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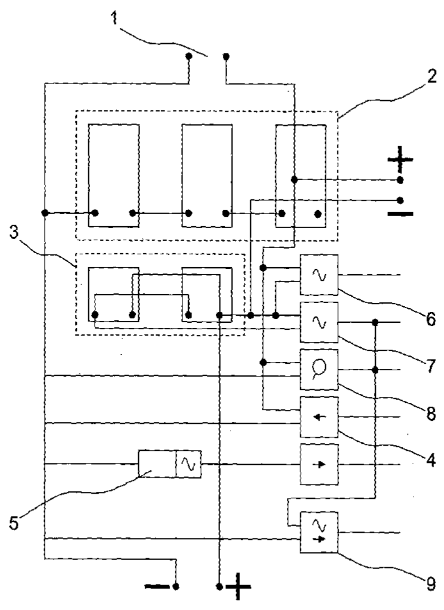

Figure 1

(57) Abstract: A combined electrical power source and storage arrangement is disclosed. The arrangement utilises used, repaired motor vehicle batteries, which once repaired, are configured to create power to operate electrical appliances. While the appliances are being used, surplus electrical power, which may otherwise be converted to heat in resistive circuit elements of the appliances, is fed back to the batteries that gave them the power in the first place, via the processor's control system. The design reduces the overall consumption of the appliances significantly, yet allowing them to operate in the conventional manner. The repaired batteries are initially powered by conventional methods of electricity production, such as solar energy.

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A COMBINED ELECTRICAL POWER SOURCE AND STORAGE ARRANGEMENT

The present invention relates to a combined electrical power source and storage arrangement.

Electrical appliances such as kettles and mobile telephones typically comprise a plurality of resistive elements associated with the electronic circuitry of the appliance, to tailor the electrical voltage and current to the required operating values. The electrical energy which passes through the resistive elements, namely the surplus electrical energy, becomes converted into heat and as a result, is wasted to the environment.

In accordance with the present invention, there is provided a combined electrical power source and storage arrangement, the arrangement comprising:

- a primary battery module comprising a positive and negative electrical terminal, the primary module being arranged to provide electrical power to an electrical appliance;
- a secondary battery module comprising a positive and negative electrical terminal, the secondary module being arranged to receive electrical power from the primary battery which is surplus to that required to power the electrical appliance;

wherein

the primary and secondary terminals are electrically coupled such that the surplus electrical power is arranged to charge the secondary battery module as the primary battery module becomes discharged in powering the appliance.

Advantageously, the primary battery module of the present invention is arranged to power electrical appliances, and the surplus electrical energy which would otherwise be converted to heat and lost, is recycled to recharge the secondary battery module. The energy stored in the secondary module may then be used to recharge the primary module or used directly to power electrical appliances. Alternatively, the electrical energy stored in the secondary battery module may be redistributed into the National Grid.

The arrangement further increases battery performance, reducing their capacity to fail, therefore extending their life.

Preferably, the primary battery module comprises a plurality of batteries arranged in a series configuration and the secondary battery module comprises a plurality of batteries arranged in a parallel configuration.

The arrangement preferably further comprises a primary inverter coupled between the positive terminal of the primary module and the positive terminal of the secondary module, and a secondary inverter coupled between the positive terminal of the primary module and the positive terminal of the secondary module.

Preferably, the primary module comprises a voltage difference between the positive and negative terminals which is greater that the voltage difference between the positive and negative terminals of the secondary module.

Preferably, the arrangement is arranged to replace most of the power consumed by the components and appliances reducing the overall consumption of the appliances, yet allowing them to operate in the conventional manner, and can be installed within a conventional input, output system to save energy.

The primary and secondary battery modules preferably comprise a lead-acid type battery module and means for reducing the accumulation of lead sulphate crystals which otherwise reduces the electrical energy storage capacity of the battery module.

Preferably, the means for reducing the accumulation of lead sulphate crystals comprises a socket which is arranged to receiving an alternating current that is applied to the battery terminals. In this respect, the arrangement is connected to a mains outlet socket, feeding intermittent duty appliances such as a refrigerator, electric kettle, microwave, cleaner, etc via the mains electricity, keeping the batteries charged, desulphating them at the same time.

This arrangement is assisted by solar power. Natural daylight and sunlight falls on the solar panels during daylight hours and the power generated is stored ready for use in the battery modules. Once stored in the primary module and used, power is fed to the secondary module, therefore increasing the output from the input, in this case the solar panels. While the solar panels are largely inactive during the winter months, appliances such as a fridge, a microwave, cleaner, electric heater, etc which are plugged into the mains, via the arrangement, provide enough waste energy to be collected and stored for later use in the secondary modules.

An embodiment of the present invention will now be described by way of example only and with reference to the accompanying drawings.

The arrangement is arranged to power appliances which operate up to approximately 600W, e.g. lighting, a computer with its peripherals, e.g. scanner, printer, etc, a television, mobile telephone chargers, radios and other small every day electrical items. These items are plugged into the mains electricity supply by us the consumer and constantly draining power generally. These appliances can instead be powered by the arrangement of the present invention.

