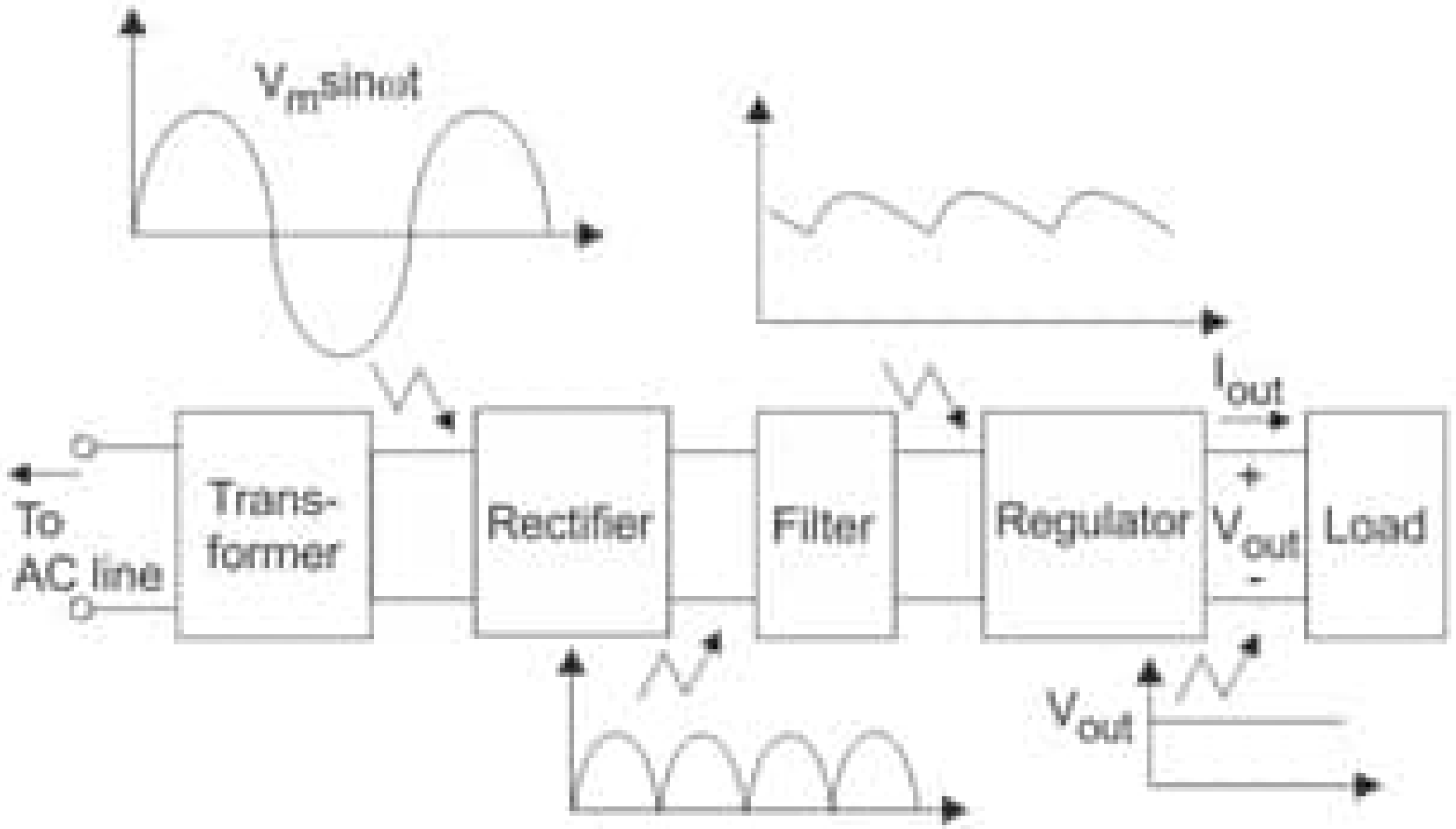
A direct current (DC) power supply is a device that converts alternating current (AC) to direct current (DC), or from one voltage to another. Most electronic devices and circuits are powered by a **DC power supply.** The majority of DC power supplies are in the form of wall adapters. It plugs into a standard AC outlet and outputs a fixed quantity of DC voltage, typically 5 or 12 volts.

