Dec. 15, 1942. G. SLAYTER 2,305,500

APPARATUS FOR ELECTRICALLY GENERATING PRESSURES

Filed Jan. 22, 1940 3 Sheets-Sheet 1

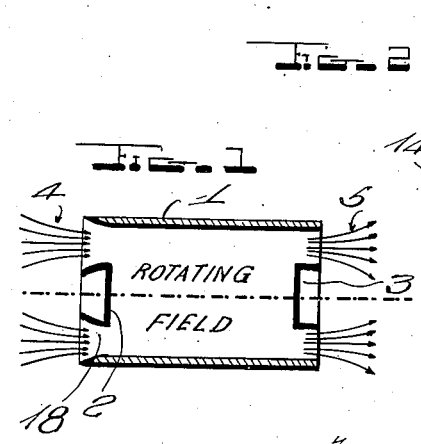

FIG. 1

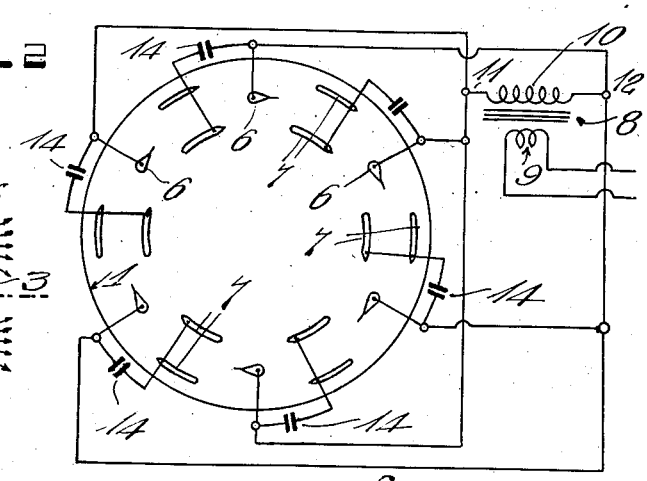

FIG. 2

