

May 10, 1938.

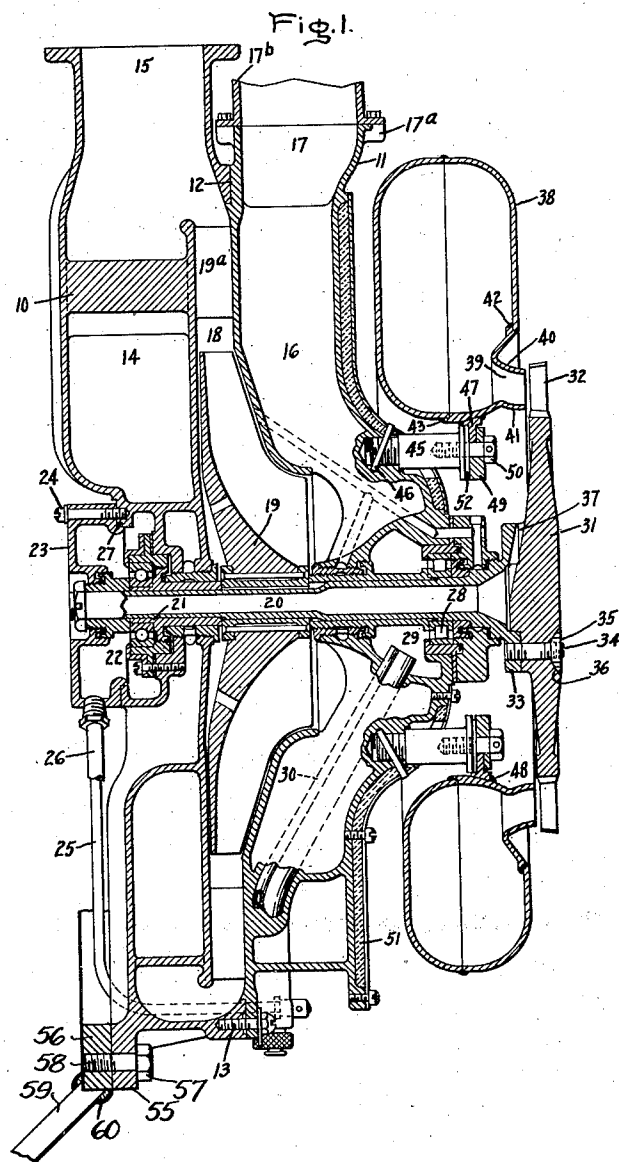
C. H. AUGER

2,117,131

SUPERCHARGER ARRANGEMENT

Filed June 2, 1936

2 Sheets-Sheet 1



Inventor:
Claude H. Auger,
by *Harry E. Dunham*
His Attorney.

