

Nov. 2, 1943.

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2,333,150

ATOMIZER

Filed Aug. 27, 1941

4 Sheets-Sheet 1

FIG. 1.

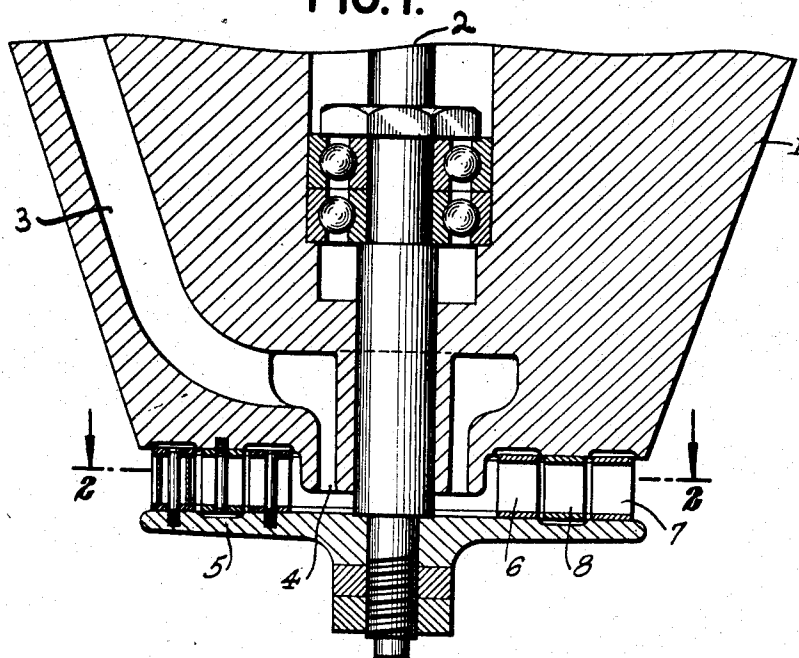
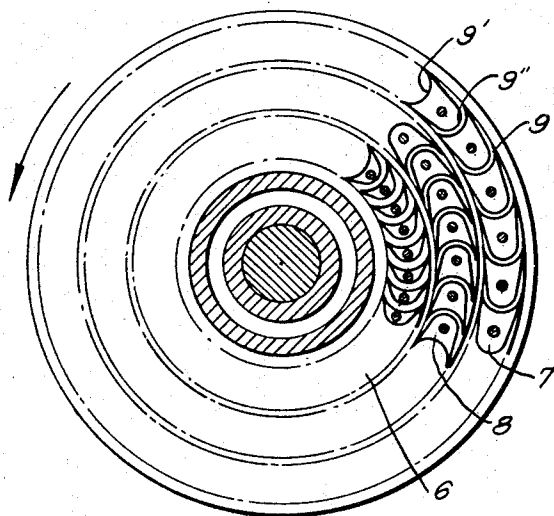


FIG. 2.



