B. H. HAMILTON & W. E. VER PLANCK.

TURBO-GENERATOR.

APPLICATION FILED APR. 19, 1907.

920,052.

Patented Apr. 27, 1909.

3 SHEETS—SHEET 1.

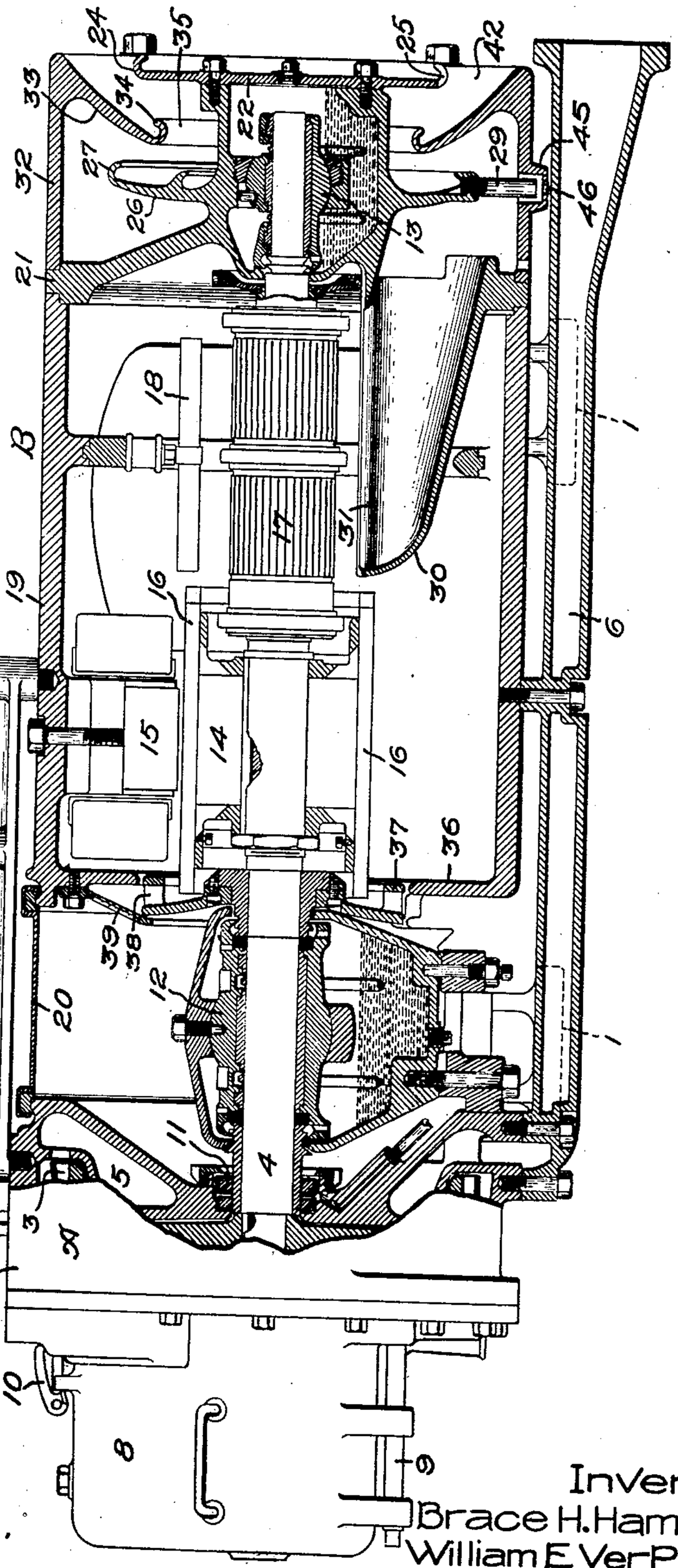

