United States Patent [19]

Walker

[11] **3,715,237**

[45] **Feb. 6, 1973**

[54] **VARIABLE ELECTRIC CURRENT GENERATING DEVICE**

[76] Inventor: **John B. Walker,** 8 Earlswood Avenue, Pittsburgh, Pa. 15228

[22] Filed: **March 23, 1970**

[21] Appl. No.: **21,912**

[52] **U.S. Cl.** .....**136/89,** 250/106 S, 310/4

[51] **Int. Cl.**.....**H01l 15/02**

[58] **Field of Search** .....136/89; 250/106 S; 310/4

[56] **References Cited**

UNITED STATES PATENTS

3,497,392	2/1970	Walker	136/89
3,093,567	6/1963	Jablonski	310/4 X
3,438,365	4/1969	Packer et al.	250/106 S X
2,884,538	4/1959	Swift, Jr.	250/106 S X
2,904,612	9/1959	Regnier	136/89
3,031,519	4/1962	Silverman	136/89

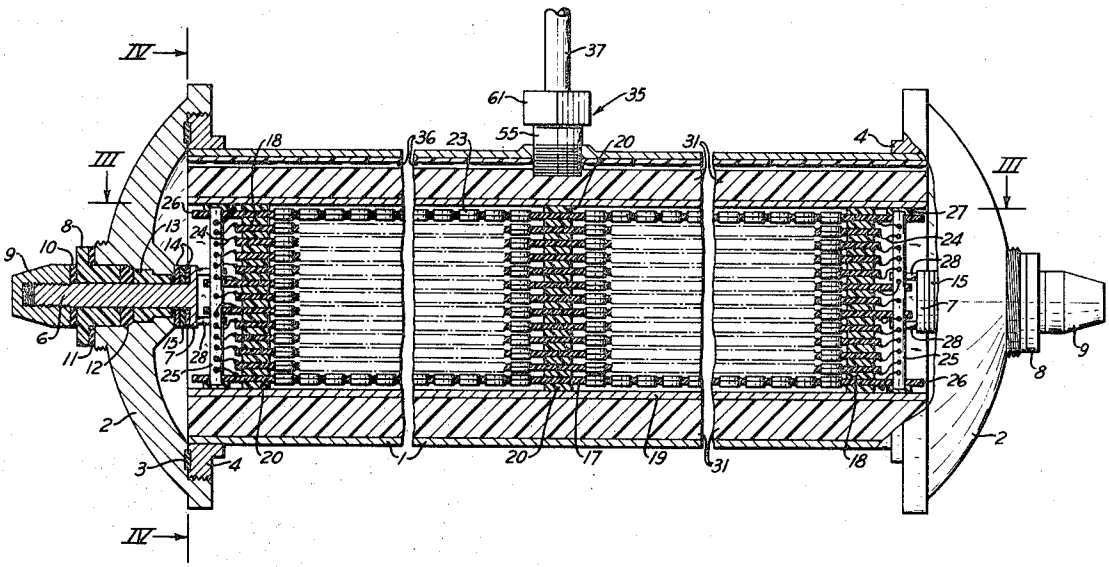
Primary Examiner—Allen B. Curtis

Attorney—Brown, Murray, Flick & Peckham

[57] **ABSTRACT**

Inside a sealed case there is a photoelectric core that is sensitive to ultraviolet radiations and that is provided with a multiplicity of openings communicating with its outside. Surrounding the core and filling its openings is a radioactive self-ionized isotopic fluid that produces ultraviolet radiations which activate the core to produce electric current.