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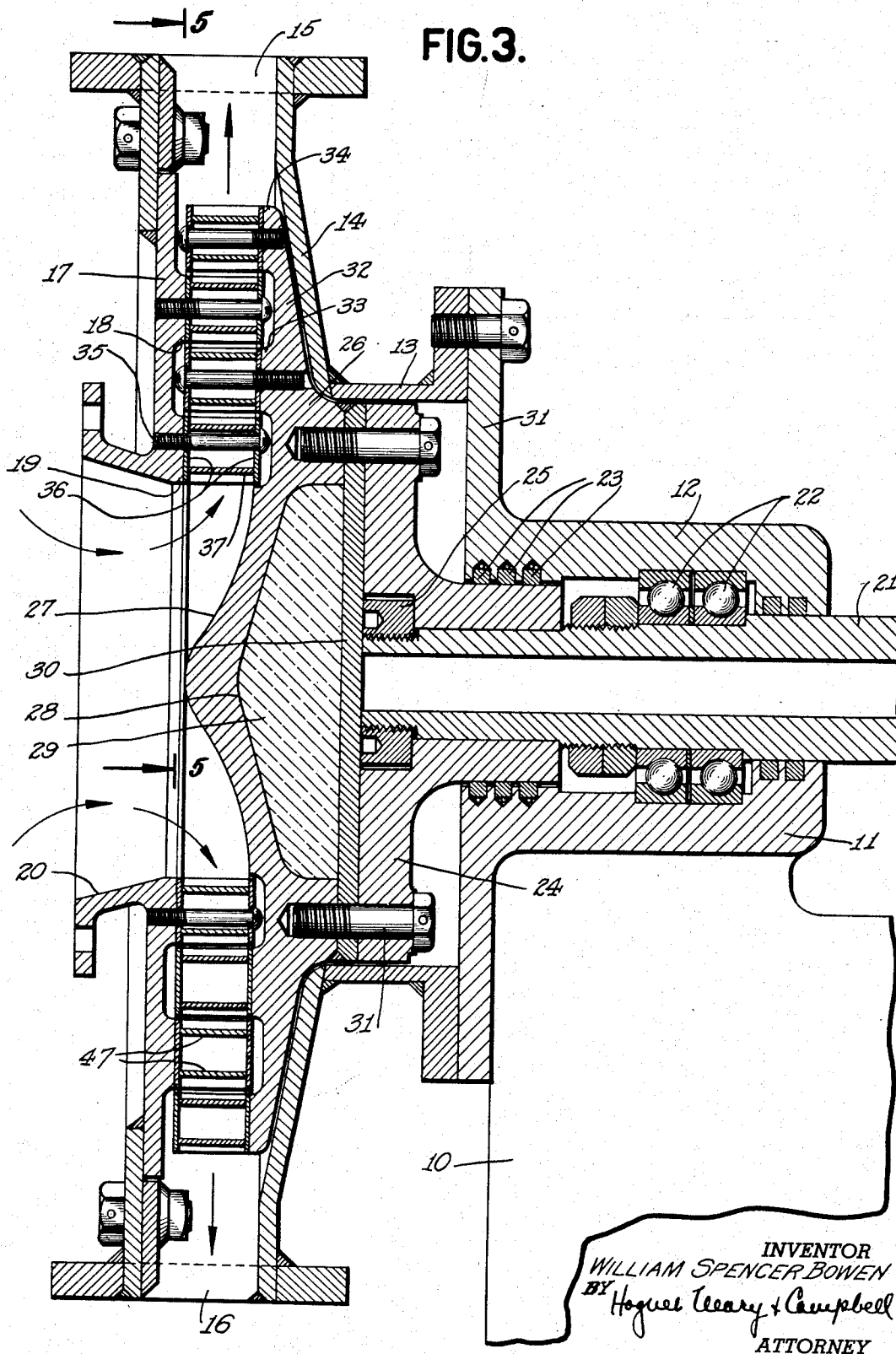
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FIG. 3.