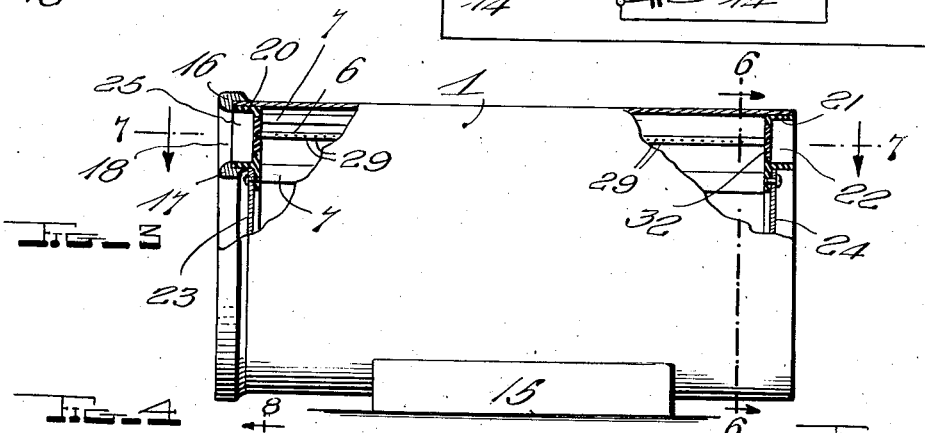

FIG. 3

FIG. 4

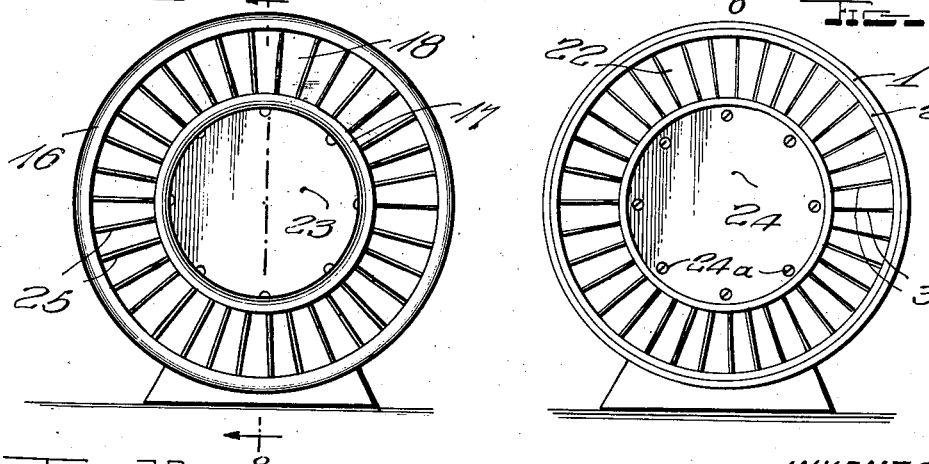

FIG. 5

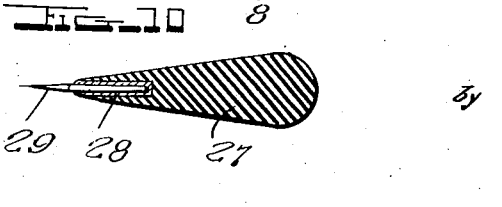

FIG. 10

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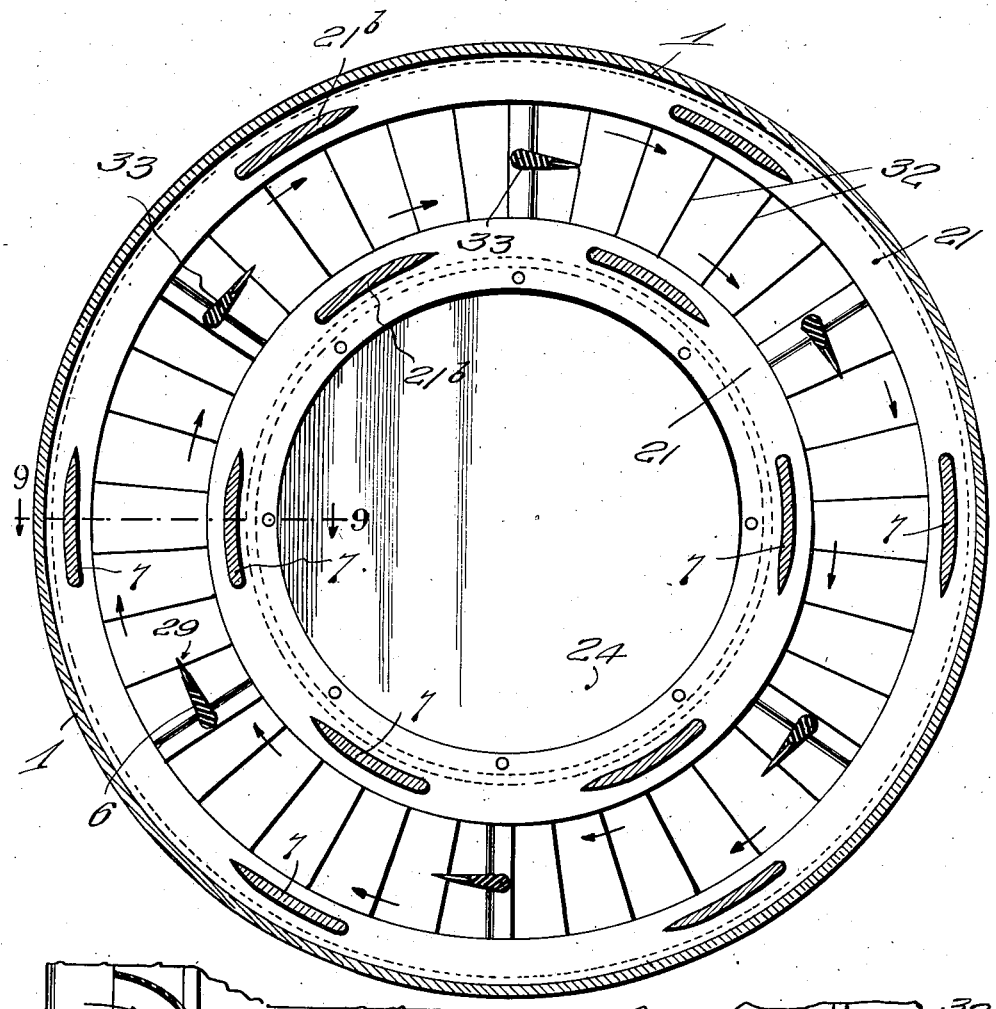
FIG. 6