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

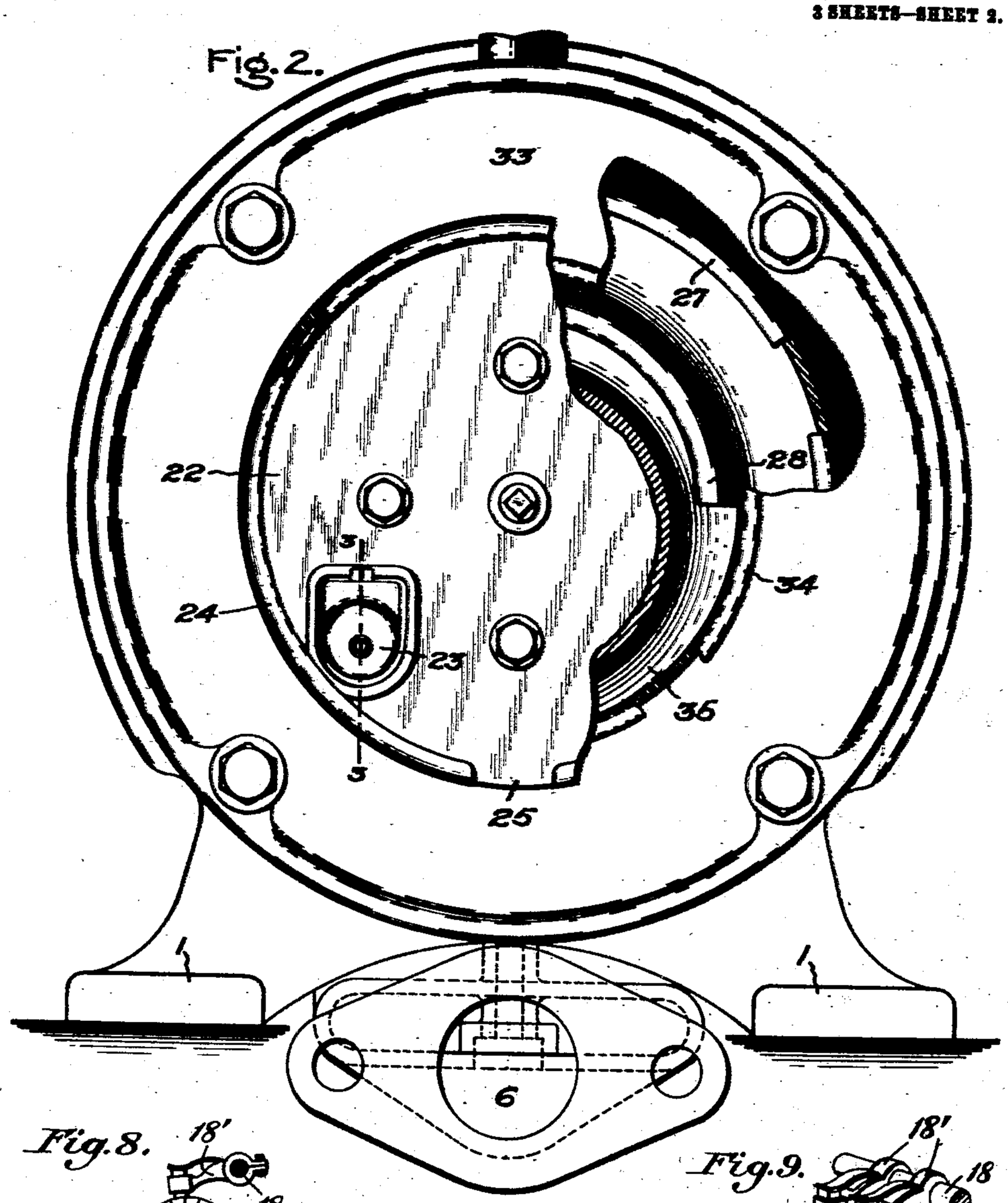


Fig. 8.

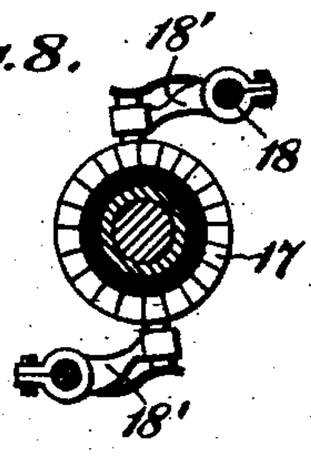


Fig. 9.