We describe below the construction of a 600 watt arrangement for powering lighting and other appliances. This will be a multivoltage arrangement supplying mains voltage, 240V (circuit diagram Fig 6).

The Batteries

The battery modules stabilise the required voltage (Fig 2 and 3) for powering electrical appliances. Each module comprises 3 or more 12V lead acid type batteries, although it will be appreciated that other types of battery may also be used.

The cells of the lead acid batteries are then checked to determine the amount of water therein - if they are empty, then distilled water is poured into the cells to the required level. A 24V kettle and a multimeter are then connected across the terminals of the one of the batteries. A note is then made of the battery voltage, e.g. 12.5V. The kettle is then switched on and the reading on the voltmeter reading will drop as the kettle discharges the battery. The rate the voltage will drop depends on the health and state of the battery. If the voltage drops relatively suddenly, then one or more of the cells will be damaged. This is determined by looking within each cell for the formation of gas bubbles. During bubbling process, brown colouring will generally appear discolouring cell’s electrolyte.

Notice here we used a 24V kettle to test a 12V battery. By carrying out this test we have stored energy, be it small, and using electricity from the battery testing process as opposed to using a conventional battery tester.

Cells

Now that the faulty cells have been located, using a hydrometer, test each cell of each battery. The weak cells will show a poor level reading on the hydrometer scale. Using the LPC (lead post connector), make a connector link to link the connectors together, bypassing the cell. Reconnect the multimeter across the terminals. This will read approximately 10V, instead of 12V. You will have learned that each cell is 2V. Carry out this procedure on each of the other batteries. You will now have batteries that can be used for the arrangement according to an embodiment of the present invention. The fact that each battery is now 10V instead of 12V is not much use when it comes to powering a device that requires 12V. Using the batteries that we have tested and repaired, you may have found that each battery gave different results when it came to testing them, e.g. two or more cells may be damaged. If this is the case keep the weakest battery to one side to make into a “spider battery” Fig 6, 1. The good cells will come to make up 12V from the 10V and 2V from the weakest battery. We are now going to connect the 10V battery and one cell of the weakest battery to make 12V. Connect the positive terminal of the 10V battery to the negative side of the cell. Connect the positive side of the cell to connector and isolate the link to the next cell Fig 6, 2. Fig 6, 3 shows the link disconnected to open circuit the cell. This connector now becomes the positive terminal. We have now created a healthy 12V battery. Carry out the same again. Make another 12V battery from the other batteries. The 24V or 12V kettle will be used as a battery tester at this stage. Once filled with water, the kettle will be connected across the battery’s terminals to test the capacity of the battery, because our batteries are used, their capacity will vary.

Batteries

Batteries can be new or used. One new battery is used for a particular part of the system, of which become apparent later. The batteries will be configured to different voltages to run the arrangement, repairing the using the LPCs Fig 6, 4 to make them fir for our purpose. We will create a primary set Fig 1, 2, secondary set Fig 1, 3, and an auxiliary set (optional). Fig 6 shows all LPCs connected to isolated cells.

Battery condition

Using a voltmeter check the voltage of each battery connected for the primary battery that you have made and individual cells you have made to make up the primary battery. Each cell should read 2.2 – 2.3V and no higher. Look over the cells and these should not be bubbling furiously. They should deliver the odd bubble occasionally with relatively clear solution. If they do appear to bubble furiously the cell is coming to the end of its life and also creating hydrogen. The arrangement works happily without creating hydrogen. Make another cell up and reconnect it to the previous cells terminals using the LPCs.

Primary batteries - Fig 1 & 2

The primary batteries will be charges by solar, wind and other methods of electrical power. In this case we are going to make a 26V battery. This battery will store power until required. Once stored, this power will run our appliances. While our appliances are being used, the surplus energy will be passed to the secondary battery.

Secondary batteries - Fig 1 & 3

We are now going to make a 12V battery. The secondary battery will store power created by a discharge of the primary battery via the appliances. Once fully charged, this power can be used to run appliances or be fed back to the primary battery, or even fed to the national grid, creating a charging process via the control panel.

Auxiliary batteries (optional)

These are optional. These are being charged from the secondary batteries after they've been charged.

Desulphator - Fig 3

Lead acid batteries suffer from sulphation after a while and reduces their efficiency, therefore reducing the life of the battery. This is due to the chemical process taking its place during its life. If a lead-acid battery is allowed to completely discharge then the lead sulphate can crystallize on the lead plates within the battery and effectively insulate the lead plate from the electrolyte. The reduced lead contact area reduces the capacity of the battery to store electrical energy. I have designed as part of the system a desulphator to reverse the effect and increase the life and efficiency of the batteries.

Inverters

An inverter is a device for converting battery DC power into mains AC power. If a short circuit occurs for any reason across its output it shuts down, if the battery voltage is too high its shut down and if the battery runs low it shuts down to prevent the battery becoming over discharged.