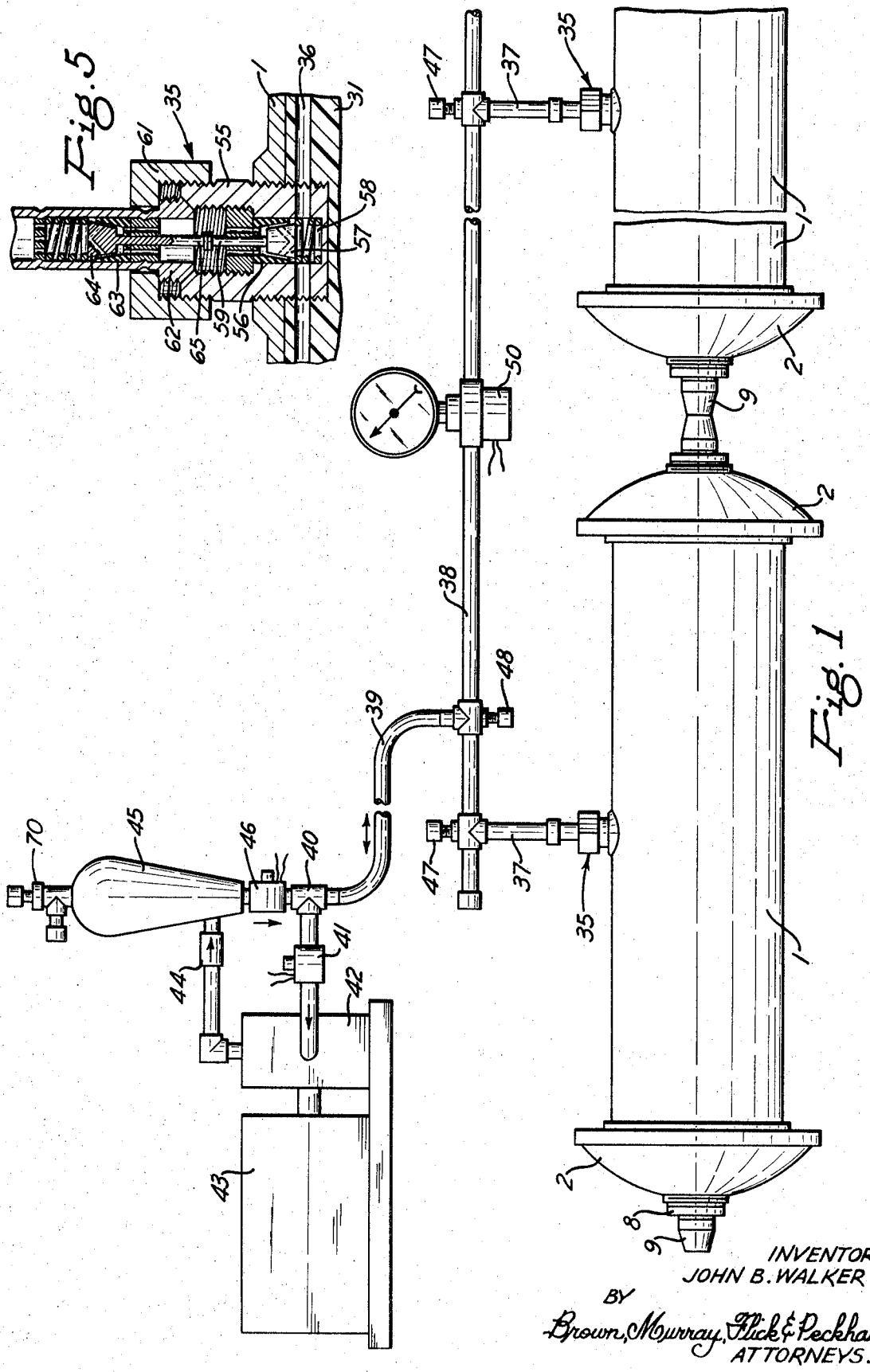
9 Claims, 5 Drawing Figures



PATENTED FEB 6 1973

3,715,237

SHEET 1 OF 3