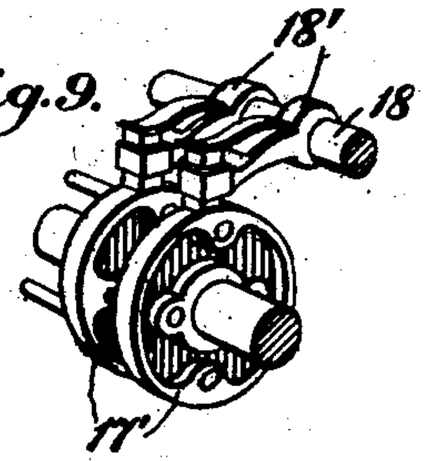
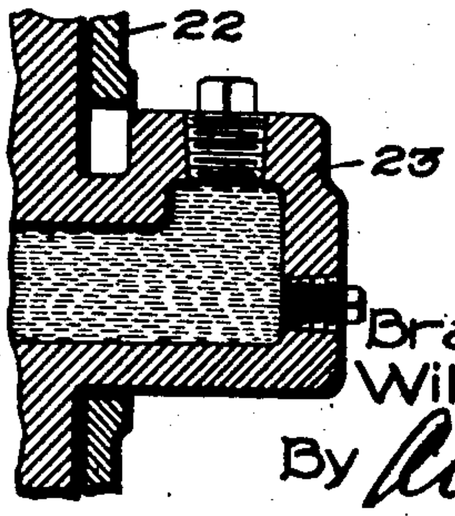