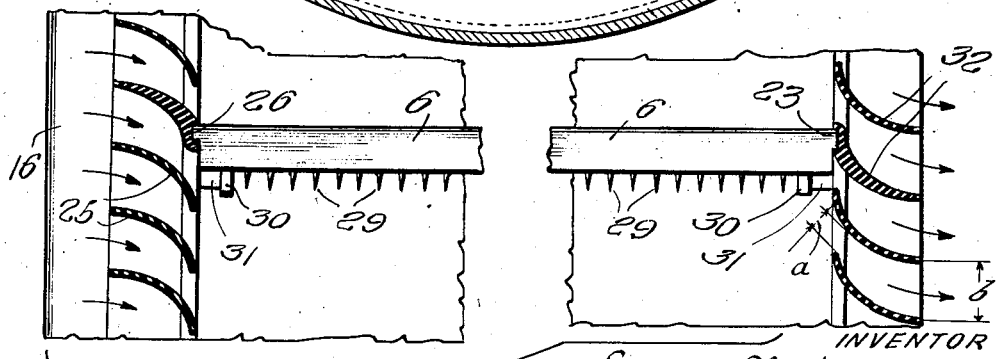


FIG. 7

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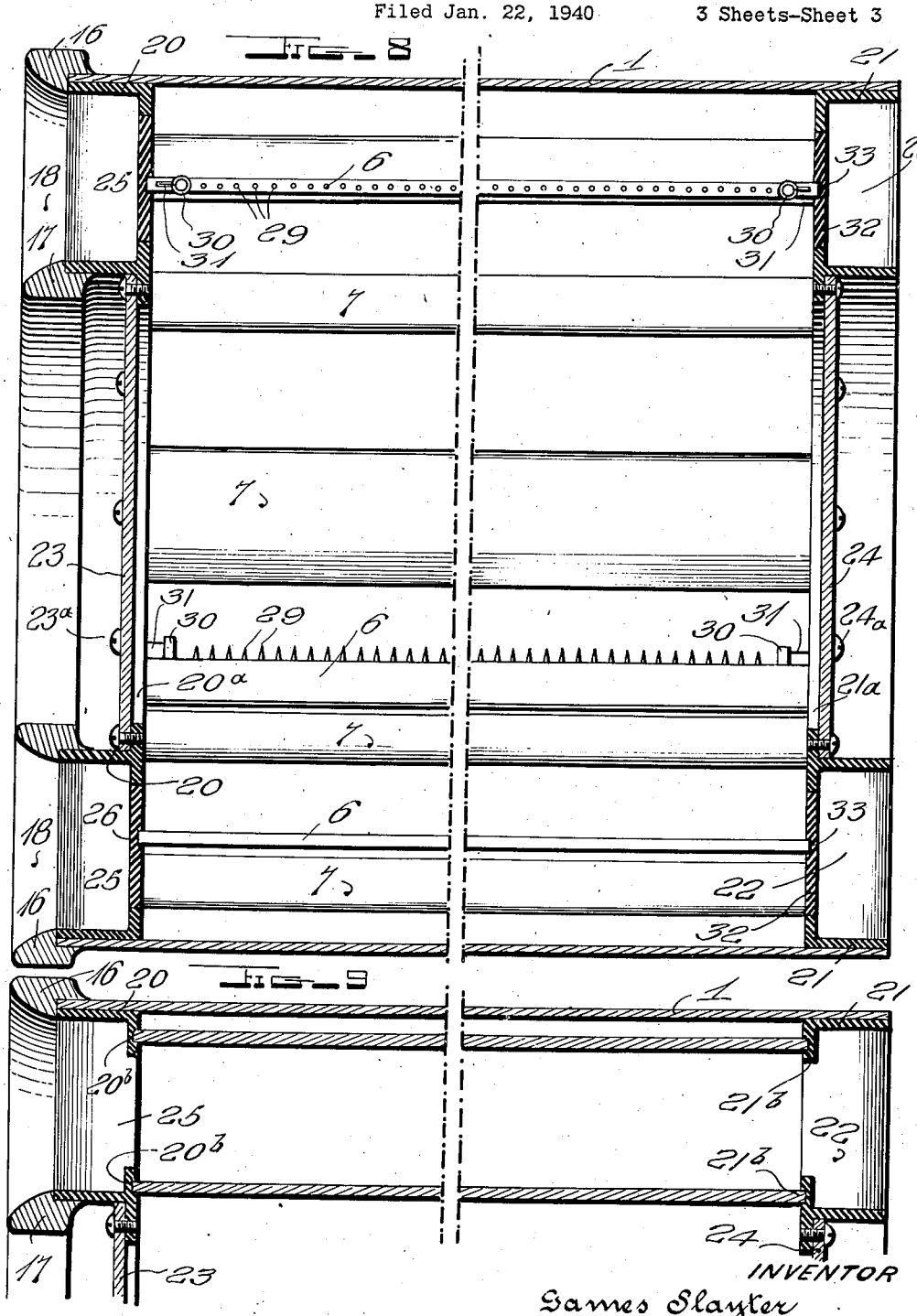

