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Portable Air Purifier Using Ionization Technique

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Abstract - *An expanded open attention to indoor air contamination has brought about the advancement of a considerable market for compact air purifiers for use in living arrangements and workplaces. Compact air purifiers are outlined principally for the ejection of suspended particles like dust and tobacco smoke.*

Trials were coordinated in a closed acrylic chamber using analyzed obsessions like those definite in living plans. Different air-cleaning gadgets that can be utilized are electrostatic precipitators, ionizers etc. we have utilized an ionizer for air cleaning.

The wind stream rates were in the scope of 0-500 m'/h .The estimations secured molecule sizes of 0.01-7.5 micron and the accompanying gases: carbon monoxide, alkali, formaldehyde, nitrogen dioxide, hydrocarbons, and hydrogen cyanide. No formal standard methodology exists for testing room air purifiers. The rate of ozone discharge by this air purifier is in a little amount. Different techniques for disposing of tobacco smoke exist, and they have altogether different efficiencies. The best technique for disposing of tobacco smoke is to forbid smoking or the ventilation in rooms with smokers might be expanded. Expanded ventilation is not generally simple to mastermind. In addition the confirmation air that ideally should be spotless is much of the time dirtied by means of air contaminants from automobiles and warming systems, and in this way it is vital to use air purifiers to get common air into the building. Regardless of the possibility that the outside air is sufficiently spotless to be utilized without cleaning, an expanded ventilation implies expanded expenses.

Keywords— Ionization, air purifier, voltage multiplier,

1. INTRODUCTION

In the event that the standard strategies for managing indoor air toxins are inadequate, air-cleaning gadgets might be valuable. The most ideal approach to address private indoor air contamination as a rule is to control or take out the wellspring of the poisons and to ventilate the home with clean open air. In any case, ventilation may be compelled by atmosphere conditions or the levels of contaminants in the outside air.

An air purifier is a gadget which expels contaminants from the air in a room. These gadgets are usually showcased as being helpful to sensitivity sufferers and asthmatics, and at decreasing or disposing of tobacco smoke. The economically reviewed air purifiers are fabricated as either little remain solitary units or bigger units that can be attached to an air handler unit (AHU) or to a HVAC unit found in the therapeutic, mechanical, and business enterprises. Air purifiers may likewise be utilized as a part of industry to expel polluting influences, for example, CO2 from air before handling.

Utilizing ionization procedure has been intended to expel poisons from indoor air. A similar innovation can be utilized as a part of versatile air purifiers that clean the air in single rooms or particular regions. Most air-cleaning gadgets are intended to expel particles or gasses.

This purifier concentrates on air purifiers for private utilize; it doesn't address air purifiers utilized as a part of extensive or business structures, for example, office structures, schools, huge flat structures, or open structures. It ought to be especially helpful to private lodging outline experts, general wellbeing authorities, and indoor air quality experts.

2. METHODOLOGY

The air ionizer purifier channels the air so that there are a great deal less particles noticeable all around at the time we inhale it. So there's altogether less possibility of any sort of breathing or sensitivity troubles. Utilizing air ionizer purifier we will likewise attempt to dispose of various scents existing in the indoor air.

2.1 Ionization

The air including us is constantly ionized. The wellsprings of the ionization essentialness impact the Earth always and, in this way, electrically neutral air does not

fundamentally exist. We encounter particles in every practical sense always and everywhere, since they are an indistinct part of the atmosphere which includes all of us around. Perceptible all around there are particles of two polarities, that is the positive one cations and the negative one anions. The way they affect us depends on upon their common extent.

Gas molecules are electrically unbiased in common conditions. A particular measure of imperativeness is required for air ionization to happen. This base measure of vitality is viewed as ionization centrality. Conclusively when the ionization essentialness is come to, non-versatile impacts of once in the past sensible particles happen. These effects cause no less than one electrons to detach from the orbital atom course, thusly molding sets of electrically charged particles. These electrically charged particles pass on a negative charge, and whatever is left of the particles pass on a positive charge. Therefore, in like manner ionization several electrically charged particles, with each atom having the opposite charge, is continually formed.

The examination of ionization is as often as possible joined by a movement of compound reactions. Two such response items are the development of ozone and nitrogen oxides. It is important to underscore that ozone is a drab gas with a trademark scent which effectively breaks down and discharges nuclear oxygen. Consequently, it has solid oxidation impacts. It devastates an extensive variety of microorganisms, yet inward breath at more prominent fixations can prompt to wellbeing dangers.