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

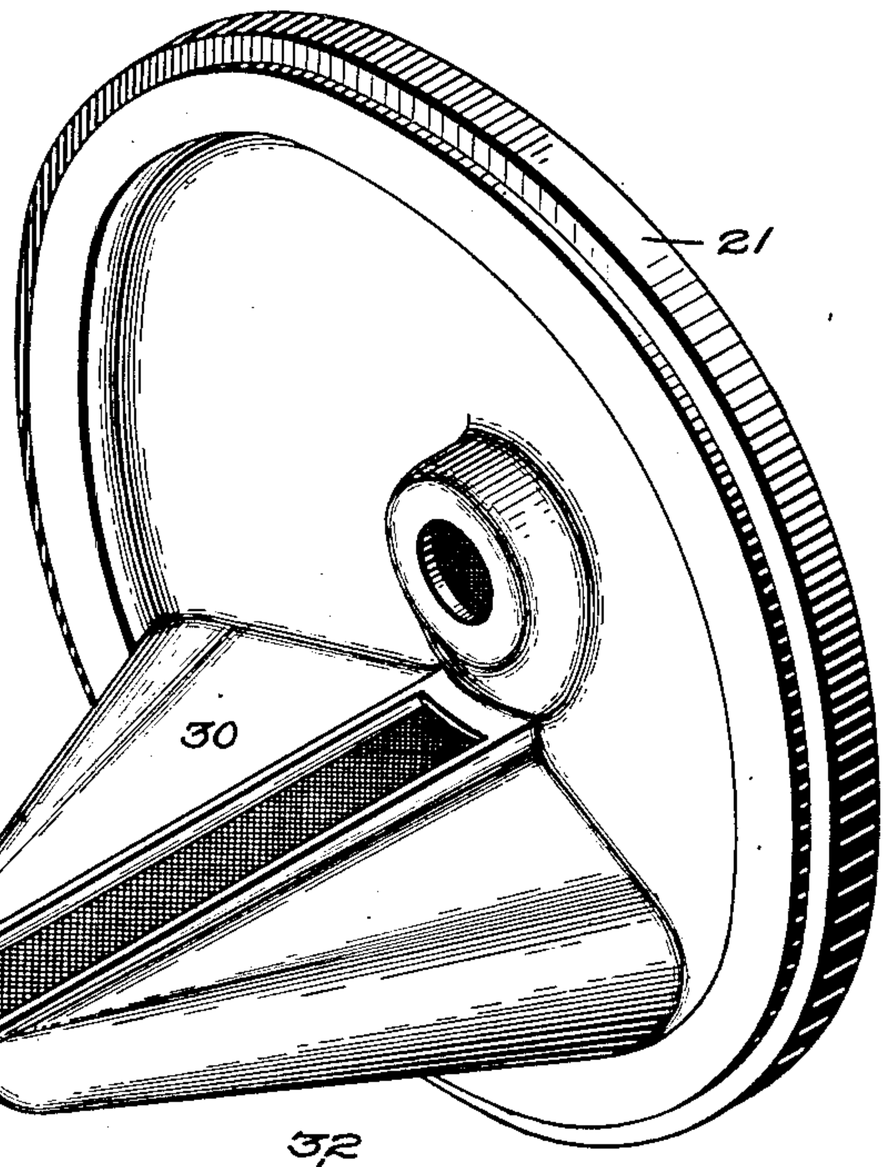


Fig. 5.