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UNITED STATES PATENT OFFICE

2,305,500

APPARATUS FOR ELECTRICALLY GENERATING PRESSURES

Games Slayter, Newark, Ohio, assignor to Slayter Electronic Corporation, a corporation of Ohio

Application January 22, 1940, Serial No. 315,085

12 Claims. (Cl. 230—69)

My invention relates broadly to an apparatus for electrically generating pressures and more particularly to an improved method and apparatus for electrically developing relatively high velocities at relatively high efficiencies.

One of the objects of my invention is to provide an improved method and apparatus for electrically generating pressures in a substantially confined casing and delivering the generated pressures at relatively high velocity and efficiency at the outlet end of the apparatus.

Another object of my invention is to provide a cylindrical arrangement of high potential discharge electrodes coacting with correspondingly arranged target electrodes disposed within a chamber substantially conforming in contour to the arrangement of the electrodes and operating to receive fluid at one end of the chamber and deliver the fluid at relatively high velocity and efficiency at the other end of the chamber.

A further object of my invention is to provide a cylindrical arrangement of discharge electrodes and coacting targets disposed in a chamber having means at opposite ends thereof for the admission and discharge of fluid whereby the fluid is injected into the chamber in a rotating path and converted from a rotating path into a substantially straight line path at the discharge end of the chamber at relatively high efficiency.

Still another object of my invention is to provide a construction of pressure generating apparatus comprising a chamber having electric discharge and coacting target electrodes therein in preformed arrangement having means at the intake end for converting the direction of movement of fluid from straight line movement to rotational movement, developing high velocity rotational movement of the air within the chamber and delivering air from the chamber in substantially straight line direction at the outlet end of the chamber at relatively high efficiency.

A still further object of my invention is to provide a system of electrically developing relatively high velocities in air which comprises establishing electric discharges in a substantially confined chamber for producing relatively high rotational velocities of air, introducing air in a path coincident with the rotational path of the air at one end of the chamber and delivering the air at relatively high efficiency in a substantially straight line direction at the opposite end of the chamber.

Still another object of my invention is to provide an improved construction of electronic fan comprising a chamber having electric discharge and coacting target electrodes therein for developing continuous rotational motion in air at high velocity with means at the inlet end of the chamber for introducing air in a direction coincident with the direction of rotational motion generated within the chamber and means at the delivery end of the chamber for reconverting the rotational motion of the air to straight line motion for discharge at high efficiency.