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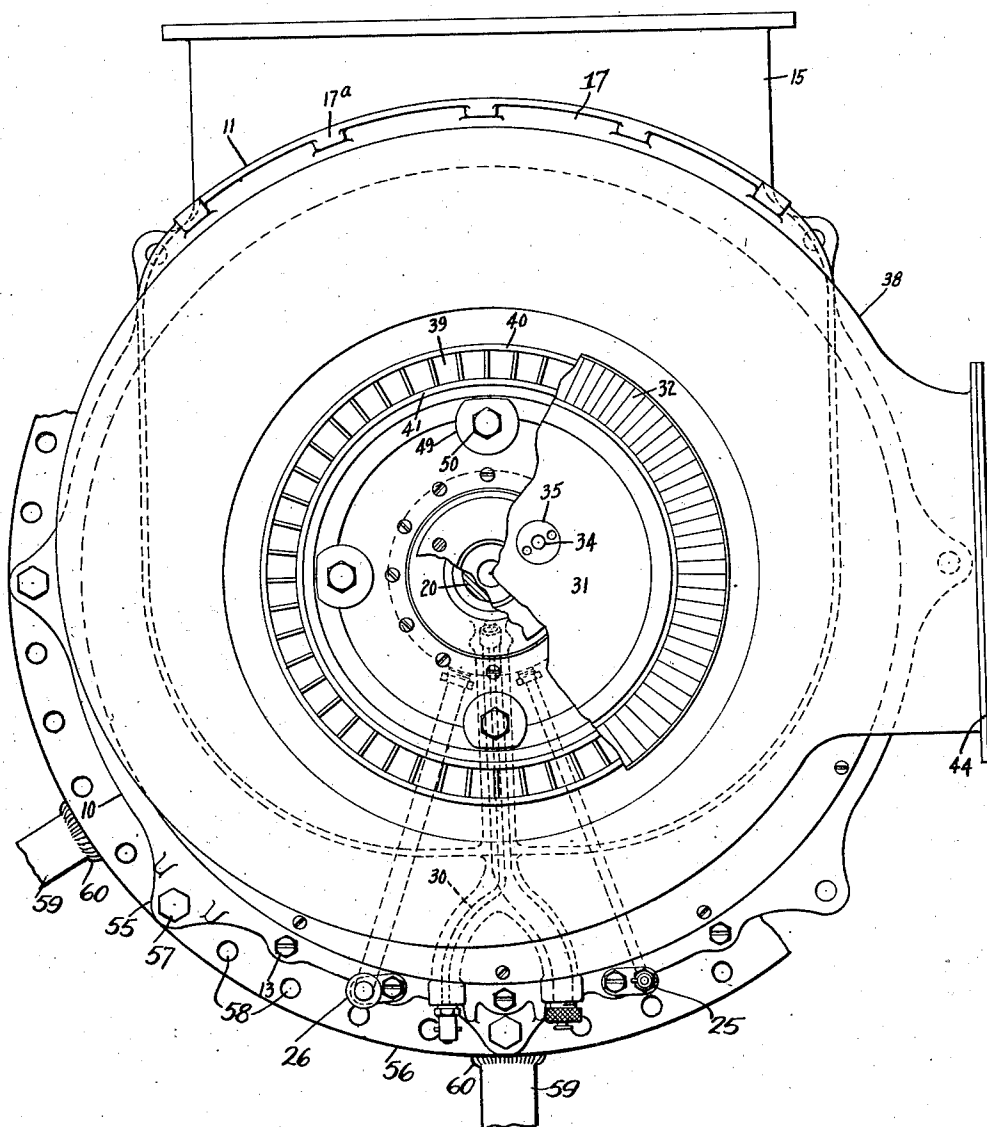
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Fig. 2.



Inventor:
Claude H. Auger,
by *Harry E. Dunham*
His Attorney.

UNITED STATES PATENT OFFICE

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SUPERCHARGER ARRANGEMENT

Claude H. Auger, Saugus, Mass., assignor to General Electric Company, a corporation of New York

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2 Claims. (Cl. 230-116)

The present invention relates to supercharger arrangements for internal combustion engines such as are used for operating aircrafts. More specifically, the invention relates to the kind of supercharger arrangements in which a supercharger or centrifugal blower is driven by a gas turbine having a nozzle box receiving gases from the exhaust manifold of any internal combustion engine.

10 The object of my invention is to provide an improved construction of such supercharger arrangements whereby a standard type of centrifugal blower and gas turbine may be produced for use in connection with various types of internal combustion engines and whereby such blower and a gas turbine may be easily assembled with different internal combustion engines.

15 This is accomplished in accordance with my invention by the provision of a supercharger having a casing made up of two flanged parts bolted together with one of said parts defining an inlet opening for admitting medium to be compressed and the other part defining an outlet opening for discharging compressed air or like medium. In other words, the inlet is completely formed on one casing part and the outlet in the other casing part. This permits relative positioning of the inlet and outlet by turning the two casings relative to each other along their flanged portions. The nozzle box for conducting gases to a turbine wheel for driving the blower in accordance with my invention is adjustably secured to the casing of the centrifugal blower so that the nozzle box may be turned into any desirable position and consequently the inlet to the nozzle box adjusted relatively to the inlet and the outlet of the blower.

For a better understanding of what I believe to be novel and my invention, attention is directed to the following description and the claims appended thereto in connection with the accompanying drawings.

20 In the drawings Fig. 1 represents a sectional view of a supercharger arrangement for internal combustion engines embodying my invention, and Fig. 2 shows a front view partly broken away of Fig. 1.

