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HYDRODYNAMIC HIGH VOLTAGE GENERATOR

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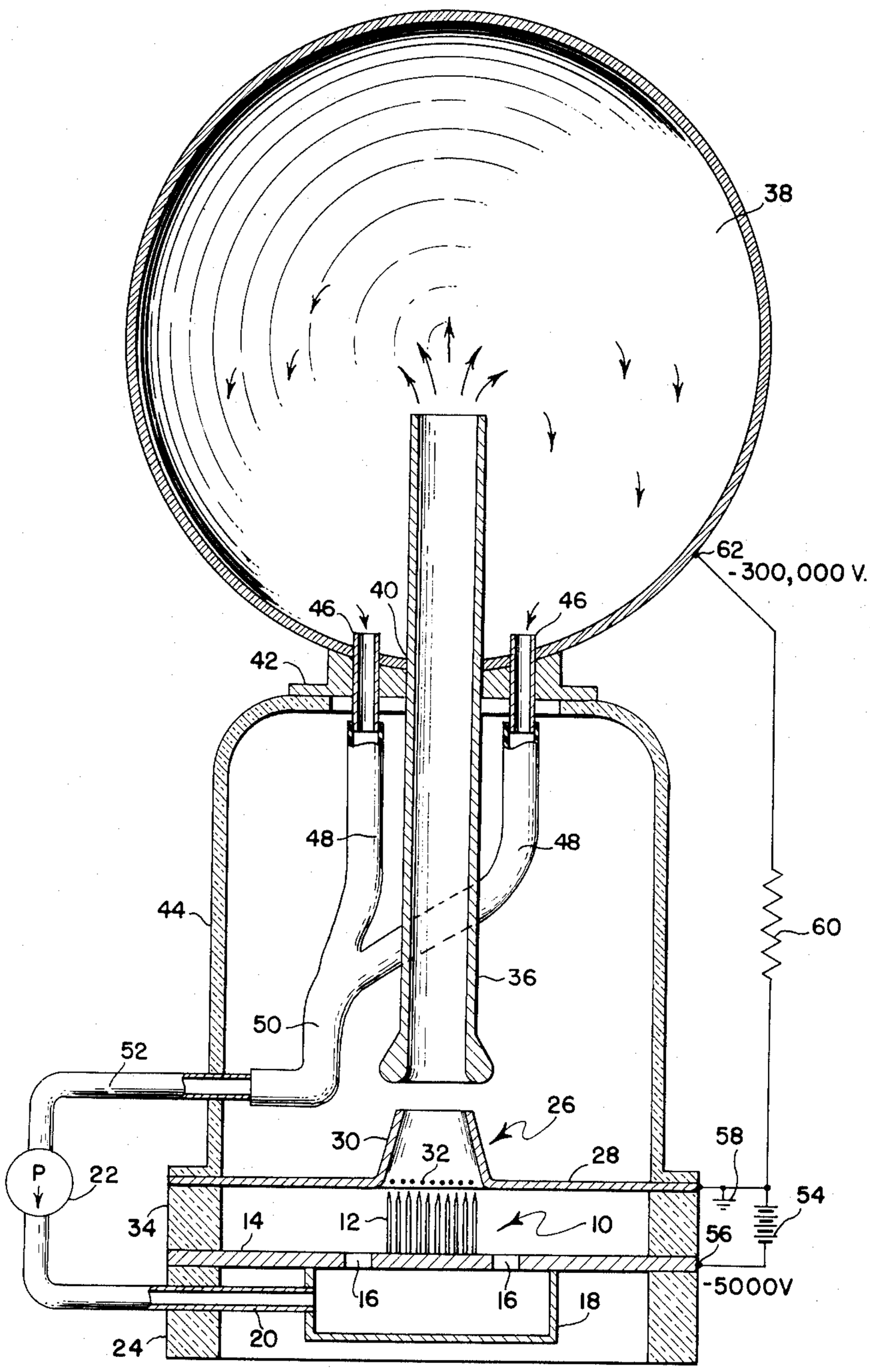

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HYDRODYNAMIC HIGH VOLTAGE GENERATOR

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This invention relates generally to high voltage generating apparatus, and pertains more particularly to a high voltage generator using a highly insulating liquid by which ions are transported in order to build up a difference in potential between two electrodes.