A still further object of my invention is to provide a system for generating movement of air in a substantially confined space at a velocity in excess of the desired usable velocities and employing a portion of the generated velocity in the open atmosphere.

Still another object of my invention is to provide a system for electrically establishing an air flow at high velocity in a substantially confined space and discharging the air at lower velocity into the open atmosphere.

A further object of my invention is to provide a system of electrically producing a whirling mass of air in a substantially confined space at relatively high velocity and discharging a portion of the air at lower velocity to the open atmosphere at relatively high efficiency.

A still further object of my invention is to provide an arrangement of shaped orifices at the intake and discharge ends of a chamber in which a high velocity rotating mass of air is generated by which the velocity of the air may be regulated and controlled at both the intake and discharge ends of the chamber.

Other and further objects of my invention reside in an apparatus for electrically producing mass movement of air at high velocities as set forth more fully in the following specification by reference to the accompanying drawings, in which:

Figure 1 is a theoretical diagram explaining the principles of my invention; Fig. 2 is a schematic view showing the electrical circuit arrangement employed in the apparatus of my invention; Fig. 3 is a side elevation, partially broken away at each end and illustrating parts in section and elevation; Fig. 4 is a view of the inlet end of the apparatus of my invention; Fig. 5 is a view of the outlet end of the apparatus embodying my invention; Fig. 6 is an enlarged transverse sectional view taken on line 6—6 of Fig. 3; Fig. 7 is a fragmentary and foreshortened sectional view taken on line 7—7 of Fig. 3, illustrating one of the emitting electrodes and the manner of mounting the electrode with respect to the intake and discharge ends of the apparatus; Fig. 8 is a foreshortened

transverse longitudinal section through the apparatus of my invention taken on line 8—8 of Fig. 4; Fig. 9 is a fragmentary foreshortened longitudinal sectional view taken on line 9—9 of Fig. 6; and Fig. 10 illustrates in cross section one form of emitting electrode which may be employed in the apparatus of my invention.

My invention is directed to a system and apparatus for securing relatively high degrees of efficiency in the mass movement of air and gases by electric discharge. Heretofore, increase in air velocity has been obtained in electric discharge systems by employing cascaded arrangements of electrodes. There are, however, certain limitations encountered in increasing velocity by cascading. Accordingly, I have departed radically from prior methods by arranging sets of emitting and target electrodes in a confined chamber and electrically connecting the emitting and target electrodes in selected phase relation with respect to a power source for setting up a rotating electric field. A mass movement of air at high velocity is obtained in a confined rotating path. This rotating mass of air obtains velocities which are substantially in excess of velocities required to perform the usual functions of cooling of air circulation. Into this rotating mass of air I direct air from a position outside of the confined chamber into the rotating mass of air in a direction substantially coincident with the path of rotation of the air. At the outlet end of the confined chamber I provide an arrangement of stationary blades so mounted as to turn the air from the rotational motion into a direct axial delivery. The permanent velocity head which is established by the rotating mass of air insures delivery of air at relatively high efficiency. As an example of the increased efficiency which is obtainable in employing the method and apparatus of my invention, consider that a rotational speed of air within the chamber is established at approximately 12,000 feet per minute, and suppose it is desired to have the fan deliver air at 1000 feet per minute. In this case, the aperture between blades at the entrance of the fan would be $\frac{1}{12}$th the delivery aperture. At the entry end of the fan a like set of blades can be mounted, but in reverse direction, so as to receive the intake air, turn the direction of motion of the intake air into the rotational motion, and accelerate the air from the intake speed of 1000 feet per minute to approximately 12,000 feet per minute. The Bernoullian reduction of pressure caused by the increase of speed at entrance is exactly compensated by the Bernoullian increase in pressure at delivery, and energy is conserved by the system.