Small electronic devices such as cell phones, digital cameras, and portable music players are powered by wall adapters. Most computers and televisions use a type of DC power supply known as an internal power supply. The device's internal power supplies convert AC voltages to DC voltages, which are subsequently utilized to power the device's various elements.

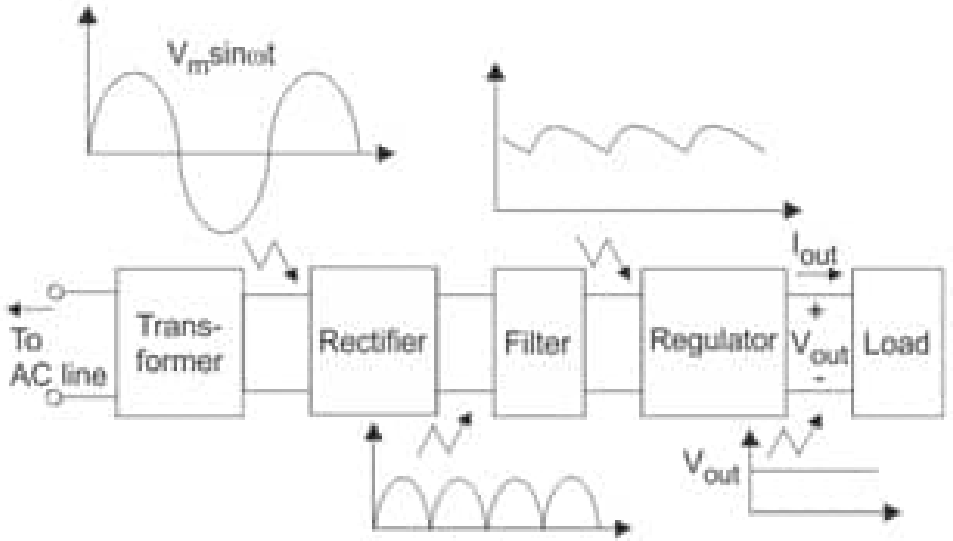
DC power supplies are also used in industrial and scientific applications where voltage and current must be properly controlled. In these instances, DC power supplies are frequently used in conjunction with electrical devices known as power regulators to ensure that the DC voltage or current remains constant. Lasers and medical equipment frequently use power regulators. DC power supplies exist in a variety of sizes and designs, ranging from modest wall adapters to massive bench-top installations. It is available at most electronics stores as well as online retailers such as **Kaiweets**.



Components of typical linear power supply

A regulated power supply can convert unregulated an AC (alternating current or voltage) to a constant DC (direct current or voltage). A regulated power supply is used to ensure that the output remains constant even if the input changes. A regulated DC power supply is also called as a linear power supply, it is an embedded circuit and consists of various blocks.

The regulated power supply will accept an AC input and give a constant DC output. Figure below shows the block diagram of a typical regulated DC power supply



Components of typical linear power supply

The basic building blocks of a regulated DC power supply are as follows:

1. A step down transformer
2. A rectifier
3. A DC filter
4. A regulator

Step Down Transformer

A step down transformer will step down the voltage from the ac mains to the required voltage level. The turn's ratio of the transformer is so adjusted such as to obtain the required voltage value. The output of the transformer is given as an input to the rectifier circuit.

Rectification

Rectifier is an electronic circuit consisting of diodes which carries out the rectification process. Rectification is the process of converting an alternating voltage or current into corresponding direct (DC) quantity. The input to a rectifier is ac whereas its output is unidirectional pulsating DC. Usually a full wave rectifier or a bridge rectifier is used to rectify both the half cycles of the ac supply (full wave rectification). Figure below shows a full wave bridge rectifier.'