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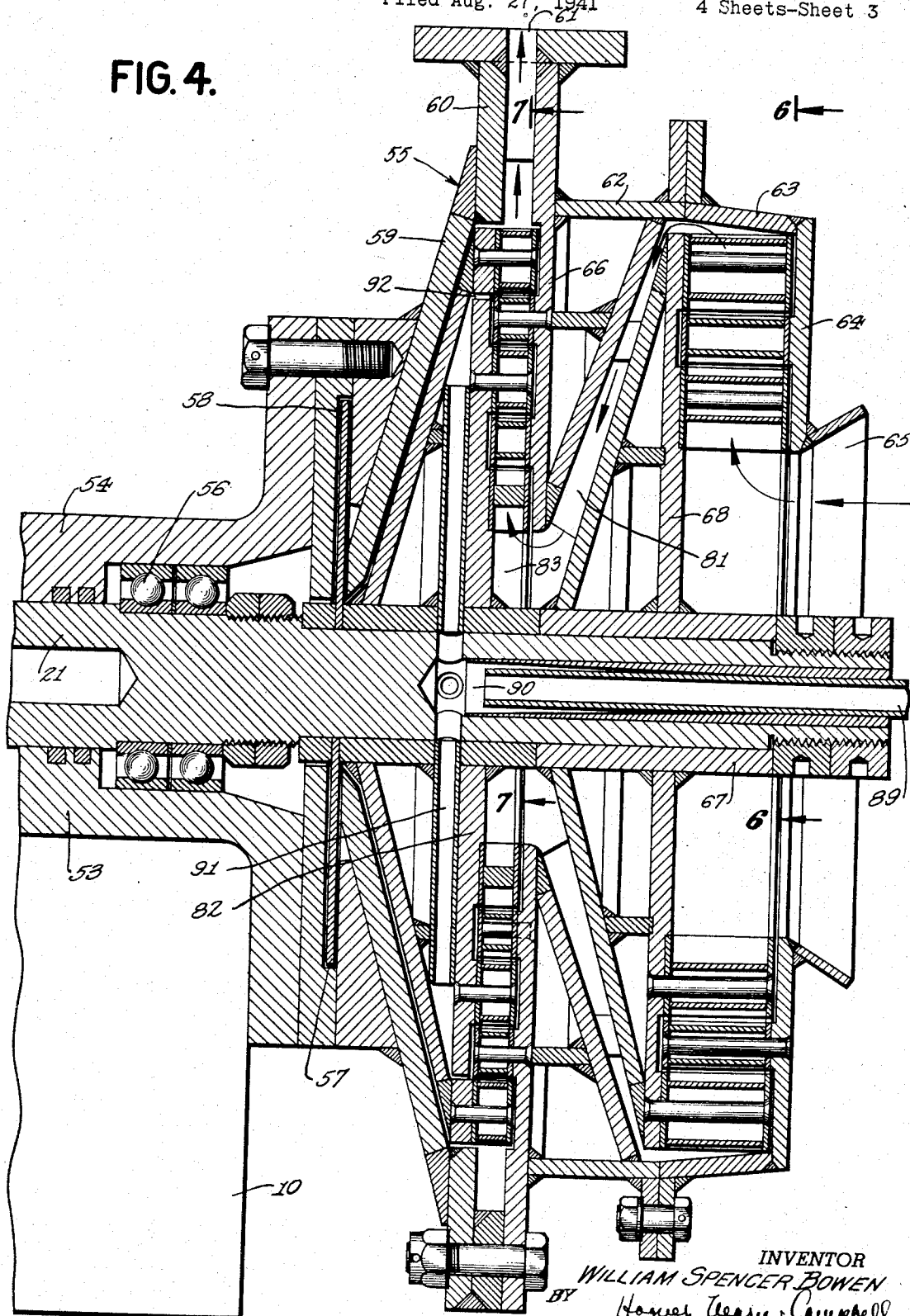
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FIG. 4.



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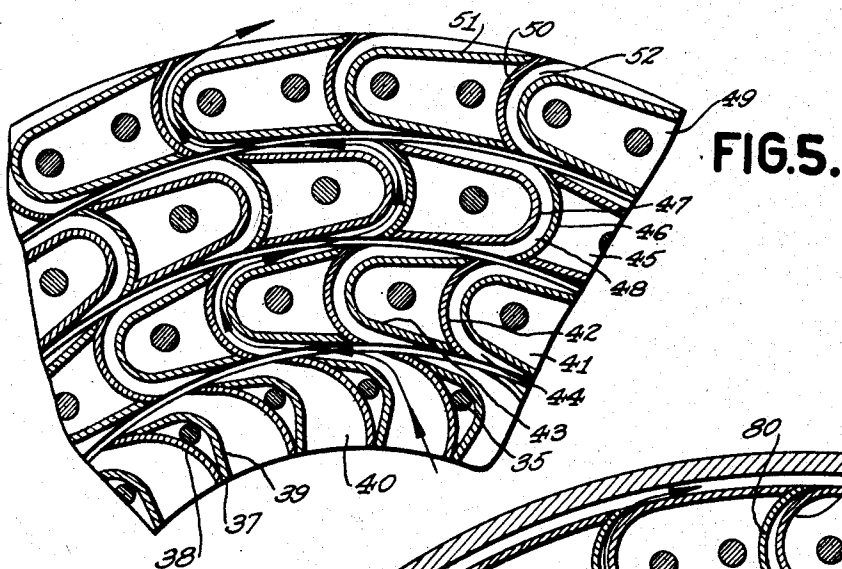


FIG. 5.