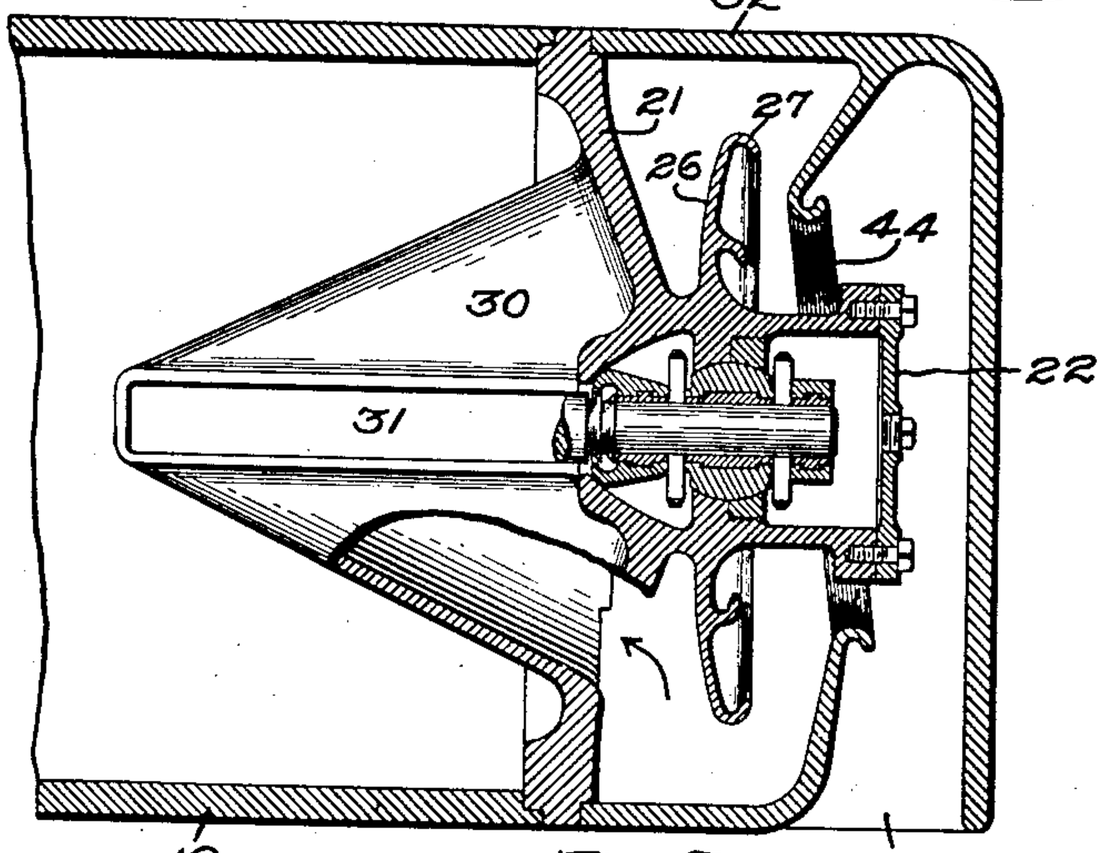
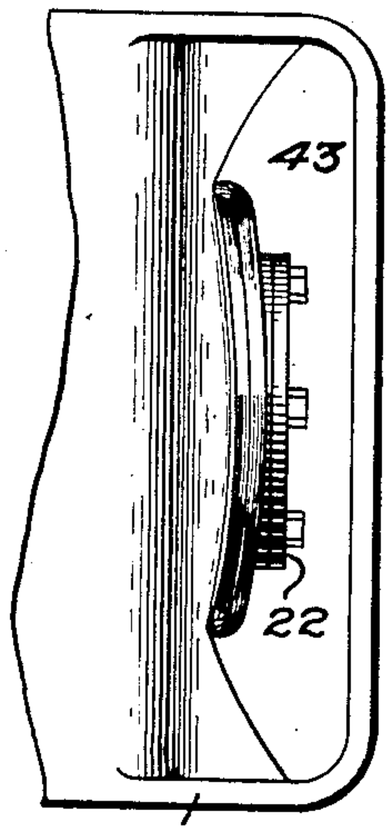
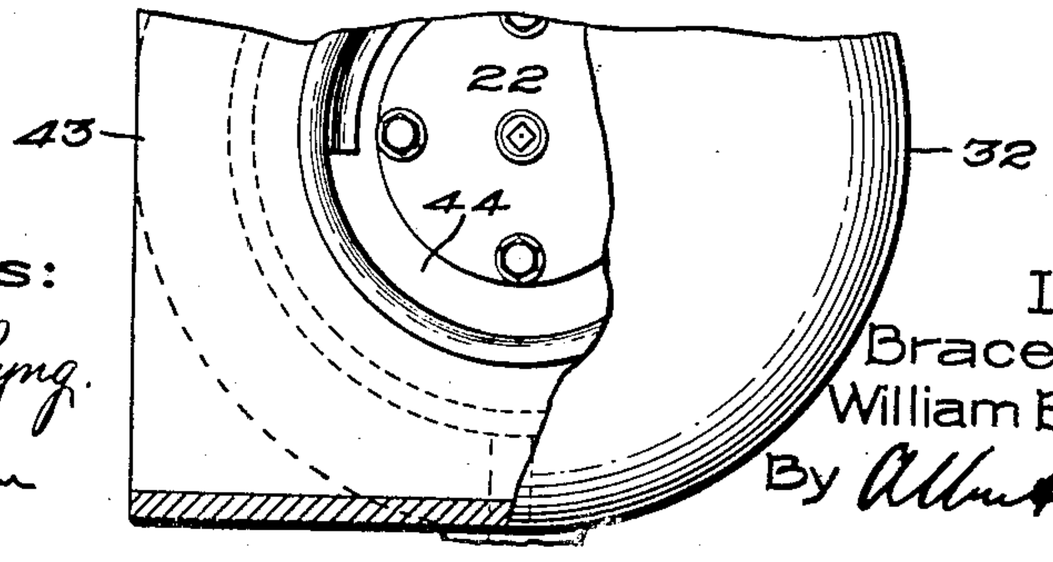


