

1,310,672.

2 SHEETS--SHEET 1.

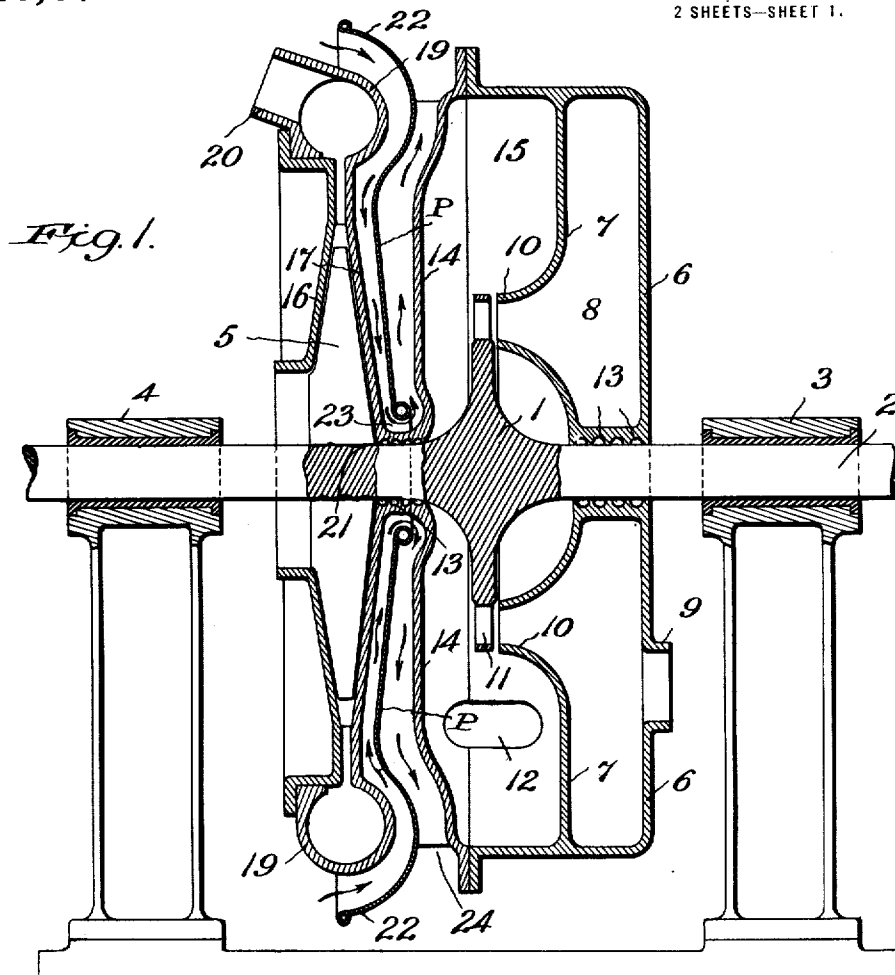


Fig. 3.

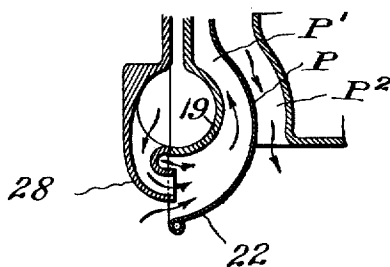
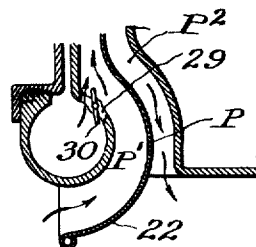


Fig. 4.



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 COOLING AND INSULATING SYSTEM FOR TURBO COMPRESSORS.
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2 SHEETS—SHEET 2.

Fig. 2.

