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CENTRIFUGAL SEPARATOR FOR EXHAUST GASES

Filed Nov. 15, 1956

2 Sheets-Sheet 1

Fig. 1

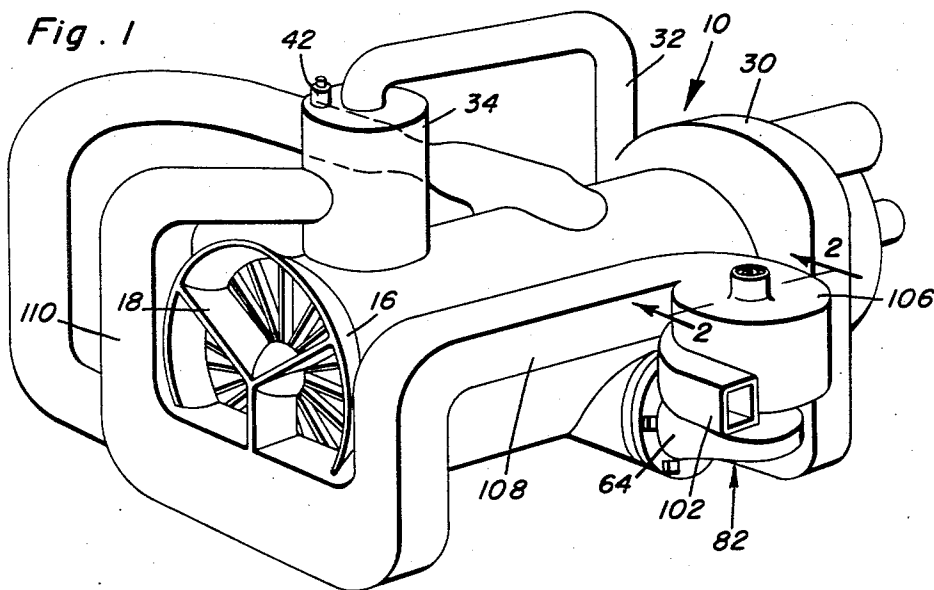
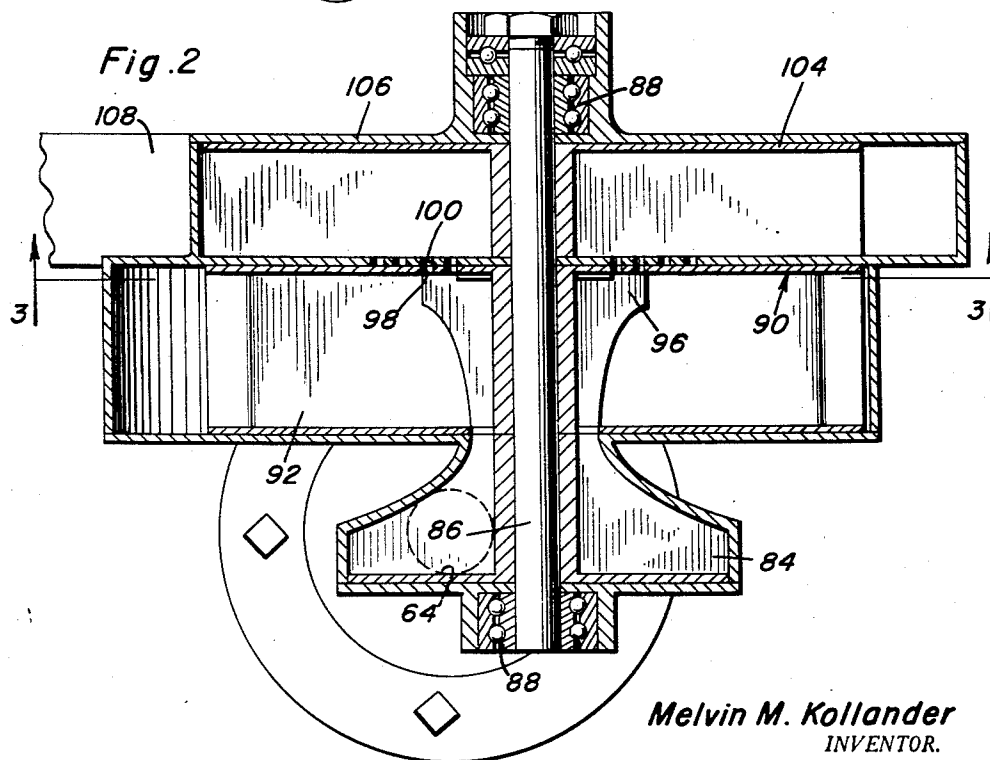