Fig. 7.

Fig. 6.





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UNITED STATES PATENT OFFICE.

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TURBO-GENERATOR.

No. 920,052. Specification of Letters Patent. Patented April 27, 1909.

Application filed April 19, 1907. Serial No. 369,104.

To all whom it may concern:

Be it known that we, BRACE H. HAMILTON and WILLIAM E. VER PLANCK, citizens of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Turbo-Generators, of which the following is a specification.

Our invention has reference to turbo-generators and more especially to those intended for out-of-door service but it is to be understood, however, that the invention is not limited to that class of service since it is capable of much wider application.

The object of the invention is the provision of an improved turbo-generator of simple structure and reliable and efficient operation.

The improvements are directed more particularly to the construction and arrangement of the casing and to means for ventilating the generator and reducing the temperature of the turbo-generator as a whole.

In the accompanying drawings illustrating one embodiment of our invention, Figure 1 is a partial vertical section of a turbo-generator; Fig. 2 is an enlarged view of the right end of the machine shown in Fig. 1 with parts broken away; Fig. 3 is a section on the line 3—3, of Fig. 2; Fig. 4 is a perspective view of the inner wall of the head at one end of the generator casing together with its projecting nozzle; Fig. 5 is a partial horizontal section of a modification; Fig. 6 is a partial side view of this modification; Fig. 7 is an end view of the modification partly in section; Fig. 8 is a detail view illustrating the arrangement of a commutator and brushes; and Fig. 9 is a similar view illustrating collector rings and brushes.

The turbo-generator is illustrated as designed for lighting trains drawn by steam locomotives and may be located on top of the locomotive boiler or on some other part of the train where it is exposed to rain, sleet, snow, dirt, etc. Owing to the severe condition of service, it is necessary to inclose the working parts of the generator in such a manner that they are protected from the elements while at the same time they are properly ventilated and are readily accessible for inspection and repair.

The generating unit may be regarded as comprising two sections, viz.: the turbine section A and the generator section B. Steam from the locomotive boiler or other source drives the turbine which in turn actuates the generator. Current from the generator is supplied to the train-lighting or other system by suitable conductors. The turbine and generator are combined to form a compact machine which is supported by feet 1 bolted to suitable supports on the locomotive or some other base.

For the purpose of illustration, a turbine of the Curtis single-stage type is shown, but the invention is not limited to the specific construction illustrated. The bucket wheel 3 of the turbine is secured to and drives a shaft 4. Steam or other elastic fluid from a suitable source is discharged against the buckets by nozzles or other devices. The supply of steam is controlled by a suitable speed-responsive device actuated directly or indirectly by the shaft 4. The exhaust from the bucket wheel enters the chamber 5 and is led away to any desired point by the exhaust pipe 6 which may extend longitudinally or transversely of the apparatus. The turbine as a whole is inclosed in a casing 7. The portion 8 of the casing which surrounds the governor or speed-responsive device is readily removable by sliding it longitudinally on the guides 9 and is secured in working position by a catch or lock 10. Packings 11 prevent leakage from the casing along the shaft. The shaft 4 is supported by suitable bearings. One bearing 12 is located between turbine and generator and another bearing 13 in the head beyond the generator. Oil rings and reservoirs are provided for lubricating each bearing.

The generator illustrated is of the bipolar direct current type. In Fig. 1, 14 indicates the armature or rotary portion of the generator and 15 the field or stationary portion. In operation the field poles occupy a horizontal position, but to illustrate more clearly the general relation of the poles with respect to the armature conductors, one of the poles is shown in a vertical position 90 degrees displaced from its actual location. The number of poles can be changed to satisfy the operating requirements and the generator may be of the alternating or direct current type as desired. The armature bars 16 are connected to the commutator 17 or to collector rings 17′. 18 indicates the supports for the brush holders but the brushes are omitted from Fig. 1 to simplify the drawing. The arrangement of the brushes 18′ with re-

lation to their coöperating devices 17 or 17′ is illustrated in Figs. 8 and 9, the commutator 17 for a direct current machine being shown in Fig. 8 and the collector rings 17′ for an alternating current machine in Fig. 9. These current collecting devices can be of any approved construction. Suitable openings are provided to permit access to the brushes and commutator. These openings are provided with covers secured by bolts or other means.

The generator has an inclosing frame or casing 19 of substantially cylindrical form and the bearing 12 is protected by a casing 20 removably secured to the casings 7 and 19. A head 21 is secured to the right end of the casing 19. Within the head are the bearing 13 and its oil reservoir. A cover or baffle plate 22 bolted to the outer end of the head closes the reservoir and when removed gives access to the oiling devices and the bearing. The hollow member 23 which projects from the reservoir through the cover has openings for filling and emptying the reservoir. A similar opening is provided near the middle of the cover. Screw plugs are used to close these openings. The baffle plate 22 has a curved edge 24 with an opening 25 in its lower portion. The head 21 also has a vertical flange or baffle plate 26 with a curved edge 27. Concentric with this edge is a similar semi-circular member 28 surrounding the upper half of the bearing. The drain pipe 29 leads from the lower portion of the edge 27 toward the outside of the machine. To prevent the suction on the interior of the cylinder 32 from objectionably interfering with the drainage therefrom, a pocket 45 is provided in the lower portion of the cylinder. The pipe 29 leads to this pocket and an opening 46 leads from the bottom of the pocket to the atmosphere. The depth of the pocket is sufficient to enable it to hold a small column of water whose weight balances or slightly exceeds the suction effect. The result is an intermittent flow from the pocket and the accumulation of an undesirable quantity of water in the bottom of the chamber is prevented.