2.2 PWM IC SG3525

- extensive operating voltage range from 8 to 35V
- oscillator and frequency range 100HZ to 500KHz
- Input and output synchronization terminals
- changeable dead time controller
- Soft-start ability
- Smooth shut down ability
- Input voltage checking ability
- Dual source/sink yield driver

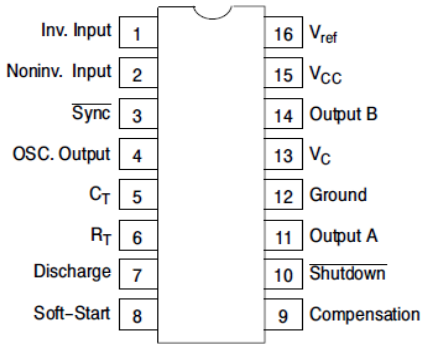

Fig -1: PWM IC SG 3525

2.3 Voltage Multiplier

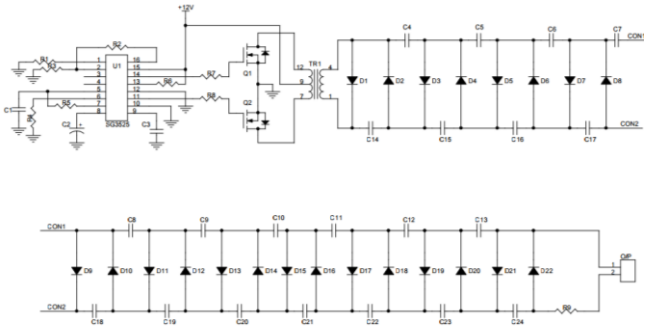

Fig -2: Voltage Multiplier

We have selected 12V for the push-pull conversion because it is suitable for operating PWM IC and push-pull MOSFET operation. Also this is an advantage that this can be used in cars where 12V supply is available from the battery.

The selection of the parts –

We have used fly-back converter to get 12V and 1A power these power supplies are easily available in the market.

We have selected PWM IC SG3525 which is capable of generating up to 400 KHz.

It has also features like shutdown operation and built in date time provision which is very important while driving inductive loads and it is capable of driving MOSFET in push-pull up to more than 300 watts. We have selected IRFZ44 MOSFETs which are excellent at 12V operation capable of handling more than 10A (if needed) and very low R_{DS} (on) value thus energy dissipation is very low and for our operation it doesn't required heat sink.

3. CIRCUIT DIAGRAM OF AIR PURIFIER

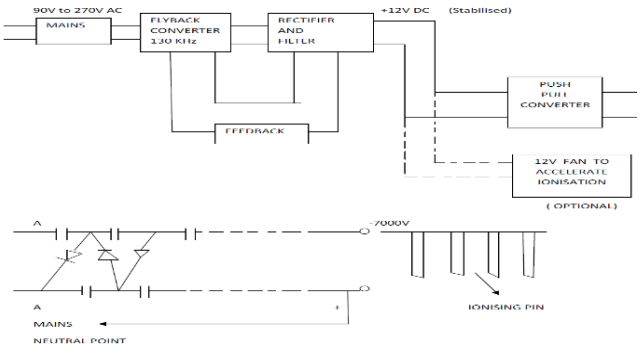

Fig -3: Circuit Diagram of Air Purifier

Air purifier uses rule of high voltage DC to create plasma which hence ionizes air and make positive and negative

particles. DC positive is connected with fair of essential supply, which along these lines gives ground static affiliation.

In this manner ionized negative particles begin streaming towards ground (which is certain) while streaming these particles get clung to clean particles get likewise pulled in to the ground.

If there should be an occurrence of a room all dividers, ground and roof are at ground potential and in this way clean (or smoke particles, bacterial and fine contaminations of 0.01 to 5 micron estimate) get pulled in to the ground and in this manner stays free from toxin. This air cleaning gadget additionally gives natural air feel because of little measure of ozone era.

To produce high voltage DC we are utilizing high recurrence oscillator framework , utilizing ferrite transformer we get around 400V at the yield utilizing voltage multiplier tie to around 7000V to 8000V.This voltage is associated with different pins with sharp tip mounted with adequate protection.

4. RESULT

1. Frequency of ionizer,
Frequency of ionizer can be calculated as,
Where, Rc = Resistor time coefficient = 6.8×10^{3}
Tc=Capacitor time coefficient = 2.2×10^{-9}

$$F = \frac{1}{(0.707 \times Rc \times Tc \times 2)}$$

$$F = \frac{1}{(0.707 \times 6.8 \times 10^{3} \times 2.2 \times 10^{9} \times 2)}$$

So, $F = 46.43KHz$
Approximate value of frequency $F \approx 50KHz$
2. Primary Impedance of Transformer

$$V \div I = 12 \div 1 = 12$$
$$12 = 2 \times Pi \times F \times L$$
$$12 = 2 \times 3.142 \times 46.43 \times 10^{3} \times L$$

L=41.12microH
3. Primary voltage/secondary voltage,

$$Vp \div Vs = 12 \div 400$$

4. Number of turns on Primary winding/number of turns on secondary winding= $N1 \div N2 = 1 \div 33$
5. Primary wire gauge =26SWG
6. Secondary wire gauge =32SWG
7. Therefore secondary voltage is 400 volts
Where, SWG=Standard Wire Gauge
Pi=3.142
F=Frequency of ionizer
L=Impedance of ionizer

5. CONCLUSION

In this paper, we gathered that the created Negative Air Ions can drive out the air pollutants, for instance, arrangement of smoke in close chamber. The particles are charged on a very basic level by the dispersal ionizer. The atom ejection depends upon the molecule spread rate. The rate of advance of atom clearing adequacy is fairly higher for petrol smoke when appeared differently in relation to mosquito coil smoke. This survey comes to completion that around 95% respirable particles has been removed from air. In future fluctuating maximum molecule generators will transform into a capable gadget for controlling air pollution.

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