Jan. 15, 1946. B. A. ROSE ET AL 2,393,066

SUPERCHARGED COLLECTOR RING ASSEMBLY

Filed Jan. 28, 1943

Fig. 1.

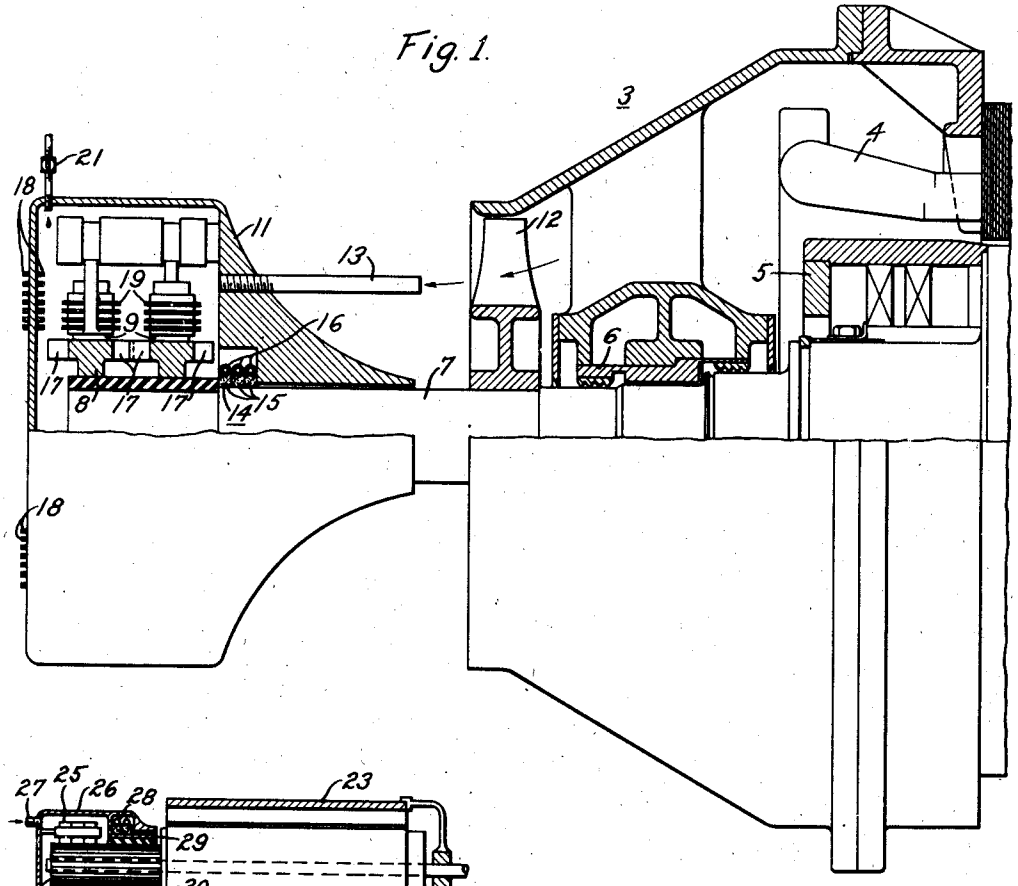


Fig. 2.

WITNESSES:
Wm. B. Sellers.

INVENTOR
Bennie A. Rose and
Frank B. Powers
BY
O. B. Buchanan
ATTORNEY

Patented Jan. 15, 1946

2,393,066

UNITED STATES PATENT OFFICE

2,393,066

SUPERCHARGED COLLECTOR-RING ASSEMBLY

Bennie A. Rose, Wilkinsburg, and Frank B. Powers, Pittsburgh 16, Pa., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application January 28, 1943, Serial No. 473,842

4 Claims. (Cl. 171—322)

Our invention relates primarily to high-altitude current-conducting contact-devices operating in air, for use aboard aircraft, for increasing the practical limits of the operating-speeds of the devices, or increasing the operating limits of the current densities in the brushes, or increasing the high altitudes at which the devices are operable, beyond present limits. More specifically, our invention relates to collector-ring assemblies or commutator assemblies which operate in air, at such high speeds, at such high altitudes, or under such dry weather-conditions, that operation is very short-lived in the absence of our special protective-measures.