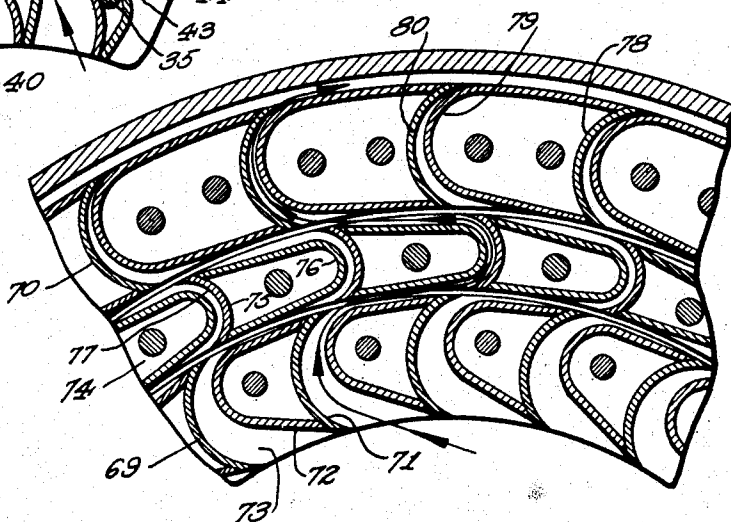


FIG. 6.

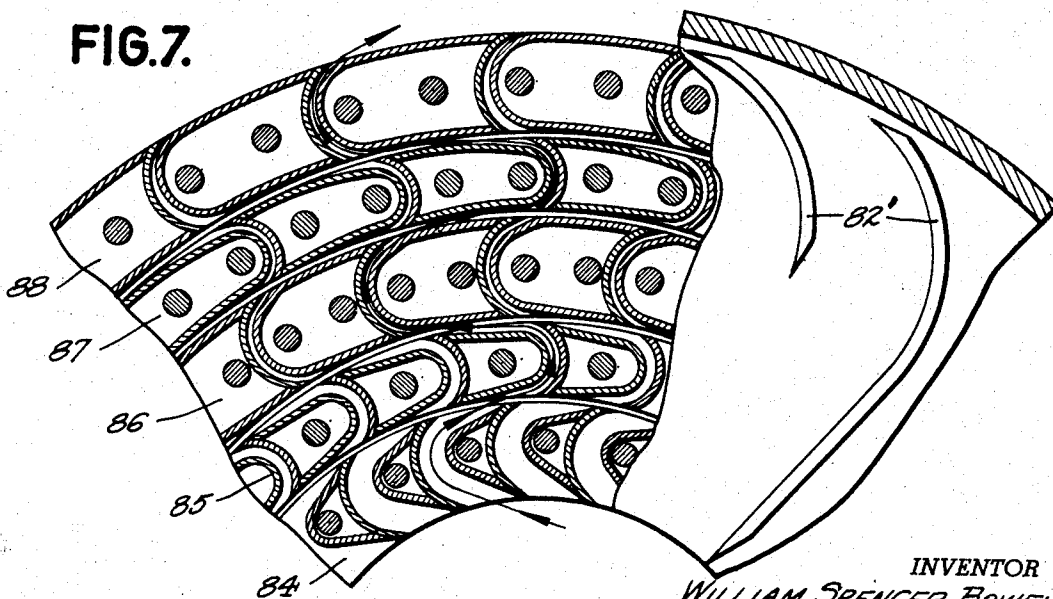


FIG. 7.

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ATOMIZER

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Application August 27, 1941, Serial No. 408,451

3 Claims. (Cl. 261—30)

The present invention relates to atomizing mechanisms and embodies, more specifically, an improved form of atomizer in which atomization is rendered more effective by the utilization of high kinetic or velocity energy.

More particularly, the invention embodies an improved form of rotary atomizer in which the liquid to be atomized is fed into the device axially thereof and is subjected to curved radially disposed rotating vanes to produce increased velocity and consequent impact due to the change in direction of the liquid flowing through the vanes. It is contemplated, in accordance with the present invention, to provide a rotary atomizer having two or more stages, this being accomplished by providing alternate courses of rotating and stationary vanes, the stationary vanes curving in a direction opposite to that of the rotary vanes, thus to change the direction of travel of the fluid passing through the stationary vanes in order that it may be directed against the subsequent stage of rotary vanes, thus to compound the velocities of the fluid flowing through the device.

