stream as the air enters the impeller vanes either from stationary jets or from apertures in the impeller. The objection to these practices is that fuel is introduced into the air-stream where it can impinge directly onto the stationary impeller shroud and thus promote unequal distribution; or there may be air-flow restrictions such as venturi used to promote mixing but which cause air pressure losses. In the present invention, there is a decided improvement in fuel-air mixture, without losses such as imposed by Venturi passages, because fuel will not be thrown onto the stationary impeller shroud but will be delivered in a symmetrical peripheral pattern at the impeller discharge.

An object of this invention is to provide a fuel injection impeller for centrifugal superchargers that will give an improved uniformity of fuel-air ratio distribution to each of the cylinders of an internal combustion engine.

A further object of this invention is to provide an improved fuel injection impeller for centrifugal superchargers that will discharge the fuel by centrifugal force from the impeller into the air-stream in a symmetrical pattern in the region just outside the impeller where the absolute velocity of the air is higher than at any other point in the induction system.

Another object of this invention is to provide a fuel injection impeller for centrifugal superchargers that will introduce fuel by centrifugal force into the air-stream in such a manner that no fuel can strike the stationary impeller shroud by being thrown radially because of centrifugal separator action of the impeller blades.

Other objects and advantages of this invention will become apparent as the description proceeds and is considered in connection with the claims and accompanying drawings wherein like characters of reference designate like parts in the several views and wherein:

Fig. I is a cross sectional view of a centrifugal supercharger showing the fuel injection impeller embodying this invention with the conventional drive shaft, fuel intake connection, air inlet, mixed fuel-air exhaust and housing,

Fig. II is a front plan view of the impeller

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showing the position of the fuel exhaust ports in the impeller, and,

Fig. III is a rear fragmentary plan view of the impeller showing the annular distribution chamber with the enclosure plate removed and showing the position of the discharge passages and ports.

Referring now to the drawings, the numeral 1 represents a housing or casing which is mounted by suitable means on an engine or power plant (not shown). Any conventional bearing 2 is provided in the housing 1 and a drive shaft 3, driven by the said engine or power plant is rotatably supported by the said bearing 2. A rotary impeller 4, having compression vanes 5 with exhaust portions 24 and intake portions 6 is rigidly affixed by any suitable means to the drive shaft 3. Air is drawn into the housing 1 through an inlet 7, by the rotation of the said impeller 4. The air is compressed, as will be described later, and discharged through an exhaust 8.

Fuel is metered by any standard carburetor or metering device (not shown) and is delivered by suitable connections to a nozzle ring 9 mounted in the casing 1 concentrically around but not in contact with the drive shaft 3, as shown in Fig. I. An annular chamber 10 is provided within the nozzle ring 9 to receive fuel. A circumferential orifice or other suitable opening is provided in the said nozzle ring at 11 through which fuel is discharged to a collector cup 12.

A fuel passage 13 between the nozzle ring 9 and the collector cup 12 is open to atmospheric pressure. With the fuel passage 13 partially full, air will be drawn through said fuel passage and will relieve any tendency to create periodic fluctuations in fuel flow.

The collector cup 12 is constructed in the form of an annular shell, that is affixed by any suitable means to and rotating with the impeller 4. An annular chamber 14, whose diameter increases from the nozzle ring 9, as shown, is provided in the collector cup 12 whereby fuel is drawn by centrifugal force from the said nozzle ring and is forced into the impeller 4. Within the said annular chamber 14 are fuel inducer vanes 15 adapted to throw any fuel that may fall from the inner walls of the collector cup 12, due to gravity and insufficient tangential speed, back to the walls of said collector cup. The annular chamber 14 is enlarged at 16, as shown, to provide for the suppression of any peripheral irregularity in fuel flow through the said collector cup. Suitable outlet apertures 17, communicating with the enlargement 16 of the annular chamber 14, are pro-

vided in the collector cup 12 to allow passage of fuel from the said collector cup to fuel transfer passages 18. Pins 25 hold the said chamber 14 in position. The said fuel passages 18 have a constantly increasing radius of rotation, as shown, whereby fuel is drawn by centrifugal force through the said passages 18 into an annular fuel distribution chamber 19. The number and size of the fuel transfer passages 18 is dictated by the strength of the impeller and the amount of fuel desired.

The annular fuel distribution chamber 19, which is sealed by an enclosure plate 20, serves as an additional chamber for further eliminating any non-symmetry of fuel flow and permits passage by centrifugal force of the fuel to discharge passages 21. A further purpose of the annular chamber 19 is to permit the drilling of both the transfer passages 18 and the discharge passages 21, as indicated by the extended dotted lines 22 of Fig. I.

The said discharge passages 21 are constructed with open communication to the annular chamber 19 diverging in circumference at the said chamber in the shape of a funnel 26, as shown, to facilitate the flow of fuel from the chamber 19 into the said passages 21. The centrifugal force setup by the rotation of the impeller causes fuel to flow from the chamber 19 into the funnel 26 and thence into the passages 21.

Outlet ports 23 communicate with and receive fuel by centrifugal force from the discharge passages 21. Fuel is discharged into the air-stream from the said outlet ports 23, as will be more particularly described later. The said outlet ports 23 may be of any size or shape, or may be fitted with a conventional type of spray nozzle. The radial position of the said outlet ports 23 is between the vanes 5 preferably to the rearward near the forward moving face of the exhaust portion 24 of the impeller vane 5, as more clearly shown in Fig. II; this arrangement of the ports 23 will cause droplets of fuel to be struck and broken up by the ejection portion 24 of the impeller thereby insuring a better distribution of fuel into the air-stream. The outlet ports 23 are preferably spaced alternately between the impeller vanes 5, as shown in Fig. II.

The axial position of the outlet ports 23 is located so that fuel being thrown radially from the outlet ports 23 cannot strike the stationary impeller shroud 1. The fuel thus cannot accumulate on the stationary impeller shroud 1 and the symmetrical peripheral fuel distribution established by the annular fuel distribution chambers 16 and 19 will be maintained. The fuel is thus

delivered in a symmetrical peripheral pattern at the discharge edges of impeller vanes 5 and the mixing of fuel and air occurs mainly just outside the impeller where the absolute air velocity is higher than at any other point in the induction system. Any variation in the construction of the impeller will necessitate variation of the position of the outlet ports 23 but the requirement of location so that fuel discharged radially cannot strike the stationary impeller shroud 1 remains the same.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What we claim is:

1. In combination with a rotary impeller for centrifugal superchargers, an air intake shroud for the impeller, a plurality of radial vanes on the impeller to compress the air in the said shroud, an annular nozzle ring carried by the impeller, an annular fuel mixing chamber carried by the impeller, an annular fuel distribution chamber carried by the impeller, and a plurality of fuel passages leading from the said fuel mixing chamber to the said distribution chamber.

2. In combination with a rotary impeller for centrifugal superchargers, an air intake shroud for the impeller, a plurality of radial vanes on the impeller to compress the air in the said shroud, an annular nozzle ring carried by the impeller, an annular fuel collector cup carried by the impeller, the said fuel collector cup containing a fuel mixing chamber that increases in diameter in the direction of flow of the fuel, an annular fuel distribution chamber carried by the impeller, a plurality of diverging fuel passages leading from the said fuel mixing chamber to the said distribution chamber, and a plurality of re-entrant discharge passages leading from the said distribution chamber to the air stream.

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