In a companion application of Lee A. Kilgore and others, Serial No. 474,474, filed February 2, 1943, and assigned to the Westinghouse Electric & Manufacturing Company, an electric drive-system for airplanes is set forth, utilizing high-frequency dynamo-electric machines operating at top-speeds of from about 10,000 revolutions per minute to about 20,000 revolutions per minute, these high operating-speeds being required in order to bring down the weight per horsepower. At least some of these machines require collector-rings, and our invention is particularly applicable to the design and construction of such high-speed collector-rings, particularly in planes of the high-altitude type.

Also, on exciters and other direct-current dynamo-electric machines on aircraft, where high-altitude flight-conditions obtain, brush-life may be of the order of an hour, more or less, under certain operating-conditions, even though the rating of the machine is not as high as would be desirable. In these direct-current machines, the speed is high, but it cannot be as high as it is possible to have in an alternating-current machine.

Our experience indicates that, at such high speeds, and at high altitudes, the current-collecting operation may be extremely troublesome under some conditions, as the brush is likely to get red hot with excessive friction, and probably with non-uniform distribution of current because the carbon of the brush has a negative resistance-coefficient. Under such conditions, the brush will chatter and jump in its holder, and will quickly disintegrate, sometimes in a matter of minutes, after such conditions have become well developed, not only requiring a brush-replacement, but also necessitating a reconditioning of the rotating current-collector part, either ring or commutator, because of a roughened current-collecting surface.

The principal object of our present invention is to solve any such difficulty by supercharging the current-collector assembly, that is, to supply more air to the assembly, at a pressure higher than that which is encountered at high-altitude flight, preferably restoring the air-pressure to the neighborhood of the normal atmospheric pressure at sea level. Under some conditions, we may want to add means for increasing the water-vapor content, either with or without the supercharging.

Our invention thus removes a limitation that stands in the path of development of high-speed aircraft-generators, particularly when utilized at low pressures approaching 20 or 25% of sea-level atmospheric pressure.

Two exemplary forms of embodiment of our invention are shown in the accompanying drawing, wherein

Figure 1 is a longitudinal cross-sectional view of the collector-end of a high-speed aircraft-generator embodying our invention, and

Fig. 2 is a similar view of a direct-current machine.

As shown in Fig. 1, our invention is particularly applicable to a synchronous machine 3, having a stationary field member 4, and a high-speed rotating armature member 5 mounted in bearings 6 and having, for example, an overhanging shaft-end 7 carrying two collector-rings 8 for conducting direct-current through relatively stationary brushes 9 bearing upon the collector-rings. The rotor-member preferably operates in the speed-range of the order of 15,000 revolutions per minute, or from about 10,000 to about 20,000 revolutions per minute, and the collector-rings have a peripheral speed in the range between 10,000 and 13,000 feet per minute, more or less, with the brushes bearing upon the peripheries of the collector-rings.

In accordance with our invention, particularly for application on high-altitude aircraft, we enclose the brushholders and collector-rings in a chamber or housing-member 11, and we supercharge this housing, by any suitable means, as by means of a fan 12 blowing air through an inlet-opening 13 into the housing. As shown in Fig. 1, the fan 12 is the air-blowing means by which ventilating-air is forced through the synchronous or other machine 3, a high-pressure part of this ventilating-system being tapped off, by the inlet-means 13, to supply air, under pressure, to the collector-housing or compartment 11. The housing is provided with a suitable

shaft-seal 14 such as a carbon-ring type of seal, having carbon rings 15 and garter-springs 16.

Ventilation for the collector-ring assembly is provided by means of fins or fan-blades 17 formed on the sides of the collector-rings 8 for violently agitating or circulating the air within the housing 11; and the housing is provided with fins 18, inside and outside, for facilitating the heat-transfer from the inside air to the outside air which is blowing over the housing from the fan or blower 12, or as a result of the motion of the aircraft through the air. As most of the loss in a collector-ring current-collector is friction-loss, we reduce the losses by reducing the number of brushes to a minimum, and we work our brushes hard, at high current-densities, with the maximum possible ventilation, utilizing violently agitated air in the brush-chamber, and heat-exchanging finned surfaces 19 on the brushholder.