Projecting from the lower portion of the inner wall of the head is a tapering discharge nozzle or directing member 30 which terminates in an opening 31 extending beneath the brushes 18′ and commutator 17 or other collecting devices, such for example as the collector rings 17′ and their brushes. The cylindrical member 32 is of substantially the same diameter as the casing 19 and is attached to and forms a part of the head 21 which incloses and supports the bearing structure 13. The outer end of this cylinder has an inwardly inclined wall or baffle plate 33 with a curved edge 34 surrounding an opening 35 in the center of the plate. This edge, as well as the edges of the plates 22 and 26, is curved in a direction opposite to the flow of air through the head. Between the generator and the bearing 12, the casing 19 is provided with an internal flange or wall 36 having an opening 37 in its center. Mounted on the shaft 4 adjacent the opening 37 is a fan 38 which as it rotates draws air from the interior of the casing and discharges it over the bearing and the adjacent surface of the turbine casing, the air escaping from openings in the lower part of the casing 20. A screen 39 may partially surround the fan to guard against the entrance of dirt or other foreign matter to the armature when the casing 20 is removed at any time.

A bar or hanger 40 bolted to the turbine and generator casings and provided with an eye bolt 41 furnishes convenient means for lifting the apparatus and moving it about.

If in apparatus of the type described the parts were tightly inclosed, the temperature of the generator might at times rise to a point where it would cause injury to the insulation of the field and armature conductors and thus decrease the life of the machine. It is also obvious that the entrance of any substantial quantity of water or dirt into the generator would be accompanied by injurious results. The construction described secures the benefits of good ventilation at all times and avoids the dangers incident to the admission of foreign matter. The right end of the turbo-generator, Fig. 1, is toward the front of the locomotive. When moving forward a sufficient quantity of air will be forced into the annular opening 42 by the movement of the locomotive and pass from the opening 31 over the current collecting devices, through the other parts of the generator and on to the turbine. But should the locomotive remain stationary for any length of time and the turbo-generator continue running under normal load conditions, it is desirable to provide means, such as the fan 38, for causing a positive flow of air over the current controlling devices and conductors and through the apparatus in general. Air is drawn by the fan from the distant end of the generator and discharged between the generator and the turbine thus preventing heated air or steam due to leakage, passing from the turbine into the generator. Rain, snow, dirt, cinders, etc., entering with the air are arrested by the baffling devices 22, 24, 26, 27, 28, 33 and 34. The foreign particles being heavier are deflected from the tortuous path of the air current, caught by the curved edges of flanges 24, 34, 27 and 28 and drained or directed downward to the outside of the machine by the inclined surface of the baffle plate 33 and through the opening 25 and drain 29. The cleaned air then passes from the interior of the cylinder 32 through the tapered nozzle and is discharged with considerable velocity in a well directed

stream over the commutator and brushes and on through the apparatus as already described. The efficient operation of the generator requires that the rubbing surfaces of the brushes and the commutator or collecting rings be kept cool. This cooling is effected very successfully by the nozzle 30 which directs the air current against them as described, the heat due to friction and resistance being communicated to the air and carried away by it. This result is secured without any interference with the ventilation and cooling of the other parts of the generating apparatus.

The turbo-generator of Figs. 1 to 4 is to be located parallel to the direction of motion of the train. Figs. 5, 6 and 7 show a modification adapted to be located transversely to the direction of train movement. The outer end of the cylinder 22 is closed and the air current enters an opening 43 in the side of the cylinder toward the front of the train instead of in the end of the cylinder as in the other figures. The baffling flange or edge is omitted from the cover 22 and the plane of the opening 44, corresponding to the opening 35, Figs. 1 and 2, is inclined to the axis of the turbo-generator. In all other respects the construction is the same as in the other form of machine above described.