25 The arrangement comprises a centrifugal type blower shown on the left-hand side of the drawing and a gas turbine for operating the blower indicated on the righthand side of the drawing. The blower has a casing made up of two parts or portions 10 and 11 with flanges 12 which are secured together by a plurality of bolts 13. The casing portion 10 defines a scroll 14 with a flanged

outlet opening 15. The part 11 forms an inlet chamber 16 with an inlet opening 17 provided with ears or lugs 17a flanged to an inlet conduit 17b. The adjacent walls of the two parts define an impeller chamber 18 for accommodating an impeller 19 and diffuser vanes 19a. The latter are integrally united with one of the parts. The impeller 19 is secured to and driven by a drive shaft 20. During operation air or like medium flows through the inlet 17 to the inlet chamber 16, whence it is forced through the impeller chamber and the diffuser into the scroll 14 to be discharged through the outlet opening 15. An important feature of the arrangement is the complete formation of the inlet 17 and the outlet 15 in the separate casing parts or portions 10 and 11 and the uniting of these two parts by means of an annular flange. This permits relative positioning of the inlet 17 and the outlet 15. For example, in the present instance the inlet and the outlet are adjacent each other. If it is desired to arrange them at 90 angular degrees, all that is necessary is to remove the bolts 13 and turn one of the casing parts 10, 11 by 90 degrees. In the present instance the two flanges are united by 24 bolts uniformly spaced apart, permitting an adjustability of 15 degrees. During angular adjustment of the casing parts 10 and 11 the conduits connected to the inlet 17 and the outlet 15 are disconnected. As clearly shown in Fig. 2 the inlet 17 with the ears 17a is circular with its center on the axis of the blower. This is necessary to permit the ears 17a to pass the flange of the outlet 15 when rotated.

30 The left-hand end of the shaft portion is supported by an anti-friction bearing 21 disposed in a bearing chamber 22. The chamber is defined by the casing part 10 and by a cap 23 secured to the casing part 10 by a plurality of uniformly spaced bolts 24. Lubricant is conducted to the bearing chamber by a grease inlet tube 25 and discharged therefrom through an overflow tube 26. In the present instance the cap 23 is flanged to a flanged portion 27 of the casing and secured thereto by means of four bolts 24. This permits an adjustability as regards the relative position of the cap and the casing of 90 degrees, making it possible to have the grease inlet and overflow tube 25 and 26 always extending in downward direction, irrespective of the position of the outlet 15 of the supercharger. If, for instance, the casing part 10 were to be turned by 180 degrees in order to have the outlet 15 extending directly downward, all that would be necessary would be to remove the bolts 24 prior to 35

the turning of the casing part 10 and to assemble the bolts 24 after the casing part 10 had been turned 180 degrees, in which case the tubes 25 and 26 would remain in the identical position as before. The right-hand end of the drive shaft 20 is supported by an anti-friction bearing in the present instance a roller bearing 28 disposed in a bearing chamber 29 receiving lubricant through a cast-in grease tube 30. The bearing chamber 29 is completely surrounded by the inlet chamber 16. Air or like medium flows through the inlet 17 to the inlet chamber 16, whence it flows around the bearing chamber 29 and enters the impeller chamber. This permits relative positioning of the inlet 17 and the outlet 15 to suit various different types of installation where such supercharger may be used. It also provides thorough cooling of the bearing chamber 29 and the lubricant contained therein.