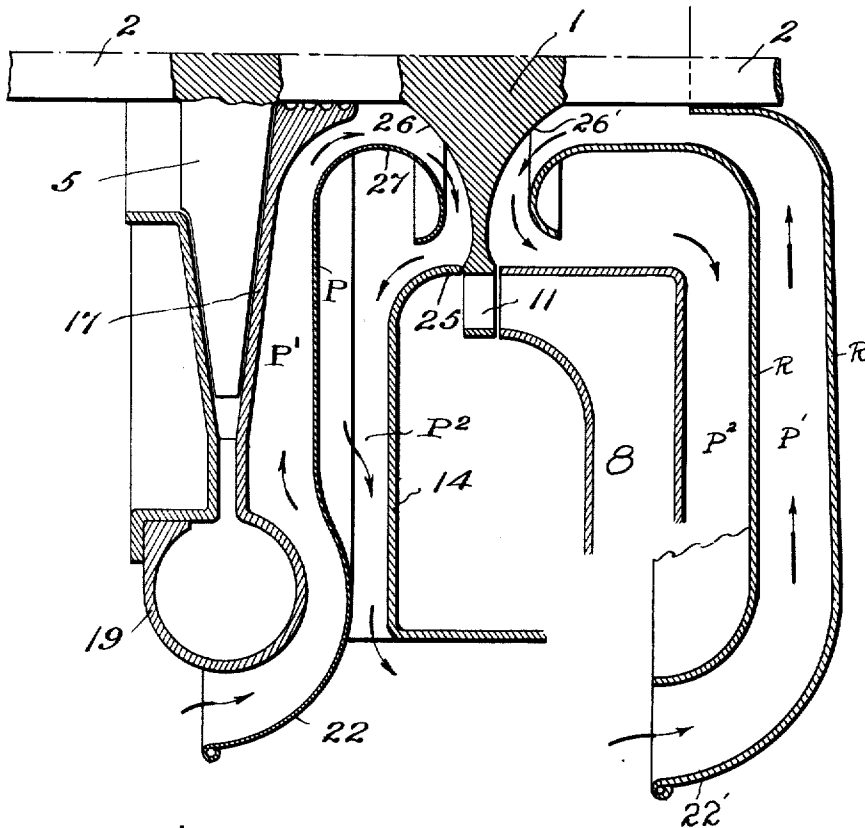


Fig. 6.

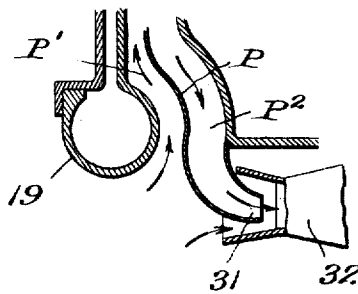
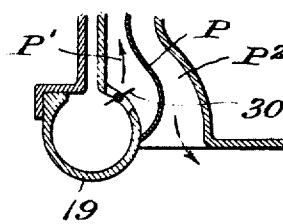


Fig. 5.



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UNITED STATES PATENT OFFICE.

EARL H. SHERBONDY, OF CLEVELAND, OHIO.

COOLING AND INSULATING SYSTEM FOR TURBO-COMPRESSORS.

1,310,672.

Specification of Letters Patent.

Patented July 22, 1919.

Application filed March 23, 1918. Serial No. 234,357.

To all whom it may concern:

Be it known that I, EARL H. SHERBONDY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Cooling and Insulating Systems for Turbo-Compressors, of which the following is a specification.

This invention relates to turbo-blowers, more particularly to gas operated turbo-blowers, that is, a blower in which the turbine wheel is operated by the exhaust gases from an internal combustion engine.

This invention relates also to a turbo-blower particularly adapted for use on airplanes and for that reason, the size of said unit on account of the extreme limitations of space in an airplane fuselage, must be kept down to the absolute minimum. This of necessity, causes the turbine wheel and the blower wheel of the compressor unit to be located rather closely together. The turbine wheel on account of its intimate contact with the hot exhaust gases, is itself at substantially a red heat when in operation. On the other hand, the blower wheel must be kept considerably cooler than the turbine wheel.

The objects of this invention are:

1. To provide an insulating air path between the two wheel units whereby the excessive heat from the turbine wheel will be prevented from being communicated to the blower wheel.

2. To provide positive cooling means for the turbine wheel.

3. A combination of the above two objects, that is to say, an insulating air path between the two units, which in addition to its insulating function, has a function of cooling the turbine wheel by direct contact therewith.

4. To provide means for forced circulation of air through the aforementioned air paths.

An embodiment of the invention will be described in more detail in the attached drawings, in which Figure 1 is a view of a turbo-compressor unit showing the insulating air path. Fig. 2 is a view showing an air path which has both insulating and cooling action. Figs. 3, 4, 5, and 6 represent modifications.

Referring now to the drawings, 1 represents a turbine wheel operated by the ex-

haust gases from an internal combustion engine. This wheel is mounted on a shaft 2, supported in bearings 3 and 4. Rigidly fastened to this shaft is the blower-wheel 5, all of well-known construction. It may be noted, however, that the two wheels are rather closely together for the already stated reason that the unit must be kept small in order to apply to an airplane engine. Associated with the turbine wheel 1, is an exhaust casing 8, formed by the walls 6 and 7. The exhaust gases enter the exhaust casing 8, through the entrance 9. The casing is substantially annular in shape and is provided with a series of nozzles 10, which direct the hot exhaust gases into the buckets 11 of the turbine wheel 1. The exhaust gases after having passed through said buckets 11, pass on to the atmosphere or to a muffler through the opening 12.