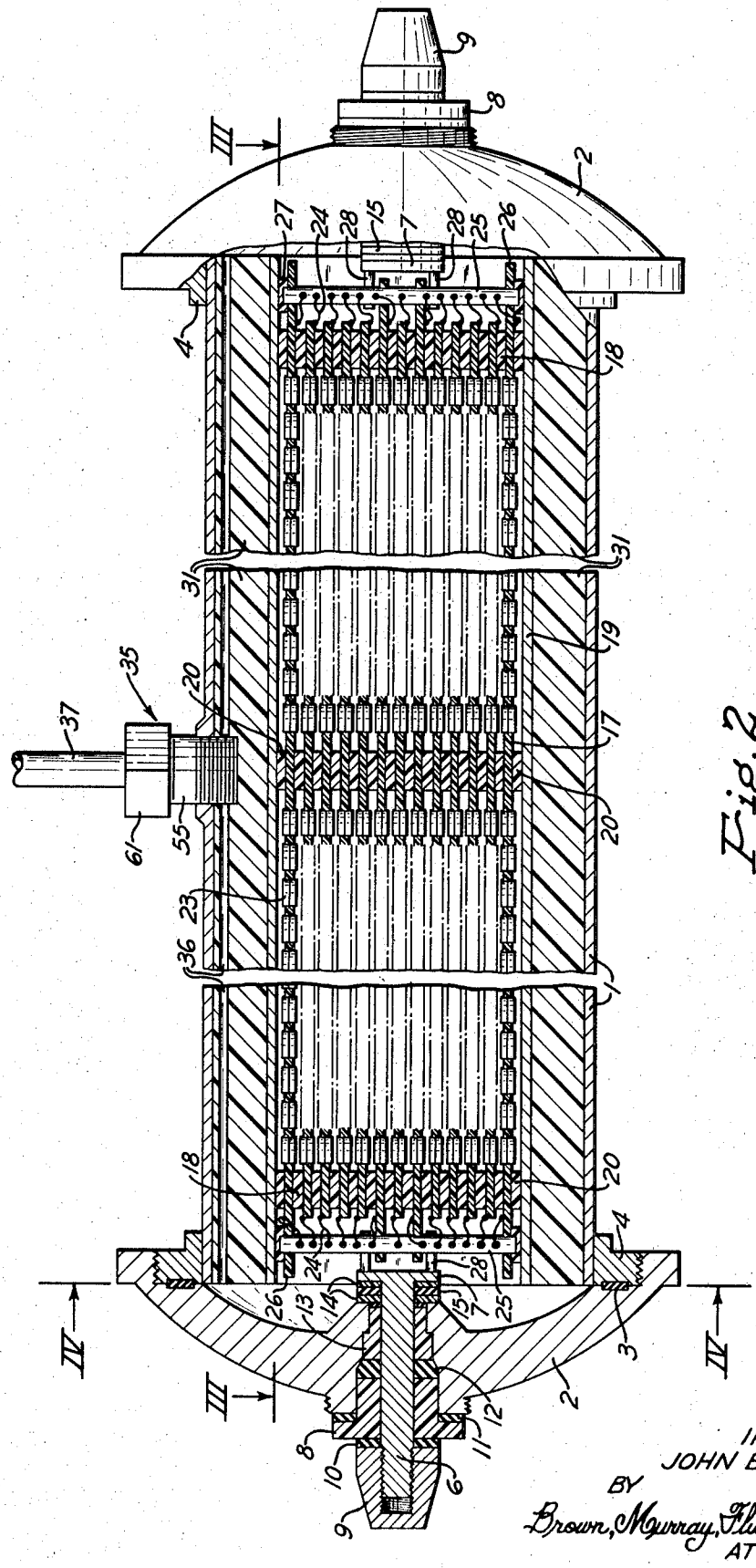


Fig. 2

INVENTOR.
JOHN B. WALKER
BY
Brown, Murray, Flick & Peckham
ATTORNEYS.