DC Filtration'

The rectified voltage from the rectifier is a pulsating DC voltage having very high ripple content. But this is not we want, we want a pure ripple free DC

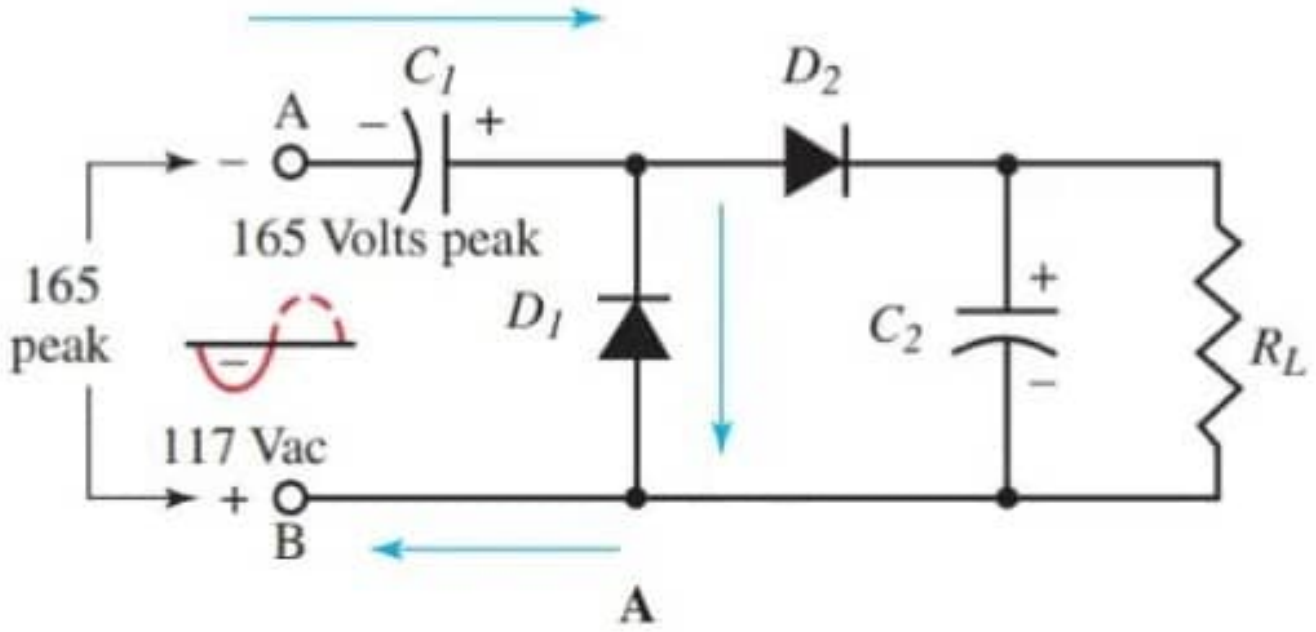
Regulation

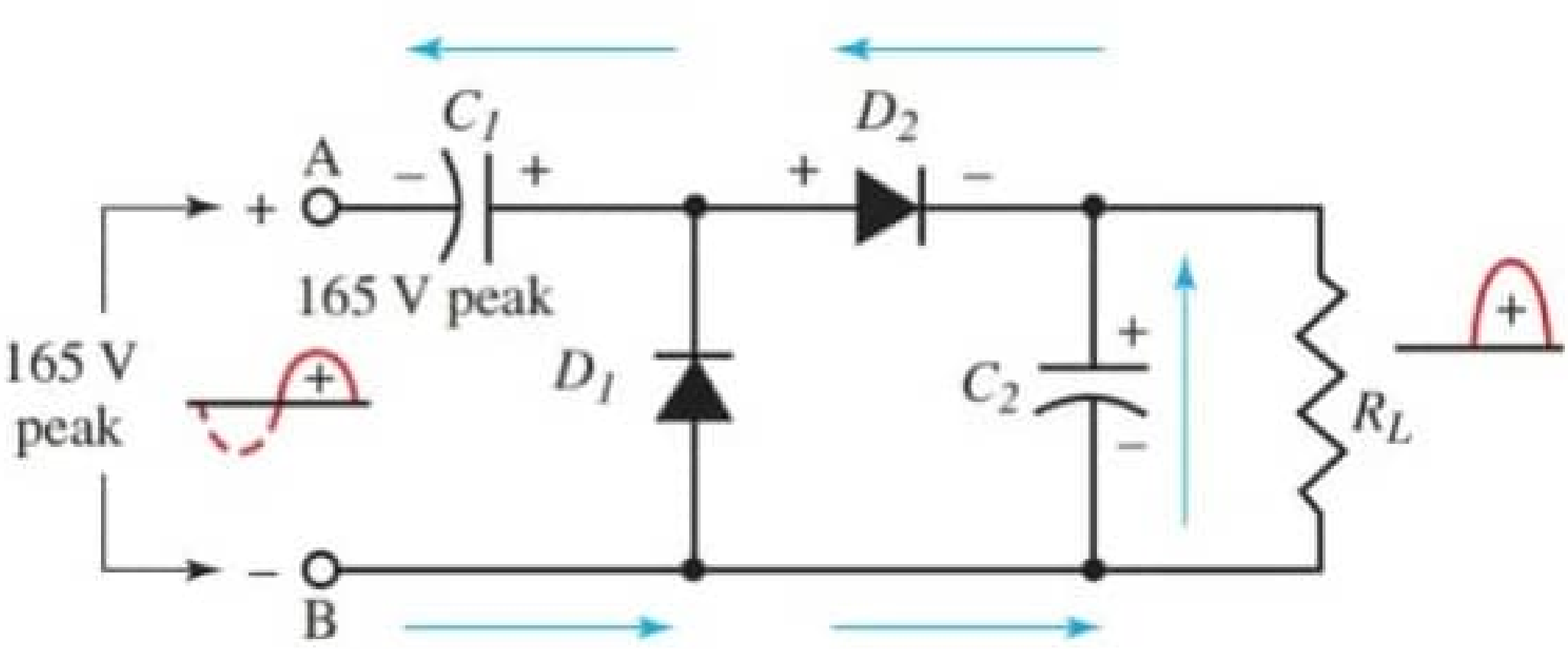
This is the last block in a regulated DC power supply. The output voltage or current will change or fluctuate when there is change in the input from ac mains or due to change in load current at the output of the regulated power supply or due to other factors like temperature changes. This problem can be eliminated by using a regulator. A regulator will maintain the output constant even when changes at the input or any other changes occur. Transistor series regulator, Fixed and variable IC regulators or a zener diode operated in the zener region can be used depending on their applications. IC's like 78XX and 79XX are used to obtained fixed values of voltages at the output. waveform. Hence a filter is used. Different types of filters are used such as capacitor filter, LC filter, Choke input filter, π type filter.

It assumed that the source of power is 117-volt ac found in homes and schools. The transformer is used to step up or step down the voltages required for the electronic circuits. Because **transformers** are heavy and costly, voltage multiplying circuits (voltage doublers) have been devised to raise voltages without the use of transformers.

Half-Wave Voltage Doubler Working

Study Figure 1. It shows the action in a half-wave voltage doubler circuit. In **part A** of Figure 1, the input ac voltage is on the negative half cycle. As a result, point A is negative. Current flows from point A, through the rectifier D_1, and charges capacitor C_1 to the polarity shown.