In some cases, it may be desirable to control the humidity, as well as the pressure, of the air within the collector-ring housing 11, and this may be done by any convenient means, exemplified by a water-dropper 21 which introduces an occasional drop of water into the collector-ring chamber.

In operation, when the plane on which the synchronous machine 3 is mounted goes up to high altitudes, our invention makes it possible to operate the collector-ring chamber in air at something like sea-level atmospheric pressure, whereas the ambient pressure outside of the housing 11 may fall to as low as ¼ to ⅕ of an atmosphere. In this way, we avoid disintegration of the brushes 9 as a result of excessive friction for lack of an adequate film of (preferably moist) air carried around by the surface of the ring and normally preventing excessive brush-friction.

Our invention is also applicable to direct-current commutators, where the peripheral-speed limits are somewhat lower, approximately in the range between about 7,000 and about 10,000 feet per minute, but where the same, or a similar, problem exists as to rapid brush-wear and disintegration at high-altitudes, where the air is not of sufficient density to properly lubricate the brush-contact surface. In Fig. 2, we show our invention applied to a direct-current machine 23, having a commutator 24 and brushgear 25. The brushgear 25 is enclosed in a housing 26 which is supercharged from a suitable compressed-air source at 27. The housing 26 must make a farily air-tight joint with the rear end of the commutator, and to this end, the commutator is somewhat elongated beyond its usual requirements, and the brushes 25 are placed at the front end of the commutator. At the rear end of the commutator 24, the housing 26 makes a seal through sealing-rings 28 which bear upon a steel sleeve 29 which is insulated from the cylindrical commutator-surface by an insulating sleeve 30.

We claim as our invention:

1. A high-altitude high-speed rotating machine for use aboard aircraft, said machine having a current-collecting assembly comprising one or more current-collecting parts having a cylindrical current-collecting surface rotating at a peripheral speed at least as high as about 7,000 feet per minute, and one or more current-collecting brushes bearing on said cylindrical current-collecting surface, said machine having a separate housing enclosing said current-collecting assembly including said brushes but not including the rest of said machine, a machine-ventilating means for causing a relatively large volume of ventilating-air to blow rapidly through the machine, and means for tapping a high-pressure part of said machine-ventilating system to serve as a supercharging-means for supplying air to said housing at a pressure higher than the ambient atmospheric pressure prevailing, at the moment, outside of said housing, at least during high-altitude flights, said machine having air-openings for maintaining a free continuous circulation of ventilating-air, and said housing having one or more relatively restricted intake-openings to the atmosphere, said opening or openings being directed toward the exhaust-air of said machine so as to collect a part of said exhaust-air, said housing being otherwise substantially air-tight.

2. The invention as defined in claim 1, in combination with moisture-adding means, for increasing the water-vapor content of the air within said housing.

3. A high-altitude high-speed rotating machine for use aboard aircraft, said machine having a current-collecting assembly comprising one or more current-collecting parts having a cylindrical current-collecting surface rotating at a peripheral speed at least as high as about 7,000 feet per minute, and one or more current-collecting brushes bearing on said cylindrical current-collecting surface, in combination with means for providing a separate compartment for said current-collecting assembly, and a dual-purpose fan carried by the machine for forcing a relatively large volume of ventilating-air rapidly through the machine and for supplying air, under pressure, to said compartment, said machine having air-openings for maintaining a free continuous circulation of ventilating-air, and said compartment having one or more relatively restricted intake-openings to the atmosphere, said opening or openings being directed toward the exhaust-air of said machine so as to collect a part of said exhaust-air, said compartment being otherwise substantially air-tight.

4. The invention as defined in claim 3, in combination with moisture-adding means, for increasing the water-vapor content of the air within said compartment.

BENNIE A. ROSE.
FRANK B. POWERS.