PATENTED FEB 6 1973

3,715,237

SHEET 3 OF 3

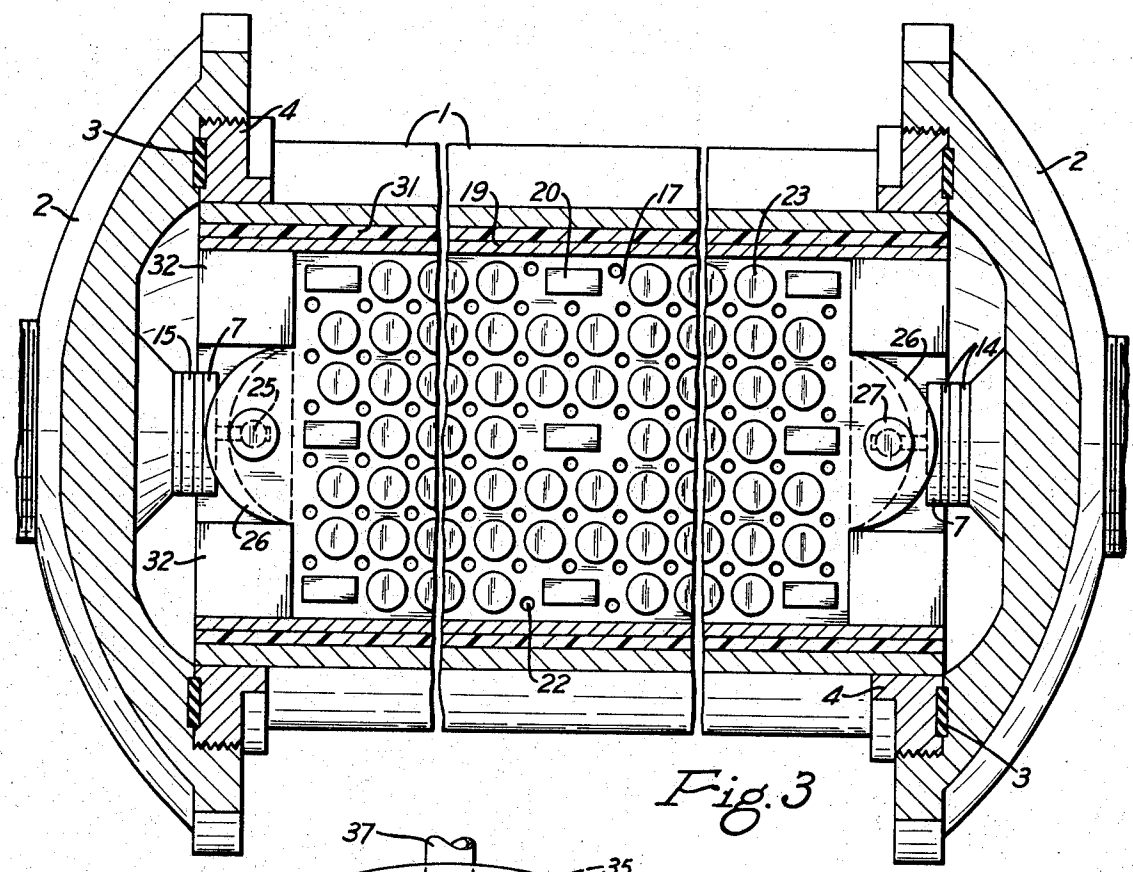


Fig. 3

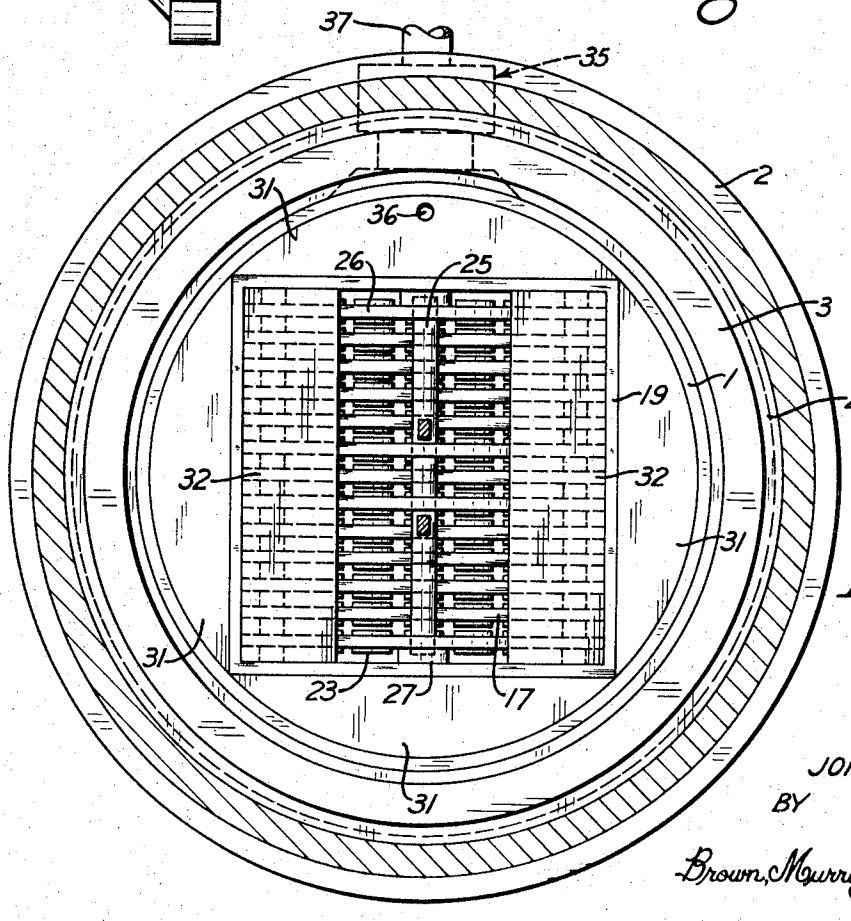


Fig. 4

INVENTOR.
JOHN B. WALKER
BY
Brown, Murray, Flick & Peckham
ATTORNEYS.

VARIABLE ELECTRIC CURRENT GENERATING DEVICE

In my U.S. Pat. No. 3,497,392, an electric current generating cell is disclosed in which a fluid surrounding a core sensitive to ultraviolet radiations is ionized by radioactive material which the core surrounds. The radiations activate the core to produce electric current that can be used for any desired purpose. The current generating cell disclosed in that patent is highly satisfactory in operation, but it does require radioactive source material such as strontium, plutonium, uranium or the like. Also, the current output is not variable appreciably; it is either full on or full off.

It is an object of this invention to provide an electric current generating device somewhat similar to my earlier one but not requiring radioactive source material. Another object is to provide such a device that is easily controlled for variable current output.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

FIG. 1 is a side view of my device;

FIG. 2 is an enlarged fragmentary longitudinal section through a cell case;

FIG. 3 is a still larger fragmentary longitudinal section, taken on the line III—III of FIG. 2;

FIG. 4 is an enlarged cross section taken on the line IV—IV of FIG. 2; and

FIG. 5 is an enlarged longitudinal section of the valves connected to the cell case.