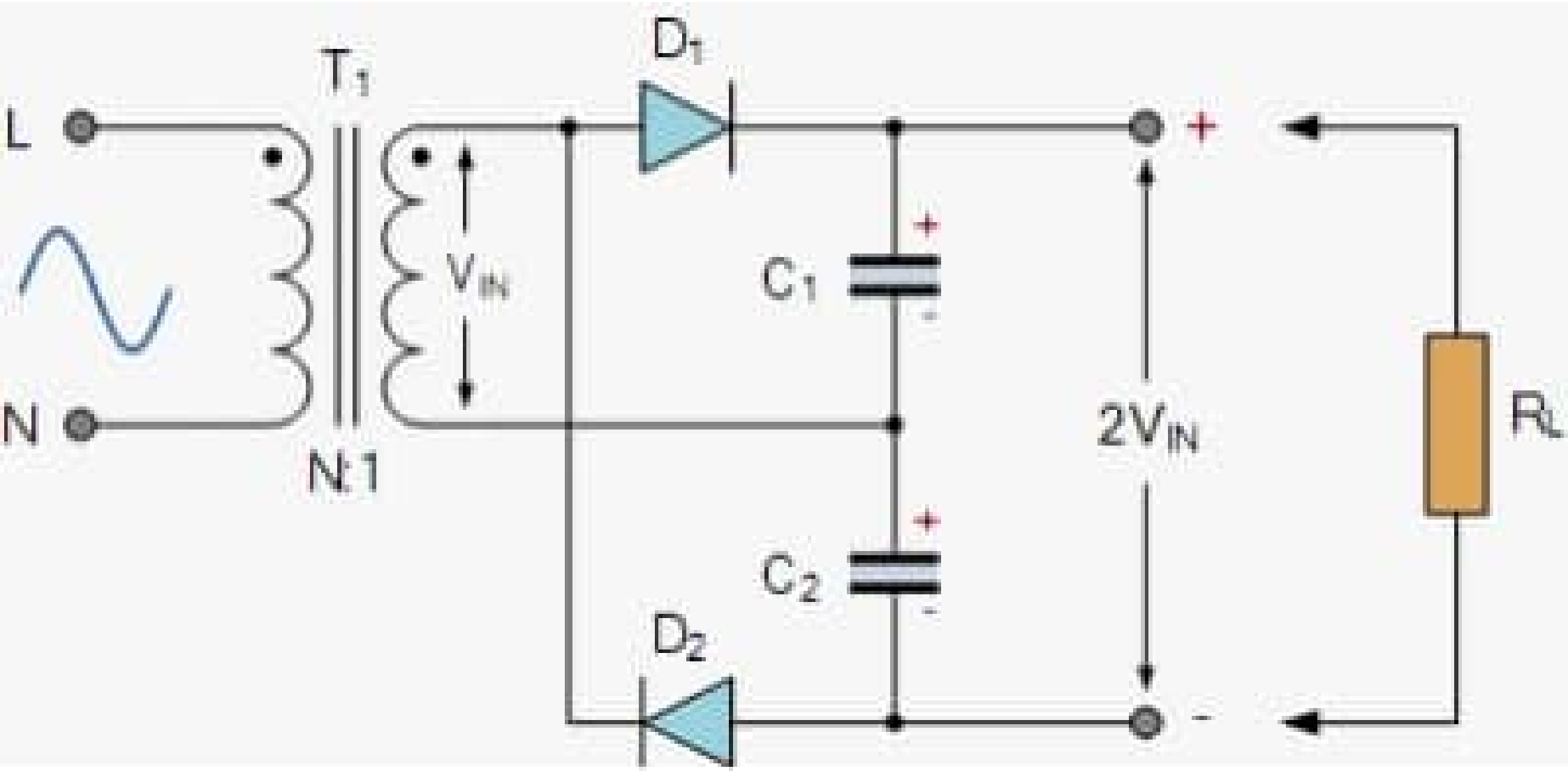


B

B–During the second half cycle, applied line voltage is in series with the charge on C_1. Current flows through D_2. C_2 gets the sum of line voltage and that from C_1.

During the **positive half cycle**, point A is positive. The applied peak voltage of 165 volts is in series with the charged capacitor C_1. In the series connection, the voltages add together. So, the output from the doubler is the applied voltage plus the voltage of C_1.

Current cannot flow through the rectifier D_1 due to its one-sided conduction. The output waveform shows half-wave rectification with an amplitude of about twice the input voltage. Rectifier D_2 permits current to flow in only one direction to the load.



Full-Wave Voltage Doubler Working

A full-wave voltage doubler is drawn in Figure 2. During the **positive peak of the ac input**, point A is positive. Current flows from point B, charging C1 in the polarity shown, through D1 to point A.