It is, accordingly, an object of the present invention to provide a rotary atomizer of the type utilizing curved vanes in a succession of stages, the vanes being arranged in such fashion as to increase the velocity of the fluid flowing there-through.

A further object of the invention is to provide an atomizer of the above character wherein the energy of the stream flowing through the mechanism is as far as possible kinetic or velocity energy which results in the building up of extremely high velocities to produce a microscopically thin film of liquid passing over the vanes at the outer edges thereof, thus to produce microscopically small atomized particles.

The foregoing and other objects are realized in a rotary atomizer having a plurality of courses of vanes producing, in effect, a compound action on the liquid by providing alternate rotary and stationary stages in advance, the curvatures of the respective vanes being of opposite direction in order to change the direction of the velocity of the streams and by the tapering effect of the adjacent surfaces of adjacent vanes to build up pressure which results in greatly increasing the velocity of the streams in the several stages.

A further and more specific object of the invention is to provide an improved supercharging mechanism embodying the features of the

compound atomizer above referred to. This supercharging mechanism enables the exhaust gases to be utilized more effectively to secure a high degree of compression and atomization of the fuel charge.

The present invention will be illustrated hereinafter as being embodied in a compound atomizer as well as in an exhaust driven supercharger in order that the invention may be understood fully. In this connection, reference will now be had to the accompanying drawings, wherein:

Fig. 1 is a view in section, taken through a compound atomizer constructed in accordance with the present invention.

Fig. 2 is a view in section, taken on the line 2—2 of Fig. 1 and looking in the direction of the arrows.

Fig. 3 is a view in vertical section, taken in a plane lying in the axis of the mechanism and showing the preferred form of exhaust driven turbine utilized by the present invention.

Fig. 4 is a view similar to Fig. 3, showing the compressor that is driven by the turbine of Fig. 1. In this connection, Figs. 3 and 4, when taken together, illustrate the complete assembly of the present invention.

Fig. 5 is a detail enlarged view, in section, taken on the line 5—5 of Fig. 3 and looking in the direction of the arrows.

Fig. 6 is a view similar to Fig. 5, taken on the line 6—6 of Fig. 4 and looking in the direction of the arrows.

Fig. 7 is a view similar to Fig. 5, taken on the line 7—7 of Fig. 4 and looking in the direction of the arrows.

Referring to Figs. 1 and 2, an atomizer or spray mechanism is illustrated as being formed of a casing 1, in which a drive shaft 2 is journaled. The casing is formed with a passage 3 through which a substance to be atomized may be fed to a feed nozzle 4. The feed nozzle extends downwardly into a rotating head formed of a plate 5 which is secured to rotate with the shaft 2.

Upon the plate 5, concentrically arranged series of vanes 6 and 7 are formed. Between the vanes 6 and 7, a circumferential series of stationary vanes 8 are mounted on the housing 1.

As illustrated in Fig. 2, each vane is formed of two curved plates 9' and 9'', being secured in position to provide passages 9 between the adjacent plates of adjacent vanes. The passages 9 curve in the manner shown and taper in such

fashion that the cross-sectional area of the passages diminishes as the fluid progresses radially outwardly through the passages.

In view of the tapering and curved formations of the vanes, the pressure upon the fluid flowing through the atomizer increases as the fluid progresses radially outwardly. This pressure is transformed into high kinetic or velocity energy and because of the change of direction by reason of the different curvature of the surfaces of the curved and stationary vanes, the velocity of the fluid increases tremendously. It will be seen that the velocity increase continues cumulatively in each of the rotary and stationary vanes and until the fluid reaches the periphery of the wheel. In compressible fluids, therefore, the compression of the fluids is increased substantially, whereas with fluids such as water or oil, the result will be the building up of pressures. As a result, the fluid or liquid leaving the atomizer is travelling under high velocity and the film is, accordingly, extremely thin. When this thin film strikes the air, it forms into the extremely small and microscopic particles. Inasmuch as the mechanism is such as to increase the velocity of the liquid to be atomized very substantially over the velocity of the rotating head, it is possible to rotate the head at a relatively low speed and yet attain velocities of great magnitude in the liquid leaving the periphery of the atomizer. For example, by proper design, peripheral speeds of the liquid leaving the atomizer in the order of 30,000 to 40,000 feet per minute, can be achieved by rotating the head at approximately 3600 R. P. M. It will be seen that this enables driving mechanism easily available to be used to rotate the head rather than to require specifically designed high speed mechanism as has been necessary heretofore.