Referring to FIGS. 2 to 4 of the drawings, the cell case may be formed from a metal cylinder 1, on the opposite ends of which end bells 2 are screwed, with sealing gaskets 3 compressed between the bells and the end flanges 4 of the cylinder. Each end bell is provided with a central passage, through which extends an electrical conductor in the form of a stud 6 having a threaded outer end and a head 7 at its inner end. The stud is centered in the passage by an insulating bushing 8 that is clamped against the end of the bell by an end cap 9 screwed onto the outer end of the stud. Sealing washers 10 and 11 are compressed between the bushing and the cap and bell. At the inner end of the bushing there is a ring of sealing compound 12 and then another insulating bushing 13. The head of the stud is separated from the inside of the bell by two plastic gaskets 14, between which there is an insulating washer 15.

The case contains a photoelectric core, which could be constructed in the same way as the core in my earlier cell. It is preferred, however, to make the core in the form shown in FIGS. 2, 3 and 4. This core includes a stack of parallel rectangular panels 17 made of electrical insulating material. These panels are spaced apart at their ends and center by thick spacers 18. The stack fits in a rectangular metal housing 19 that is open at both ends. The upper and lower panels are spaced from the top and bottom of the housing by insulating spacers 20. Each panel is provided with a large number of perforations 22 and carries between the perforations a plurality of cells 23 sensitive to ultraviolet light. Preferably, these cells are mounted in openings in the panels and project from both sides of each panel. Each pair of cells can be spaced apart or be separated by a spacer. The panels are spaced just far enough apart to prevent the cells on each panel from touching those on the adjacent panels. The cells can be any of several varieties, such as selenium, silicon, cadmium and indium construction.