Referring to the drawings in more detail, reference character 1 indicates the cylindrical housing within which the rotating mass of air is recirculated for building up relatively high velocities under the action of electric discharge. At the inlet and outlet ends of the chamber 1, I have indicated centrally arranged members 2 and 3 which shape the path along which the air enters and discharges from the cylindrical casing. The arrows at 4 indicate the paths along which the air enters the confined chamber 1. It will be observed that the annular orifice through which the air enters is streamlined for the reduction of head resistance. It is through this annular zone that the air is directed by means of shaped radially extending blades into a direction coincident with the direction of the rotating field within the chamber 1. At the discharge end of the chamber, the directional lines 5 indicate the path of the air between radially extending blades by which the direction of movement of the air is changed from the rotating field to a direction projecting from the end of the chamber along an axis which is substantially coincident with the longitudinal axis of the chamber.

In Fig. 2 I have illustrated the manner of arranging and electrically connecting the electrodes for establishing the rotating field. It will be observed that the emitters extend longitudinally of the cylindrical chamber 1 as designated generally at 6. The emitters 6 are disposed intermediate pairs of target electrodes 7 arranged in annular rows on opposite sides of the emitters 6. The target electrodes 7 are shaped to conform in curvature with the curvature of confined chamber 1. The high potential source for energizing the electrodes is obtained through transformer system 8 having primary winding 9 connected with the power source and secondary winding 10 having the opposite ends 11 and 12 thereof connected to alternately disposed emitters 6. The sets of target electrodes 7 which coact with an adjacent emitter 6 are connected to that end of secondary winding 10 which for any selected instance is at opposite potential to the potential of the emitter, the connection being completed through a condenser indicated at 14. Considering any set of electrodes in the circular arrangement of electrodes, the emitters 6 of one set of electrodes is connected, for example, to the end 11 of secondary winding 10, while the coacting target electrodes 7 are connected with the terminal 12 of secondary winding 10 through condenser 14. Thus, discharge takes place between the emitters 6 and the coacting target electrodes 7 establishing a flow of air which is recirculated within the confined chamber and augmented and increased by the successively acting coacting sets of electrodes arranged in the annular path, thereby setting up a rotating field of relatively high velocity. My invention contemplates the use of polyphase supply systems by which successive and repeated impulses are imparted to the mass of air for setting up a rotating field of relatively high velocities.

In Fig. 3 I have shown the arrangement of cylindrical chamber 1 mounted on a suitable support 15. The support 15 may be hollow and may be extended to a position adjacent the discharge end of the cylindrical chamber 1 and may connect with an annular channel, connected through apertures with the discharge end of the cylindrical chamber 1 to function as a dust collector to receive dust and dirt which is thrown out by the air by centrifugal action. The inlet end of the chamber 1 is illustrated as provided with stream-lined annular members 16 and 17 which define an annular orifice 18 through which the air is drawn. The transversely disposed insulated frame 20 extends across the intake end of the chamber 1 and provides the framing which supports the longitudinally extending emitters 6 and target electrodes 7. At the discharge end of the chamber 1, I provide a similar transversely disposed frame of insulated material indicated at 21 and providing supporting means for the ends of the emitters 6 and target electrodes 7. The frame 21 provides an annular discharge zone 22 for the air delivered from chamber 1. The transverse frames 20 and 21 each include an inwardly projecting annular flange portion 20a and 21a providing mounting means for the central closure discs indicated at 23 and 24.

In order to direct the air from a position of rest into a path substantially coincident with

the rotating field of air within the chamber, I arrange in the annular zone 18 a multiplicity of radially extending blades 25. The blades 25 are shown more particularly in Fig. 7 and illustrate the manner in which the direction of the air is changed to correspond with the direction of rotation of the air within the chamber. Certain of the radially extending blades 25 are interiorly recessed as indicated at 26 to provide a support for the end of the emitters 6. The emitters 6 have been shown generally as comprising semiconductive streamlined body structure 27 supporting the strip 28 in which emitting points 29 are mounted. It will be understood that the form of emitter illustrated is merely shown by way of example and that various constructions of emitters may be employed in the system of my invention. For the purpose of preventing streamers or spark-over adjacent the ends of the emitters, I provide potential equalizers adjacent each end of the emitter in the form of tubular members 30 having conductive strip-like portions connected therewith as indicated at 31.