Fig. 2



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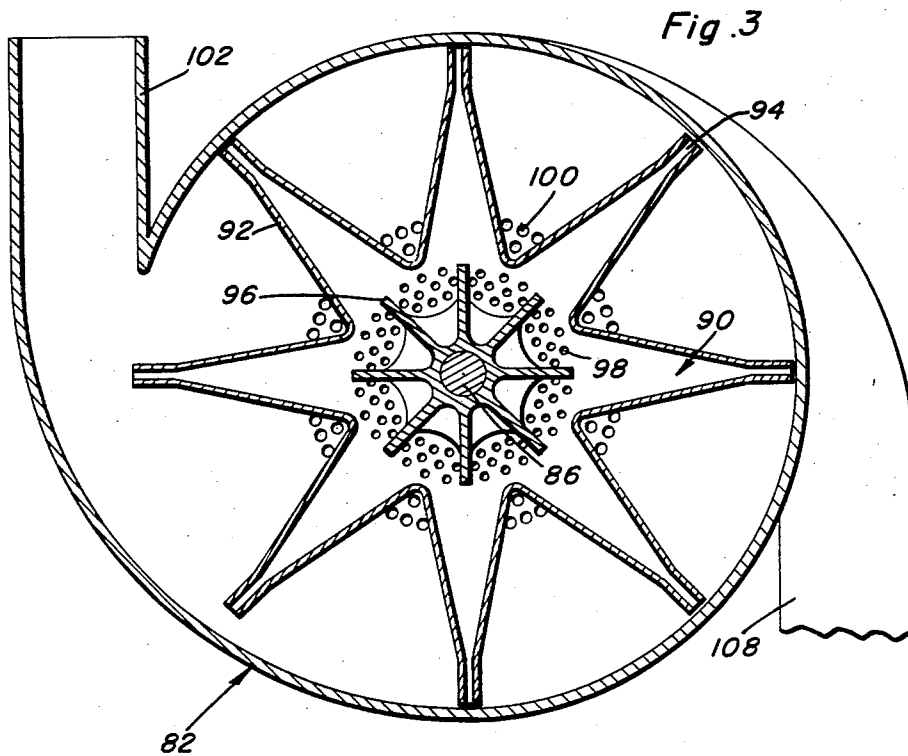
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CENTRIFUGAL SEPARATOR FOR EXHAUST GASES

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3 Claims. (Cl. 183—2)

The present invention generally relates to an exhaust gas separator for a power plant such as an internal combustion engine of the turbine type which incorporates a centrifugal device for separating the heavier unburnable gases from the lighter burnable gases.

An object of the present invention is to provide a separator in the exhaust system of a turbine engine for separating the heavier products of combustion from the lighter unburned portion thereof and subsequently discharging the heavier products of combustion and returning the lighter or unburned particles back to the intake of the engine for re-use thus increasing the efficiency of the engine.

Other objects of the present invention will reside in its simplicity of construction, reduction of moving parts to a minimum, adaptation for many uses, compactness in orientation of elements and its light weight.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a perspective view of the exhaust separator of the present invention associated with a turbine engine;

Figure 2 is a detailed sectional view taken substantially upon a plane passing along section line 2—2 of Figure 1 illustrating the details of construction of the centrifugal separator for the exhaust products; and

Figure 3 is a detailed sectional view taken substantially upon a plane passing along section line 3—3 of Figure 2 and looking upwardly for illustrating further structural details of the exhaust product separator.

Referring now specifically to the drawings, the numeral 10 generally designates the turbine engine with the exhaust gas separator mounted thereon. The engine forms no part of this invention but is illustrated in order to describe a preferred use of the separator. The details of the structure for mounting the engine 10 are not shown inasmuch as various types of supporting arrangements may be employed for supporting the engine in any desired position. Additionally, the details of an exhaust stack as well as the details of inlet air screening mechanisms and other necessary auxiliaries are not specifically disclosed inasmuch as these arrangements will be adapted for each individual installation. While the separator is primarily adapted for use with a stationary constant speed engine, it may be employed in combination with various types of internal combustion engines.