The cells are all electrically connected together in any suitable manner. One way of doing this is to provide the panels with printed circuits that the terminals of the cells engage. At the opposite ends of the panels the cells are connected by wires 24 to bus bars 25 that extend across all of the panels centrally thereof. To support the bus bars and also to help retain the panels in place, some or even all of the panels may be provided with central projections 26 at their ends, through which the bus bars extend snugly. The opposite ends of the bars are insulated from the surrounding metal housing by means of insulating caps 27. Each bus bar is electrically connected to the head 7 of the adjacent stud by means of flexible conductors 28 attached thereto. The corners of metal housing 19 may engage the inner surface of the surrounding case, but the space between the sides of the housing and the case are filled with plastic fillers 31, that hold the housing in place. PLastic spacing blocks 32 are disposed in the ends of the metal housing.

In order to generate electricity, the cell case is filled with a radioactive self-ionized isotopic fluid, which of course fills the spaces between the panels as well as the perforations in them. This fluid produces ultraviolet radiations that activate cells 23 to cause them to produce electric current which is led off through the bus bars and the conductors 6 extending out of the end bells. The radioactive fluid may take several different forms. Any radioactive gas isotope that produces alpha or beta radiations and to which mercury vapor or benzene (C_6H_6) is exposed can cause the desired ultraviolet radiations to be produced. The isotope ionizes the mercury or benzene atoms to produce the radiations. For example, mercury vapor or benzene can be mixed with isotopes krypton 85, xenon 133, or argon 39. Although tritium H3 also could be used, it has the disadvantage of not being an inert gas. Instead of using a mixture of an inert gas and mercury vapor, the radioactive mercury isotope Hg 203 can be used by itself to produce the ultraviolet radiations. The photoelectric core is coated with a special liquid plastic material impervious to alpha and beta particles but not to ultraviolet radiation.

By using one of the above fluids, radioactive source material can be eliminated from my current generating device and a better basis for control is established. The control of the current generated by this device is effected by controlling the pressure of the fluid in the sealed case. With a fixed pressure, a fixed level of current output is provided, but if the pressure is increased the current will increase or if the pressure is reduced the current will decrease. This is because controlling the pressure of the ionized fluid controls the amount of ultraviolet radiations that affect the sensitized core. Control can vary from a fully off to a fully on condition. Variation in the fluid pressure is accomplished by pumping the isotopic fluid in and out of the case.

As shown in FIG. 1, a single core-containing case can be used or two or more can be electrically connected in parallel or series. Each case is provided centrally with an opening, in which a valve 35 is screwed. The inner end of the valve passage communicates with a passage 36 extending lengthwise through the surrounding filler 31 so that the valve is in communication with the inside of the end bells and therefore with the stack of panels. Each valve is connected by a short flexible hose 37 to a

manifold **38**, from which a hose **39** extends to a T-fitting **40**, the side of which is connected to a solenoid valve **41** that leads to the inlet of a pressure-vacuum pump **42** driven by a motor **43**. The solenoid valve is opened when the motor is turned on. The outlet of the pump is connected by a check valve **44** to a chamber or tank **45** that has a solenoid outlet valve **46** connected with the remaining port of the T-fitting. Shut-off valves **47** and **48** also are provided.

Connected into manifold **38** is an electrically controlled automatic differential pressure control valve **50** that is electrically connected with the pump motor to shut if off when a predetermined vacuum is reached at the vacuum side of the valve. This valve also is electrically connected with solenoid valve **46** to close it when a predetermined pressure is reached at the pressure side of valve **50**. Valve **46** also can be opened independently of valve **50**, so that if fluid at a pressure exceeding normal operating pressure is stored in tank **45**, valve **46** can be opened when desired to increase the pressure in the cell case above that called for by valve **50**.