In accordance with the provisions of the patent statutes, we have described the principle of operation of our invention, together with the apparatus which we now consider to represent the best embodiment thereof; but we desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

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

1. In combination, a dynamo-electric machine having poles, an armature and current collecting devices together with a cylindrical casing or frame inclosing the same, a cylindrical head for the casing including an air inlet in its outer end, a nozzle projecting from the inner wall of the head into the casing which receives air from the interior of said head and has its discharge opening extending adjacent the armature and current collecting devices, and a baffling device intermediate the air inlet and the nozzle for preventing the entrance of foreign matter with the air to the interior of the machine comprising a cylindrical plate centrally located adjacent the outer edge of the head, another centrally located plate substantially parallel to the first, and a plate projecting inwardly from the outer edge of the periphery of the head into the space between the parallel plates and having a central opening of less diameter than the outer diameter of said plates.

2. In combination, a motor, a generator driven thereby having an inclosing casing or frame, a head at one end of the casing having an opening therein, a fan adjacent said opening for circulating air through the generator and discharging it toward the motor, a head at the opposite end of the casing including an air inlet, an air delivery nozzle projecting into the interior of the casing, a baffling device intermediate the inlet and the nozzle for preventing the entrance of foreign matter with the air to the interior of the machine, and a drain for said device having a pocket for accumulating a column of liquid sufficient to overcome the suction effect of the fan.

3. In combination, a dynamo-electric machine having an armature and current collecting devices, a cylindrical casing or frame which completely incloses the machine laterally, a transverse head at the armature end of the casing having an air outlet centrally located therein, and a cylindrical head for the collecting device end of the casing comprising an air inlet in its outer portion, an inner wall which separates the head from the interior of the casing, a delivery nozzle carried by the wall which projects into the interior of the casing adjacent the collecting device, and a series of spaced plates intermediate the inlet and the nozzle with their edges curved in a direction opposite to the flow of air through the apparatus, said series comprising substantially parallel cylindrical plates centrally mounted in the head, and a plate projecting inwardly from the periphery of the head into the space between the parallel plates and having a central opening of less diameter than that of the plates.

4. In combination, a dynamo-electric machine having a shaft and an inclosing casing or frame, a cylindrical head at one end of the casing, a bearing for the shaft centrally located in the head, a circular plate on the end of the bearing, a second plate on the bearing parallel to the first, a third plate projecting from the outer portion of the head into the space between said plates, an inner wall extending between the bearing and the periphery of the head, and an air delivering nozzle projecting from the wall into the interior of the casing.

5. In combination, a dynamo-electric machine having current collecting devices, a casing for the machine having receiving and discharge openings to permit a circulation of air through the machine, a baffling means suitably located with respect to the receiving opening to prevent the entrance of foreign matter, and a nozzle receiving air from said means and discharging it over the current collecting devices to the interior of the casing.

6. In combination, a dynamo-electric machine having an inclosing casing or frame, an air inlet, a baffling device adjacent the

inlet for preventing the entrance of foreign matter, means for causing a circulation of air through the machine, and a drain for said device having a pocket for circulating a column of liquid sufficient to overcome the suction effect of the air-circulating means.

In witness whereof, we have hereunto set our hands this seventeenth day of April, 1907.

BRACE H. HAMILTON.
WILLIAM EVERETT VER PLANCK.

Witnesses:
JOHN A. McMANUS, Jr.,
PHILIP F. HARRINGTON.

Corrections in Letters Patent No. 920,052.

It is hereby certified that in Letters Patent No. 920,052, granted April 27, 1909, upon the application of Brace H. Hamilton and William Everett Ver Planck, of Lynn, Massachusetts, for an improvement in "Turbo-Generators," errors appear in the printed specification requiring correction, as follows: In line 111, page 2, the word "controlling" should read *collecting;* same page, line 123, the word "of" should read *or*, and page 4, line 4, the word "circulating" should read *accumulating;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 7th day of September, A. D., 1909.

[SEAL.]

F. A. TENNANT,
Acting Commissioner of Patents.