Briefly, the turbine engine 10 includes a generally cylindrical body or casing provided with an outwardly flared portion 16 at the front or intake end thereof together with inwardly extending radial arms 18 forming a support for a longitudinal shaft of a compressor. At the rear of the casing is a centrifugal blower housing 30 which receives the air from the compressor and further compresses the same and discharges the same tangentially

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into a conduit 32 which discharges into an enlarged plenum chamber 34 thus maintaining the plenum chamber 34 under pressure and the chamber 34 is communicated with an inlet to the engine.

5 The exhaust conduit 64 from the engine extends into a centrifugal separator generally designated by the numeral 82 and including a single stage conventional turbine 84 which is mounted on and drives a vertical shaft 86 supported on suitable bearings 88. The shaft 86 also drives a centrifuge impeller designated by the numeral 90 which is specifically illustrated in Figure 3 as being a hollow star-shaped member having radially projecting hollow arms 92 with orifices 94 at the outer ends thereof. A central impeller 96 having radial arms is rotatable there-
10 with and a plurality of apertures 98 is provided in the upper wall of the impeller and also a plurality of apertures 100 is provided in the upper wall of the casing or housing whereby light products of combustion will pass through the casing wall 100 while the heavy products of combustion will pass tangentially from the discharge conduit 102 in the side wall or peripheral wall of the casing 100. The light combustion products will retain portions of burnable material and are fed into the center of a centrifugal blower or compressor impeller 104 disposed in a suitable housing 106 which feeds back into the intake of the compressor through conduit 108. Thus, the burnable products in the exhaust are returned to the intake of the compressor for re-use thus increasing the efficiency of the unit. Also, a by-pass line 110 may be provided
20 between the plenum chamber 34 and the intake of the compressor for maintaining the plenum chamber pressure at a constant predetermined pressure.

The exhaust gases pass through a quench screen and then the exhaust gases flow into the centrifugal separator in which the heavy gases containing free carbon and carbon dioxide are vented and discharged to the atmosphere and the lighter gases containing carbon monoxide and aldehydes representing unburned fuel are returned to the compressor for regeneration. If required, the energy of gases vented to the atmosphere may be utilized in driving the centrifuge through single stage turbines. The use of the turbine operated centrifuge facilitates the passage of the exhaust gases through the area of the quench screens without any appreciable pressure loss. The process for returning a portion of the exhaust gases to the compressor not only returns unused fuel to the plenum chamber but also utilizes the heat of exhaust gases to elevate inlet air temperature further increasing the engine efficiency.

50 The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A centrifugal separator for the exhaust gases of an internal combustion engine comprising a generally vertically disposed cylindrical housing having a tangential exhaust opening for heavy gases at the periphery of the housing, an inlet opening in the bottom of the housing for receiving exhaust gases and an outlet opening in the top thereof, an impeller rotatable within the housing, said impeller including top and bottom plates and hollow diverging radial arms generally defining a hollow star-shaped member with openings at the points of the star-shaped member for rotating the gases throughout their radial movement for discharge of heavy gases to the tangential exhaust opening, said lower plate having an en-
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larged opening aligned with the inlet opening in the housing, said upper plate having a plurality of openings aligned with the outlet opening in the housing for discharging light gases from the center of the housing.

2. The combination of claim 1 wherein a small impeller is disposed centrally within the star-shaped member for initial centrifugal movement of the incoming exhaust gases received from the internal combustion engine.

3. A separator for exhaust products of combustion comprising a generally cylindrical casing having generally parallel end walls, said casing having a tangential discharge conduit communicated therewith, an impeller rotatably mounted in said casing, said impeller having an enlarged hollow central area and a plurality of hollow radial arms communicating with the central area and terminating in orifices disposed in adjacent relation to the inner surface of the casing, one of said end walls having a centrally disposed inlet opening for exhaust products, the other of said end walls including centrally disposed outlet means, and means communicating with the outlet means for pumping light weight gases away from the out-

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let means, the centrifugal force exerted on the exhaust products by rotation of said impeller causing the heavy gases to be discharged through the orifices and discharge conduit with the light gases being discharged from the outlet means to the pump means.

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