Casing 8, may be mounted on the shaft 2 as shown and a labyrinth packing 13, may be provided.

A wall 14, is provided on the other side of the turbine wheel 1, which, together with the casing element 7, forms an exhaust chamber 15 of considerable size into which the gases may escape just after leaving the buckets 11.

The blower-wheel is of usual construction and may be provided with a casing consisting of elements 16 and 17, which merge into the air supply pipe 19, from which the compressed air is led, to be used for any desired purpose through the pipe 20.

The casing elements 14 and 17 together form a bearing 21, which may be provided with a labyrinth packing 13'.

The casing element 14, is obviously at a high temperature, while the casing element 17, must be kept at a considerable lower temperature. The air space between these two casing elements even if not in motion, provides a slight insulating space between the two cases. An important object of this invention, however, is to provide a double layer of moving air between these two casing elements. This double layer of air has primarily an insulating function. Secondly, however, it is obvious that by its direct contact with the casing elements 17 and 14, it has a positive cooling action, particularly on the very hot casing element 14, adjacent to the turbine.

An annular partition P is provided, located substantially mid-way between the two casing elements 14 and 17. At its outer periphery, the partition P may be formed into an air receiving horn 22, located just outside of the air passage 19 and opening forwardly, so that as the vehicle on which the turbo-compressor is mounted, rushes through the air, air will be taken in under some pressure.

At its inner periphery, the partition P terminates short of the bearing 21 to provide a space 23 through which the air may pass. The air may escape at the point 24.

It will be evident that this arrangement provides a double layer of moving air, one layer of air being in direct contact with the casing element 17 and the other layer of air being in direct contact with casing element 14. It will also be evident that one layer of air will be particularly efficacious in cooling the hot wall 14 and that both layers together provide an efficient insulating means between the casing elements 14 and 17.

Referring now to Fig. 2, we have the casing elements 14 and 17 as before. It will be noted, however, that the casing 14 is arranged in this modification to terminate farther out from the shaft 2 at a point 25 near the buckets 11. This it will be noted, exposes a considerable portion 26 of the turbine wheel 1 to the air space between the two casing elements 14 and 17. The partition P is provided with the horn 22 as before. At its inner end, however, it is curved, as at 27, so that it will guide the air passing along the passage P' into direct contact with the hot turbine wheel 1, after which it passes on out through the passage P².

In this modification, there is the same insulating and cooling action as described in detail in connection with Fig. 1. In addition, however, there is the important feature of the direct and positive cooling of the turbine wheel 1, due to the fact of the moving air being directed into positive contact therewith.

In short then in this modification, there is a cooling action on the casing elements 14 and 17, an insulating action of the double layer of air P' and P² and the direct cooling of the turbine wheel 1, by actual contact therewith.

In Fig. 2, a similar arrangement is provided for cooling the other side of the wheel at 26'. Partitions R and R' together form a horn 22', an incoming air path P' and outgoing air path P², which cools the wheel 1 by contact therewith at 26'.

It should be noted, however, that if the compressed air is to be used for carburetion purposes, it is desirable that it be heated to a greater or less degree. If the air is to be so used, the parts may be so designed that the cooling and insulating action will be small,

in which case more or less heat will be transmitted to the blower casing, but not to such an extent as to excessively heat the blower casing.

The turbine wheel, by virtue of its high speed and the friction of the air against its surface, operates to draw air in through the passage P' and by centrifugal force, throws it out through passage P².

The air may be caused to circulate around the partition P in a number of different ways in addition to the centrifugal action just described, which will now be described, reference being made to Figs. 3, 4, 5 and 6. In Fig. 3, the partition P and horn 22 are provided as before. Leading off from the air pipe 19, there is a nozzle 28, which is turned around and directed into horn 22 to direct air coming from the blower wheel into the passage P'. In this modification, it is evident that the air passing out of the nozzle 28, will cause air to be drawn in through the horn 22, or that air passing into the horn 22 will cause air drawn from the nozzle 28 according as the air velocity is greater through 28 or through 22, as in an injector.

In Fig. 4, a modification is shown in which air is tapped directly from the air supply pipe 19 through an opening 29, which opens directly into the air passage P'. A throttle valve 30 may be provided if desired, which may be either manually or automatically operated. The operation of this modification will be obvious.

Referring now to Fig. 5, a modification is shown in which the horn 22 is omitted, the entire supply of air for the air paths P' and P² coming from the air supply casing 19. As in Fig. 4, throttle valve 30 may be provided.