Valve **35** normally is open so that the cell case can be pressurized or the pressure reduced in the case. It is closed only when hose **37** is disconnected from the case. The closed valve is designed to prevent escape of fluid from both the case and the hose. For this purpose the valve is constructed as shown in FIG. **5**. It has a body **55** screwed into the case and containing an interiorly tapered rubber cup **56** with a perforated top. Inside the cup there is a conical closure member **57** pressed toward its seat by a coil spring **58** and having an upwardly extending stem **59**. Pressed against the upper end of the valve body by a threaded collar **61** is the lower end of another valve body **62** likewise containing another rubber cup **63** and a spring-pressed conical closure member **64** provided with a downwardly extending stem **65**. As long as the two valve bodies are pressed together by collar **61**, the two valve stems also are pressed together with the result that the closure members are held off their seats. On the other hand, if the collar is removed, the closure members will be pressed against their seats by the coil springs and both the case and hose **37** will be sealed.

The system is evacuated and then charged through a special valve fitting **70** connected to the top of storage tank **45**. Before the radioactive fluid is delivered to the system the latter is evacuated by pump **42**, the air being forced out of the system through the fitting. However, since this does not evacuate the tank, the latter then is evacuated by a portable vacuum pump (not shown) which can also draw additional air out of the system by sucking the check valve **44** off its seat. Of course, during this operation solenoid valve **41**, as well as manifold valves **47** and **48**, must be open and solenoid valve **46** closed. When the portable pump is turned off, solenoid valve **41** is closed and then the gas isotope from a pressure cylinder is connected with valve fitting **70** and the gas allowed to enter the storage tank. Check valve **44** prevents the pump circuit from After flooded with gas during charging and prevents back pressure during other pump phases. Mercury or benzene is drawn into the tank through the valve fitting along with the gas. AFter the tank has been pressurized in this way with the radioactive self-ionized isotopic fluid to its proper predetermined level, the charging cylinder is shut off and fitting **70** is closed, followed by disconnection of the cylinder from the tank. The system now is ready to be activated.

Solenoid valve **46** now is opened by a manually operated electric switch to allow the radioactive fluid to expand and flow to the manifold and through valves **35** into the cell cases. As the fluid enters the cell cases **1** it expands further and flows into the photoelectric cores, where it starts to activate the ultraviolet sensitized cells **23** to produce a flow of electric current that is detectable at the end caps **9** of the electrical conductors.

The amount of current flow is determined by the fluid pressure in the cell cases. When the pressure reaches a preset level at the differential control valve **50**, the electric circuit in that valve will close solenoid valve **46**. At that time the electric current output should be at its peak and should remain there as long as the fluid pressure in the cells holds up. Lowering the current output of the cells is accomplished by turning on the vacuum pump motor **43** which opens valve **41** in the same circuit. The vacuum pump then pumps ionized fluid out of the cell cases and compresses it in storage tank **45** for further use. The pump can be stopped at any time and yet the cell cores will continue to function, but at a lower rate of current flow. If all of the ionized fluid is withdrawn from the cells, electric current production will be shut off. By increasing or decreasing the fluid pressure in the cell cases in the manner just explained, the current flow is controlled to any desired level.

Starting up the cells or increasing the current flow is simply a matter of opening solenoid valve **46** to let the ultraviolet radiating ionized fluid bleed back into the cell cases **1**. Since the solenoid valve **41** is closed at that time, the fluid is prevented from feeding back into the pump. The differential pressure control valve **50** will close solenoid **46** when the proper fluid pressure in the system is reached.