The target electrodes 7 are supported in opposite aligned recesses 20*b* and 21*b* in the transverse frames 20 and 21, respectively. The recesses 20*b* and 21*b* are curved in a direction coincident with the contour of the chamber and enable the target electrodes to be compactly mounted and maintained in position between the transverse frames 20 and 21.

It will be observed that the blades 25 are so shaped that air injected into the chamber is rotating in a direction coincident with the direction of movement of the air secured by the discharge of the cylindrical arrangement of the electrodes. Similarly, the blades 32 at the discharge end of the chamber are shaped to turn the air from the rotational motion into a direct axial delivery. Referring to Fig. 7, the aperture between the blades 32 at the interior of the chamber has been indicated by distance *a*, whereas the delivery aperture at the discharge ends of the blades 32 has been indicated by distance *b*. In an apparatus where the rotation of the air within the chamber acquires a speed of 12,000 feet per minute and it is desired that the air speed at the discharge end of the apparatus be 1,000 feet per minute, the aperture between the blades at the interior of the chamber indicated at *a* would be ½ the delivery aperture *b*. The emitter strips 6 are mounted in suitable recesses 33 provided in the interior surfaces of certain of the blades 32 aligned with similar recesses 26 in certain of the blades 25 at the intake end of the chamber.

The central closure discs 23 and 24 are readily removable and replaceable by means of securing screws 23*a* and 24*a* which extend into the upwardly extending flange portions 20*a* and 21*a* of the transverse frames 20 and 21, respectively. With the end closures 23 and 24 removed, it is readily possible to arrange the emitting and target electrodes in position or to remove and replace an electrode. Electrical connections are made to the target electrodes and to the emitting electrodes by means of conductors which occupy minimum space against the interior faces of the transverse frames 20 and 21.

I have not attempted to show the parts of the apparatus in actual proportions, but have merely illustrated the principles of my invention by which high efficiencies are obtainable by the development of velocities in excess of the velocity at which the air is ultimately discharged. The form of electrodes and the assembly thereof may vary in structure and arrangement in order to secure in various ways the required high velocity rotation force permitting a portion of such rotational force to be utilized in the development of usable velocities at the discharge end of the apparatus.

The fundamental system employed in my invention is that of establishing a whirling field by successive electric discharges in a circular path in a confined chamber, thereby developing a high velocity head. Through the inlet end of this chamber, air is introduced in such manner that the velocity thereof is increased to a velocity approaching the velocity of the whirling mass of air. The air thus admitted to the whirling mass of air is accelerated to the velocity of the whirling mass of air and the velocity sustained for a period of time during which a substantial velocity head is built up. At the discharge end of the chamber, the velocity of the air is decreased and the air delivered at a velocity which is less than the velocity of the whirling mass of air within the confined chamber.

While I have described my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

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

1. Apparatus for electrically generating pressures in a fluid medium comprising in combination a casing having intake and outlet openings, electric discharge and coacting target electrodes mounted in a substantially circular path within said casing and electrically connected and energized for establishing a continuous electric discharge in a circular path, means for introducing fluid in said casing through the intake opening in a direction substantially coincident with the direction of movement of the discharge within said casing, and means for converting the rotating motion of the stream of fluid to substantially straight line motion and delivering the fluid in a substantially straight line direction through the outlet opening in said casing.

2. Apparatus for electrically generating pressures in a fluid medium comprising in combination a casing having intake and outlet openings, electric discharge and coacting target electrodes extending longitudinally through said casing in positions substantially tangent to transverse circular sections through said casing, said electric discharge and coacting target electrodes being electrically connected and energized to establish a discharge in a circular path, and means adjacent the intake and outlet openings in said casing for controlling the admission and discharge of fluid with respect to said casing.

3. Apparatus for electrically generating pressures in a fluid medium comprising in combination a casing having intake and outlet openings, electric discharge and coacting target electrodes disposed in said casing and electrically connected to effect an electrical discharge in a circular path and thereby establishing a rotating velocity head in the casing, and means adjacent the intake and outlet openings in said casing for controlling and regulating the admission and discharge of the fluid medium to and from said casing.