One object of the invention is to provide a high voltage generator that will have a comparatively high power efficiency. In this regard, previous generators have been constructed in such a manner that charges could build up on an insulating medium in the neighborhood of the electrodes to such an extent that they impede or interfere with the efficient generating of the desired high voltage. The present invention obviates such a happening.

Another object of the invention is to minimize the current fluctuations that have been rather pronounced in the prior art generators that are known to me.

Also, the invention has for an object the construction of a high voltage generator that is very rugged and easily serviced when servicing is needed.

A further object of the invention is to provide a generator of the foregoing character that will be self-healing after an occasional breakthrough.

Another object is to provide a high voltage generator that will require no complicated mechanical alignments.

Yet another object of the invention is to provide a high voltage generator employing a transport liquid that will be an ideal coolant for high powered devices.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application which will be indicated in the appended claims.

In the drawing:

The single figure that has been presented constitutes one form that my invention may assume, the view being in elevation and partly schematic in character.

Referring now in detail to the drawing, the high voltage generator there exemplifying my invention includes an emitter electrode generally designated by the reference numeral **10**. In the form that it has been pictured, the emitter **10** comprises a plurality of upstanding needles **12** having rather sharp upper extremities. These needles **12** project upwardly from a metallic plate **14**, and for a purpose soon to be made manifest, the plate is formed with a plurality of apertures or openings **16** circumjacent the upstanding needles **12**.

Secured to the underside of the plate **14** is a liquid-type housing labelled **18**. This housing **18** may be readily attached to the plate **14**, e.g., by welding. Leading to the housing **18** is a tube or pipe **20** connected to the discharge side of a liquid pump **22**. More will be said hereinafter concerning the role played by the pump **22**. However, at this time it can be stated that the pump **22** supplies a highly insulating liquid, such as kerosene or transformer oil, to the housing **18** so that it can then flow upwardly through the openings **16**, all in a manner that will be described more fully hereinafter. It will be observed that the tube or pipe **20** passes through a cylindrical skirt **24**, which may be of porcelain or like material. The plate **14** of the emitter **10** is supported on the upper edge of the skirt **24** which also serves as an electrical insulator therefor.

Closely adjacent the upper ends of the various needles **12** is disposed an auxiliary electrode indicated generally by the reference numeral **26**. This electrode **26** includes a plate **28** having a tapering or frusto-conical central portion **30**. At the lower end of the tapering portion **30**, this being in a planar relationship with the plate **28**, is a grid structure **32**. The parts **10** and **26** co-act with each other to form an ionizer. It is important for the proper practicing of the invention, however, that the upper points of the needles **12** be extremely close to the grid structure **32**. Actual practice has demonstrated that this is essential in order to provide a very high space charge density during the generating procedure. This spacing can be properly maintained by employing an intermediate cylindrical member **34**, also of porcelain or the like inasmuch as a difference of potential must be maintained between the emitter **10** and the auxiliary electrode **26**. The difference in potential that is employed will be mentioned later.

Superimposed above the auxiliary electrode **26** is a metallic transport tube **36**. Its lower end is in a relatively close or proximal relationship with the upper edge of the tapering portion **30** of the auxiliary electrode **26**. The spacing between the upper end of the tapering portion **30** and the lower end of the transport tube **36** is of the order of several centimeters, whereas the spacing between the points on the needles **12** and the grid structure **32** is of the order of only several millimeters.

The metallic transport tube **36** extends upwardly into a metallic hollow sphere **38** which functions as an ion collector electrode, it being contemplated in the pictured instance that the tube **36** will be welded to the sphere **38** at **40**. Affixed to the lower portion of the collector sphere **38** is a cradle member **42**. The cradle member **42** has a flange which overlies the upper edge of a housing **44** of porcelain or the like, it being planned that a suitable insulating material be employed which will withstand the high voltage differences that will be encountered between the collector **38** and the lower auxiliary electrode **26**.