The electric circuit for solenoid valve **46** is such that it can be closed independently of the differential control valve, so that a fluid pressure less than the maximum can be provided. This makes it unnecessary to first reach a maximum peak pressure and then pump down to the pressure desired, thereby avoiding unnecessary use of the pump. Also, since valve **46** can be opened independently of the differential control valve, the pressure in the system can be increased above the limit allowed by the control valve. This would be done only when the ionization level of the fluid decreases relative to its radioactive half life span. In this way the current output can be kept at a desired maximum in spite of the drop off of the radiation intensity of the fluid. However, there is a limit to this that is reached when the radiation level drops off to a point that increased fluid pressure cannot prevent a decline in current output. This may be arrived at near the half life of the radioactive isotope used.

This electric current generating device can be used with a fixed fluid pressure to produce a fixed level of electric current. The cell cases can be placed in racks and connected in series or parallel, or they can be used as portable auxiliary power units. On the other hand, the cells can produce a variable current output by auto-

matically or manually raising or lowering the fluid pressure in their cases. The feature of pumping the fluid in and out of the cell cases to control current flow or to shut it off lengthens the photoelectric core life because it does not need to run at full power output at all times. Also, excess current does not have to be bled off. This method of operation and control also enables the cells to be used at low pressure due to the fact that the gas molecules in themselves are radioactive and do not have to be ionized by collision of alpha or beta particles from a radioactive source material that makes it mandatory that the fluid to be ionized be in a close compact condition with the radioactive source material at a set moderately high pressure.

At any time desired, the manually operated valves **47** can be closed so that either photoelectric core can be shut down or either can be operated at a different pressure than the other. Also, a faulty circuit can be removed by shutting off a valve **47** and disconnecting the adjoining hose **37** from its valve **35**. The cells also can be placed in a parallel circuit without a change in the manifold. If a cell case is removed from the manifold after being pressurized, the unit can be used as a portable power pack or it can be shifted to another circuit if desired.

I claim:

1. An electric current generating device comprising a sealed case, a photoelectric core inside the case sensitive to ultraviolet radiations and having therein a multiplicity of opening communicating with its outside, a radioactive self-ionized isotopic fluid surrounding the core and filling its openings, said fluid producing ultraviolet radiations that activate the core to produce electric current, means electrically connected with said core and extending out of the case for conducting said current away from the photoelectric core, said photoelectric core including a stack of spaced panels, and a plurality of ultraviolet light sensitive cells mounted on both sides of each panel and electrically connected together.

2. An electric current generating device according to claim **1**, in which said panels are provided with a multiplicity of perforations between said cells.

3. An electric current generating device according to claim **1**, including a housing around said stack of panels but open at its ends, and insulation between the housing and case.

4. An electric current generating device according to claim **1**, in which a bus bar at each end of said stack extends through projecting portions of at least some of the panels, and wires connect the bus bars with the cells on each panel.

5. An electric current generating device comprising a sealed case, a photoelectric core inside the case sensitive to ultraviolet radiations and having therein a multiplicity of openings communicating with its outside, a radioactive self-ionized isotopic fluid surrounding the core and filling its openings, said fluid producing ultraviolet radiations that activate the core to produce electric current, means electrically connected with said core and extending out of the case for conducting said current away from the photoelectric core, and means for varying the pressure of said fluid in said case to control the electrical output of said core.

6. An electric current generating device according to claim **5**, including a storage chamber for said fluid outside of said case, a conduit connecting the chamber with the inside of the case, said pressure-varying means being means for pumping fluid through said conduit from the case to said chamber to reduce the fluid pressure in the case and increase the pressure in the chamber, and a valve for allowing flow of fluid from said chamber back through said conduit to the case to increase the pressure therein.

7. An electric current generating device according to claim **6**, including a differential pressure control valve exposed to the fluid pressure in said case for controlling said pumping means and first-mentioned valve.

8. An electric current generating device according to claim **5**, in which said core includes a plurality of ultraviolet light sensitive cells electrically connected together, and means supporting the cells in a plurality of parallel layers with each layer containing a plurality of the cells.

9. An electric current generating device according to claim **5**, in which said fluid is a mixture of a radioactive gas isotope that produces radiations normally having a wave length outside the ultraviolet range, and another gas that shifts the wave length of said isotope radiations so that said ultraviolet radiations are produced.

* * * * *