The blower is operated by a gas turbine which has a bucket wheel 31 secured to an overhung portion of the shaft 20. In present instance the bucket wheel has a solid disk carrying at its outer circumference a row of buckets 32. A central portion of the disk is centered with and fastened to a flange 33 formed on an overhung portion of the shaft. The fastening is accomplished by means of a plurality of bolts 34 having heads 35 sunk in the outer surface of the disk to reduce wind resistance. In order to avoid excessive weakening of the disk, the heads 35 have rounded, inner portions forming substantially spherical surfaces and fitting into rounded or spherical recesses 36 of the surface of the disk. Adjacent portions of the disk and the flanged shaft member 33 define an opening or openings 37 communicating with a central bore in the shaft. During operation, a stream of air flows through the shaft bore, the opening 37 and along the inner surface of the disk thus effecting cooling of the latter. Gases are conducted to the turbine wheel by a nozzle box 38 having a nozzle diaphragm 39 with an annular row of nozzle blades or partitions held between an outer nozzle ring 40 and an inner nozzle ring 41. The nozzle rings form a part of the casing of the nozzle box and are secured thereto by welds 42 and 43 respectively. The nozzle box has an inlet 44 (Fig. 2) for receiving gases, for instance exhaust gases, from the exhaust manifold of an internal combustion engine (not shown). Depending upon the relative location of the exhaust manifold of the internal combustion engine to which the nozzle box inlet 44 is to be connected, it is at times desirable to have this inlet 44 positioned on the right-hand side as indicated in Fig. 2 of the drawings. At other times it becomes desirable to have the inlet on the opposite side or in an intermediate position. This is accomplished by my invention by the provision of means for adjustably securing the nozzle box to the casing of the centrifugal blower. In the present instance 4 studs 45 are secured to the outer wall of the part 11 of the blower casing and locked in position by pins 46. The nozzle box, more specifically the inner nozzle ring 41, is provided on its outer surface with a ring 47 secured thereto by welds 48. This ring is fastened to the aforementioned studs 45 by means of clamps 49 and a plurality of bolts 50. With this arrangement the nozzle box may be turned in any position relative to the blower by loosening the bolts 50 which permit turning of the nozzle box and thereafter re-tightening said bolts 50.

To reduce heat transmission from the nozzle box to the blower the surface of the casing part

11 adjacent the nozzle box is covered with lagging 51. The clearance between the bucket wheel and the nozzle box may be adjusted by changing shims 52 between the clamp ring 49 and the studs 45. Furthermore, the number and lengths of ducts or conduits connecting the supercharger with the outside of the engine housing for the purpose of conveying air to the supercharger and for cooling the bearings is reduced to a minimum by disposing the inlet side of the supercharger adjacent the turbine. For example, when a double inlet supercharger is used, taking air on both sides of the impeller, two ducts are required. If the single inlet supercharger is used and the single inlet is in the half of the casing removed from the turbine, there will be required one duct for the supercharger intake and another duct to provide air for cooling the bearing casing adjacent the hot turbine wheel. By having the inlet duct in the casing half adjacent the turbine, one duct will serve for supplying the inlet to the supercharger, and cooling the bearing as well.

In certain cases, it is desirable to provide for adjustability of the supercharger structure as a whole and the airplane structure, and in certain other cases, it is desirable to adjust the outlet of the supercharger and at the same time to maintain the inlet of the supercharger in a fixed position. This is accomplished in accordance with another feature of my invention, by the provision of means for adjustably connecting the supercharger structure to the airplane structure. As shown in the drawings, the outlet casing half of the centrifugal blower has a plurality of lugs 55 which are fastened to a ring 56 by means of a plurality of bolts 57. The ring 56 has a plurality of openings 58 for receiving the bolts 57, and the ring is secured to an element 59 forming a part of the airplane structure by means of a weld 60. The number of openings 58 in the ring 56 is a multiple of the number of lugs 55. This arrangement permits adjustability of supercharger structure on the airplane, the degree of which is determined by the angular distance between adjacent openings 58.

With my invention, I have accomplished an improved construction of supercharger arrangements including centrifugal blowers and gas turbines for internal combustion engines whereby such arrangements may be readily adjusted as regards the inlets and outlets of the centrifugal blower and the gas turbine. This has distinct advantages in that it renders such arrangements readily adaptable for use in connections with different internal combustion engines, thus constituting in substance a universal supercharger arrangement.

Having described the method of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A supercharger arrangement for internal combustion engines including the combination of a centrifugal blower having a casing and a shaft, a gas turbine for driving the blower including a bucket wheel secured to the shaft, a nozzle box having an inlet for receiving gases and a ring of nozzles for discharging gases to the bucket wheel, means for adjustably securing the nozzle box to the blower, said means comprising a plurality of studs secured to the blower

casing, a ring secured to the nozzle box, and clamping means for fastening the ring to the studs.

2. Supercharger arrangement for internal combustion engines including a casing, an impeller in the casing, an exhaust gas turbine, the wheel of which is mounted on the same shaft as the impeller, bearings supporting said shaft, a grease

chamber for the bearing surrounding the shaft and an inlet passage to said impeller, said inlet passage being disposed between said impeller and said exhaust turbine and enclosing at least partly the bearing and the grease chamber adjacent the turbine wheel. 5

CLAUDE H. AUGER.