The insulating liquid that is forced upwardly through the transport tube **36** is returned to the pump via a plurality of annularly located tubes **46** leading downwardly through the sphere **38** and its underlying cradle member **42**. Each tube **46** has connected thereto a tubular element **48**, such as rubber, which tubes **48** merge into a single tube or conduit **50** attached to a horizontally directed tube **52**. It is the tube **52** that is actually connected to the intake of the pump **22**.

While precise voltages and their polarities used for energization purposes are susceptible to variation, nonetheless typical voltages will be given. In this regard, a source of potential **54** is employed which applies a negative potential of, say, minus 5,000 volts to the emitter **10**. The positive side of the source **54** is grounded at **58**, and it will also be discerned that the auxiliary electrode **26** is likewise grounded at **58**. Thus, a difference of potential of the order of 5,000 volts exists between the emitter **10** and the auxiliary electrode **26**. Owing to the transport of ions upwardly through the transport tube **36**, the ions being dispersed in the manner indicated by the various arrows within the sphere **38**, a very large negative potential is realized at the surface of the sphere **38**. In other words, as already indicated, the sphere **38** acts as a collector for the ions that have been moved upwardly through the tube **36**. Accordingly, use is made of the high negative potential that appears on the collector or sphere **38**, a conductor being attached to such a sphere **38** at **62**. In circuit with the sphere or collector **38** and the source of potential **54** is a load resistor **60** which can constitute a variety of usable instrumentalities. At any rate, the depositing of ions by way of the upwardly flowing insulating liquid provides a

negative potential on the order of several hundred thousand volts. This is realized with the intial employment of only a difference in potential of 5,000 volts across the emitter 10 and the auxiliary electrode 26.

Having presented the foregoing information, the manner in which my high voltage generator functions is believed readily apparent. It will be appreciated that the pump 22 furnishes the desired amount of mechanical energy for forcing the insulating liquid through the tube 20, the housing 18, and the openings 16. As the liquid continues upwardly past the needles 12 of the emitter 10, electrons are deposited on the various atoms as they flow by in the direction of the grid structure 32. The now negative ions 32 are flushed through the intervening space between the tapering portion 30 and the lower end of the transport tube 36, their path progressing upwardly through the tube. It is of the utmost importance to appreciate that the transport tube 36 is of a conductive material. Previous experience has shown very vividly that where an insulating material is used for the tube 36 that there is a building up of ions along the inner walls of the tube 36 and that these ions, in the present instance considered to be negative, would provide a repelling force for additional ions as they come along. However, with the present invention this does not occur and the efficiency is very much enhanced.

Continuing with the description of the operation or functioning of my generator, it can be discerned that the ions carried by the insulating liquid are discharged from the upper end of the transport tube 36 into the interior of the hollow collector 38. Because of the flow of liquid, these ions are then deposited on the walls of the collector or sphere 38. The ions on the collector 38 build up an appreciable potential differential between the collector and the auxiliary electrode 26. It has already been stated that voltages can be produced having value approximating several hundred thousand volts. Thus, there is experienced a very large increase in voltage over that applied between the emitter 10 and the auxiliary electrode 26.

The liquid from the collector or sphere 38 is then returned to the pump 22 for reuse, this being via the various tubes 48 and the tube 52.

From what has herein been said, it is believed readily apparent that a highly efficient voltage generator has been devised. In realizing this high degree of efficiency, particular attention should be made to the close spacing of the needles 12 with respect to the grid structure 32 for the purpose of creating a space charge of high density. Coupled with the employment of the metallic transport tube 36, this high space charge density is in effect preserved so that it will efficiently deposit the ions on the interior collector 38.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

What is claimed:

1. A hydrodynamic high voltage generator comprising an ionizer including an emitter electrode and auxiliary electrode closely adjacent thereto, an elongated metallic transport tube having one end disposed near said auxiliary electrode in axial alignment with said electrodes, a hollow collector electrode spaced from said ionizer and into which the other end of said transport tube projects, means for circulating an insulating liquid through said ionizer, said transport tube and said collector, and means for applying one potential difference between the electrodes of said ionizer whereby a larger difference in potential is produced between said ionizer and said collector electrode.

2. A high voltage generator in accordance with claim 1 in which said emitter electrode is provided with a plurality of needles and said auxiliary electrode is provided with a grid structure in a proximal relation with the pointed ends of said needles.

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