Referring to Figs. 3 to 7, Fig. 3 illustrates the left-hand end of an exhaust driven supercharger embodying the present invention, while Fig. 4 shows the right-hand end. If these figures are placed side by side, the entire mechanism will be readily apparent.

Referring to Fig. 3, the exhaust driven turbine is shown as having a support 10 formed with a bearing housing 11 and housing cap 12. To the housing 11 and cap 12, there is bolted a casing 13 which is formed with an outwardly flaring wall 14, formed with top and bottom outlets 15 and 16, respectively. A front plate 17 is removably secured to the wall 14 and is formed with annular vane supporting surfaces 18 and 19. Centrally of the plate 17 there is formed an inlet 20 into which the exhaust gases are introduced, as indicated by the arrows in Fig. 3. Similar arrows illustrate the flow of the exhaust gases through the outlets 15 and 16.

Mounted within the bearing 11 is a drive shaft 21 provided with suitable bearings 22 and sealing rings 23. The drive shaft is formed with a flange plate 24 which may be locked in position by means of a lock 25. A turbine rotor is shown at 26 and is formed with a central gas deflecting surface 27 as illustrated, in order that the exhaust gases may be directed effectively into the vanes of the turbine. The central portion of the rotor is hollow as indicated at 28 in order to receive an insulating material 29. A retaining plate 30 is welded or otherwise secured to the rotor 26 and the entire assembly is secured to the flange plate 24 by means of bolts 31.

The rotor 26 is formed with a peripherally

flanged extension 32 having annular vane supporting bosses 33 and 34.

Each of the bosses 18, 19, 33 and 34 is provided with a series of vanes, the structure of which is illustrated in Fig. 5. For example, boss 19 has secured thereto by means of bolts 35, side plate 36 between which a series of vanes 37 are secured. This series of vanes is illustrated in Fig. 5 and each of the vanes of the series is formed with a driving plate 38 and a guide plate 39. As shown in Fig. 5, the plates are formed and mounted in such fashion as to provide converging fluid passages 40. Boss 33 is formed with a series of vanes 41, as illustrated in Fig. 5, secured in the same fashion that the series of vanes 37 are secured, and being formed with cooperating guide plates 42 and 43. These guide plates form fluid passages 44 which serve to change the direction of movement of the fluid in order that the energy thereof may be utilized to drive the rotor 26. The plates 42 thus become the driving vanes or surfaces for the first stage of the impeller.

Boss 18 is formed with a series of vanes 45 that are formed of plates 46 and 47. The plates 46 and 47 thus provide channels 48 that reverse the flow of the fluid and direct it against the rotor vanes of the final stage, such vanes being indicated generally at 49, and being mounted upon the boss 34. Vanes 49 are formed by plates 50 and 51 to provide channels 52 through which the driving fluid passes, the vanes 50 providing the working surface for the second stage of the impeller.

It will be observed that the formation of the vanes of the several stages is such as to produce a high degree of torque for driving the shaft 21 inasmuch as the passages between the vanes converge as illustrated in Fig. 5. Moreover, the insulating material 29 serves effectively to isolate the shaft 21 from the heat of the exhaust gases.

Referring to Fig. 4, the support 10 is provided with a bearing housing 53 and a cap 54, each of which is flanged to serve as a mounting plate upon which the compressor housing indicated generally at 55 may be mounted. The compressor housing receives the drive shaft 21 which is journaled in bearings 56 and is formed with a circular chamber 57 within which a centrifugal sealing disc 58 is received. The sealing disc is mounted on the drive shaft and serves to prevent the flow of grease into the compressor housing from the bearing 56.

The housing is formed with a flanged portion 59 supporting the exhaust member 60 of the compressor. Exhaust member 60 is formed with an exhaust duct 61 as illustrated in Fig. 4. A central casing member 62 is secured to the casing member 59 and is flanged to receive the forward casing member 63 which is formed with a front wall 64 having an inlet 65. The intermediate or central casing member 62 is formed with an inner stationary wall 66 which serves to support the stator vanes hereinafter to be described.