Referring now to Fig. 6, a modification is shown in which the means for causing the forced circulation of the air, is located at the end of the air path rather than at the beginning thereof, as in the other figures. Passage P² terminates in a rearwardly directed nozzle 31, around which is arranged a Venturi tube 32, whereby air is sucked in at the mouth 33, passes through the passage P' and P² and out at the nozzle 31. It is evident that one or more of these modifications may be combined in the same device if necessary or advisable. That is to say in Fig. 3, for example, a venturi may be used at the rear end of the passage P², or in Fig. 6, for example, a horn 22 could be used, or an opening 29 and a throttle valve 30 could also be used. With proper design, however, one of these air circulating devices will be sufficient and the simpler arrangements are preferred to the more complicated combinations.

It should be understood that while I have illustrated several different embodiments of

the invention and parts thereof, that these and other parts may be modified without departing from the spirit of the invention.

I claim—

5 1. In a turbo-compressor, a fluid driven turbine wheel, a blower wheel and means to cause two distinct layers of air to circulate between the two wheels.

2. In a turbo-compressor, a fluid driven turbine wheel, a blower wheel, casing elements associated with each wheel and means to cause air to circulate between a turbine wheel casing element and the adjacent blower wheel casing element.

15 3. In a turbo-compressor, a fluid driven turbine wheel, a blower wheel, casing elements associated with each wheel and means to cause two distinct layers of air to circulate between a turbine wheel casing element and the adjacent blower wheel casing elements.

4. In a turbo-compressor, the combination of a fluid driven turbine wheel, a blower wheel, casing elements associated with each of said wheels and means to cause air to circulate between a turbine wheel casing element and the adjacent blower wheel casing element, said means comprising a partition arranged between said turbine wheel casing element and said adjacent blower wheel casing element.

5. A turbo-compressor for a vehicle comprising a turbine wheel and a blower wheel and means becoming operative due to rush of air past the turbo-compressor to cause air to circulate between the two wheels.

6. In a turbo-compressor, the combination of a turbine wheel, a blower wheel, a casing for said blower wheel and means to cause air to circulate past the said casing and into contact with the turbine wheel.

7. In a turbo-compressor, the combination of a turbine wheel, a blower wheel, casing elements associated with each of said wheels and means to cause air to circulate past an element of the blower wheel casing, into contact with the turbine wheel and past the adjacent element of the turbine wheel casing.

8. A turbo-compressor for a vehicle comprising a turbine wheel, and a blower wheel, a casing for said blower wheel, and means to cause air to circulate past the said casing and into contact with the turbine wheel, said means becoming operative due to the passage of the vehicle through the air.

9. A turbo-compressor for a vehicle comprising a turbine wheel and a blower wheel, casing elements associated with each wheel, means to cause air to circulate past an ele-

ment of the blower wheel casing, into contact with the turbine wheel, and past the adjacent element of the turbine wheel casing, said means becoming operative due to the rush of air past the vehicle.

10. A turbo-compressor for a vehicle comprising a turbine wheel and a blower wheel, casing elements associated with said wheels, a partition located between a casing element of the blower wheel and the adjacent casing element of the turbine wheel, and means associated with said partition and adapted to cause air to circulate on both sides of said partition, said means becoming operative due to the rush of air past the vehicle.

11. A turbo-compressor for a vehicle, comprising a turbine wheel and a blower wheel, casing elements associated with said wheels, a partition located between a casing element of the blower wheel and the adjacent casing element of the turbine wheel, and means associated with said partition and adapted to cause air to circulate past one side of the partition, onto the turbine wheel and past the other side of the partition, said means becoming operative due to the rush of air past the vehicle.

12. In a turbo-compressor, the combination of a turbine wheel, a blower wheel, casing elements for said wheels, a partition between a casing element of the blower wheel and the adjacent casing element of the turbine wheel, and means for causing a part of the air compressed by said blower wheel to circulate on both sides of said partition.

13. In a turbo-compressor, the combination of a turbine wheel, a blower wheel, casing elements associated with each wheel, an annular partition arranged between a blower wheel casing element and the adjacent turbine wheel casing element, adapted to provide two distinct air passages that connect with one another near the inner part of said partition.

14. A turbo-compressor for a vehicle comprising a turbine wheel and a blower wheel, casing elements associated with each wheel, an annular partition arranged between a blower wheel casing element and the adjacent turbine wheel casing element, adapted to provide two distinct air passages that connect with one another near the inner part of said partition and means associated with said partition and adapted to be actuated by the rush of air past the vehicle to cause air to circulate through said air passages.

In testimony whereof I affix my signature.

EARL H. SHERBONDY.