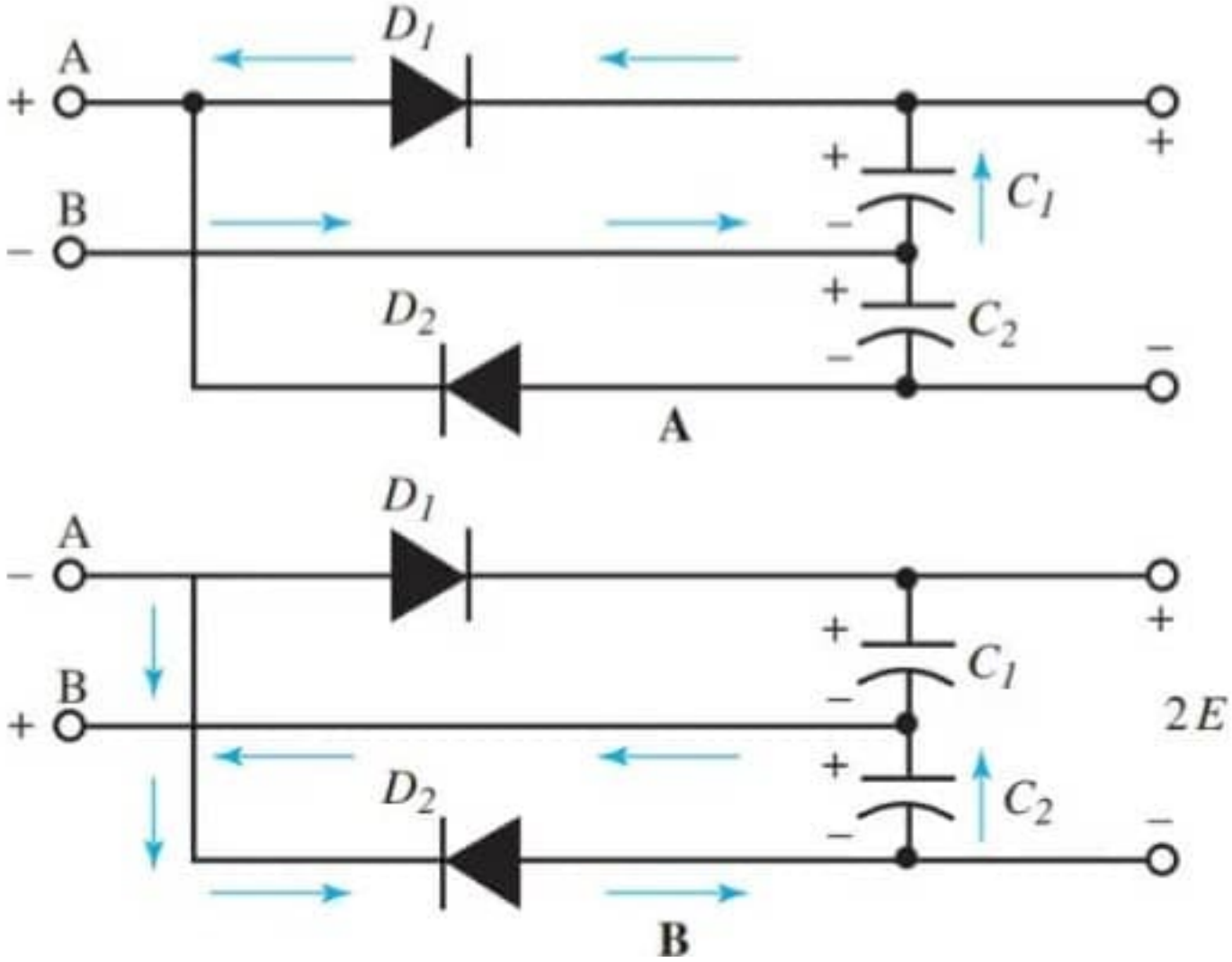


Figure 2. Full-Wave Voltage Doubler Circuit Diagram

A–C_1 charges during the first half cycle.

B–C_1 + C_2 in series.

During the **negative cycle** of the input, point A is negative. Current flows through D_2 to C_2, charging it to the noted polarity, to point B.

Notice that during one cycle of ac input, capacitors C_1 and C_2 have been charged so that the voltages across C_1 and C_2 are in series. The output is taken from across these capacitors in series. The output voltage is the sum of both voltages or twice the input voltage.

Voltage doubler circuits provide useful high voltages for circuits needing low current. Because output voltage depends on charged capacitors, **voltage regulation** is poor. Conventional **filter circuits** are added to smooth out the voltage as in transformer rectifier circuits.