Shaft 21 extends into the compressor casing and is formed with a hub 67 upon which a rotor plate 68 is mounted. The rotor plate carries two series of rotor vanes, these series being indicated at 69 and 70 in Fig. 6. The rotor vanes 69 are formed by plates 71 and 72 that form converging fluid passages 73 to compress and direct the fluid to a series of stator vanes 74 which are mounted upon the front plate 64. The stator vanes are formed by plates 75 and 76 to form passages 77 which reverse the direction of motion of the fluid and direct it toward the series of vanes 70 which

are formed by plates 78 and 79. These plates 78 and 79 form converging passages 80 to compress the air further and discharge it, as indicated by the arrows in Fig. 4, into inwardly extending passage 81 which is formed with rectifying vanes 82' to take the whirl out of the air. The air under pressure is thus directed from the first wheel formed by the plate 68 to the second wheel formed by a plate 82 that is also secured upon the rotor 67. The entrance to the second wheel is shown at 83 wherein the air is picked up by a series of vanes indicated at 84 in Fig. 7. All of the vanes on plate 82 are formed in a manner generally similar to the vanes previously described and will, therefore, be alluded to herein generally and without specific description. It will be observed that the air compressed by the vanes 84 will be directed against a series of stator vanes 85 that are mounted upon the plate 66, thus having the direction of movement thereof changed so that the air may be again effectively compressed by means of the second stage of rotor vanes 86. The next series of vanes 87 mounted upon the stationary plate 66 again reverses the direction of flow of the air and directs it to the final stage of vanes 88 that are mounted upon the plate 82. From the vanes 88 the compressed air is directed to the outlet 61.

In order that the compressed air may be mixed intimately with the fuel, the compressor is provided with a fuel supply pipe 89 that is received axially of the hub 67 and supplies fuel to a central chamber 90 from which it is directed outwardly radially through pipes 91. The centrifugal force of the outwardly moving fuel directs it with great force through apertures 92 in the rotor plate 82 and introduces the fuel into the highly compressed air stream just as it enters the final compression stage effected by the vanes 88. This results in an effective mixture of fuel and air that is not only homogeneous in character but also is under great pressure and provides an extremely effective source of fuel for supercharging purposes.

While the invention has been described with specific reference to the accompanying drawings, it is not to be limited save as defined in the appended claims.

I claim:

1. Supercharging mechanism comprising, in combination, a turbine, a compressor driven by the turbine, said compressor having an axial inlet and peripheral outlet, a rotor for the compressor having first and second wheels, a plurality of stages of vanes on each of the wheels forming converging passages, a plurality of stages of stator vanes cooperating with the first named vanes, means to direct fluid from the periphery of the first wheel to the center of the second wheel, means between the two wheels to rectify the flow of the fluid, and means to introduce fuel into the compressor adjacent the last stage of the second wheel.

2. Supercharging mechanism comprising, in combination, a turbine, a compressor driven by the turbine, said compressor having an axial inlet and peripheral outlet, a rotor for the compressor having first and second wheels, a plurality of stages of vanes on each of the wheels forming converging passages, a plurality of stages of stator vanes cooperating with the first named vanes, means to direct fluid from the periphery of the first wheel to the center of the second wheel, means between the two wheels to rectify the flow of the fluid, means to introduce fuel into the compressor adjacent the last stage of the second wheel, the compressor being formed with a circular chamber, and a grease seal disc on the rotor and received in the circular chamber.

3. Supercharging mechanism comprising, in combination, a turbine having a rotor and rotor shaft and a plurality of stages of vanes in the turbine and on the rotor, means to direct exhaust gases into the turbine axially thereof, insulating material on the rotor to obstruct the flow of the heat of the exhaust gases to the rotor shaft, a compressor driven by the rotor shaft, said compressor having an axial inlet and peripheral outlet, at least one stage of stator vanes, a plurality of stages of rotor vanes forming converging passages and cooperating with the said stator vanes respectively, and means to introduce fuel into the compressor adjacent the outlet thereof.

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