4. Apparatus for electrically generating pressures in a fluid medium comprising in combina-

tion a casing, electric discharge and coacting target electrodes disposed in said casing and electrically connected and energized for establishing a rotating velocity head, and preformed blade devices at each end of said casing forming admission and delivery orifices for said casing for controlling and regulating the admission and discharge of the fluid medium to and from said casing.

5. Apparatus for electrically generating pressures in a fluid medium comprising in combination a casing, electric discharge and coacting target electrodes disposed in said casing and electrically connected and energized for establishing a rotating velocity head, and radially disposed blade members at each end of said casing forming preshaped admission and delivery orifices for said casing for controlling the admission and discharge of the fluid medium.

6. Apparatus for electrically generating pressures in a fluid medium comprising in combination a casing, electric discharge and coacting target electrodes disposed in said casing and electrically connected and energized for establishing a rotating velocity head, and annular zones of radially disposed blade members at each end of said casing forming preshaped admission and delivery orifices with respect to said casing for controlling and regulating the admission and discharge of the fluid medium.

7. Apparatus for electrically generating pressures in a fluid medium comprising in combination a casing, electric discharge and coacting target electrodes disposed in said casing and electrically connected and energized for establishing a rotating velocity head, a multiplicity of radially disposed blade members at each end of said casing, said blade members being preformed to provide means for delivering fluid medium through one end of said casing in a direction substantially coincident with the direction in which said rotating velocity head is established, and radially disposed blade members at the discharge end of said casing shaped to receive the fluid medium from the path in which the rotating velocity head is established for discharging the fluid medium in a direction substantially coincident with the longitudinal axis of the discharge end of said casing.

8. In apparatus for electrically generating pressures in a fluid medium, a cylindrical casing, means for introducing fluid medium into the cylindrical casing in a direction substantially tangentially to the cylindrical side wall of the casing, means for moving the fluid medium in a circular path in the casing including pointed electric discharge and coacting target electrodes arranged in the casing to establish electric discharges in a circular path in the casing, and means remote from the first named means for discharging fluid medium from the casing.

9. In apparatus for electrically generating pressures in a fluid medium, a casing having an intake opening for receiving a fluid medium and having an outlet opening directly opposite the intake opening, and means located in the casing between said openings for creating successive electric discharges in a circular path to impart a whirling motion to the fluid medium as the latter passes through the casing from the intake opening to the outlet opening.

10. In apparatus for electrically generating pressures in a fluid medium, a casing having an intake opening for receiving a fluid medium and having an outlet opening through which the fluid medium is discharged, means located in the casing between said openings for imparting a whirling motion to the fluid medium in the casing, said means comprising a plurality of electric discharge electrodes streamlined in the direction of the whirling motion of the fluid media and having relatively sharp emitting points, target electrodes coacting with the emitting points of the discharge electrodes to provide an electric discharge from the points to the target electrodes, said coacting discharge and target electrodes being arranged in the casing to provide electric discharges in a circular path in the casing.

11. In apparatus for electrically generating pressures in a fluid medium, a casing having an intake opening for receiving a fluid medium, means located in the casing for imparting a whirling motion to the fluid medium in the casing, said means comprising a plurality of electric discharge and coacting target electrodes mounted in a circular path in the casing in a manner to establish electric discharges in a circular path in the casing, and means for discharging the fluid medium from the casing in a direction substantially parallel to the general axis of the whirling fluid medium in the casing.

12. In apparatus for electrically generating pressures in a fluid medium, a casing having an intake opening for receiving a fluid medium, means located in the casing for imparting a whirling motion to the fluid medium entering said casing through the intake opening, said means comprising a plurality of electric discharge electrodes having pointed emitting portions, a plurality of target electrodes positioned to coact with the emitting portions of the discharge electrodes to establish electric discharges from the said pointed portions to the target electrodes, said electrodes being arranged in a circular path in the casing to provide a whirling electric field in said casing and means for discharging fluid medium from the field at a relatively lower velocity and high pressure than the fluid medium in said whirling field.

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