The value of the inverter will depend on the input and the output the consumer requires. In this case we require two 12V, 600 watt inverters. One will be connected between the positive terminals of the primary and secondary battery modules and the other will be connected across the positive and negative terminal of the primary battery module.

Control panel

The separate and remotely located control panel will house the inverters, diodes and various other components relating to the arrangement according to an embodiment of the present invention.

VARIACS - Fig 2 & 8

The variac is a device which allows a variable AC output. In our case we are feeding 230V AC into the variac, rectifying the output and setting the output to the correct output voltage. We set this at 32.5V open circuit voltage. This will be fed from the inverter connected to the secondary battery module and the output connected to the primary battery module. This charges the primary batteries at a slightly lower rate than we are using from them. The system relies on the variac as part of the recycling process.

Solar panels

The value of the solar panels will depend on the input and output the consumer requires. In this case we are going to use two 165W panels. These will charge the primary battery module. We will also use two 60W panels, configured to revive a weak 12V battery in both the primary and secondary battery modules. The connections of the panels will ‘float’, e.g. has no permanent connectors, as the output cables can be connected to the appropriate battery via crocodile clips to 'equalise' with the other batteries in the system. Each battery must be fully charged and equal before switching the system on. If one battery is flat then the combined power source and storage arrangement will not work. Solar panels come in different voltages and different outputs. My calculations show that it would have originally required 600W of power to operate my appliances, but because of the efficiency of the arrangement, only 300W of power are required. The panels deliver full power in bright sunlight and approximately 1/10 of the power in overcast weather conditions, delivery approximately 30W all day. So instead of using the variac circuit to feed the primary batteries, the secondary batteries are used to operate the other appliances.

Referring to the drawings, you will notice a small solar panel together with the 300W panels. This panel is used to connect any of the batteries or cells to equalise the voltage with the other cells or batteries. A weak cell will restrict current flowing through the arrangement causing the arrangement to lose power.

Connecting the components together

<u>Primary and secondary battery modules (Fig 1, 2 & 3)</u>

After making two 12V batteries, connect the negative terminal of one to the positive terminal of the other. You now have a primary battery module in which the associated batteries are connected in a series configuration.

By connecting the negative of one to the other and the positive of one to the other you have connected the batteries of the secondary module in which the 12V batteries are connected in a parallel configuration, giving 12V but with an increased capacity, and power from both batteries.

The connections you have made creating a 12V supply will be used as the secondary battery module of the arrangement. Using more batteries we now need 26V. From the remainder of the batteries and extra batteries, test, repair and create 26V using a combination of cells to make up the voltage. It could be 10V from one battery, 6V from another and 10V from another making 26V. Make two of these and connect the negative of one to the other.

Connect one 12 volt 600W inverter to the 12V supply previously made, observing correct polarity in the process. Connect the multimeter across the battery terminals observing the voltage, reading approximately 12.5 volts. Connect four light bulbs to the inverter output. Switch the inverter on, observe the voltage reading. Upon switching each light on, the voltage will start to drop. After a period of time the voltage will drop. Once the voltage drops, a warning beeper will sound from the inverter when the voltage reaches approximately 10.8V. With the inverter kept switched on, leave the voltage drop to 10.3V. The inverter will switch itself off preventing batteries to becoming too discharges. Switch off the inverter, the voltage will rise slightly.

Now, connect the negative of the 26V battery to the negative of the primary battery. Connect another 12V 600W inverter to the positive terminal of the primary battery module and the positive of the secondary battery module. Connect that inverter's positive terminal to the primary battery module and the inverter's negative terminal to the secondary battery module positive terminal. With the multimeter still connected to the secondary battery module as the previous test, add another multimeter, connecting the positive on the primary battery module and the negative of the multimeter to positive terminal of the secondary battery module.

Both meters will read different voltages. The 12V reading will read 11V and the 26V will read 14-15 volts. Now remove the plug from the first inverter and plug it into the second inverter. Take note of the voltage readings. Switch on the second inverter, leaving the first inverter switched off.

Switch each lamp on in turn, observing the voltages. As the lamps are lit, the voltage will drop slightly from 14-15 volts and slowly decrease. Notice on the primary battery, module the voltage will begin to rise and will keep rising. Observing both voltages carefully with the lamps lit, the first will continue rising and the second will drop in proportion.

What Happened Here?

First we made a 12V secondary battery module and then we made a 26V primary battery module. The connections between the modules were then made connections and the voltage readings were observed. During this process, the secondary battery module was completely discharged. With the same load connected to the primary battery module and the second inverter, the voltage increased on the first multimeter reading. Why? When the appliances are drawing power from the primary battery, module a current flows through the secondary battery causing the secondary battery module to charge.

Using the four lamps is a good example of the operation of the arrangement according to an embodiment of the present invention. These lamps could each be a lamp in the property, for example. Once the secondary battery module charges, this power can be used in many ways, running a computer or TV or any other appliance, or the power can be fed back to the primary battery (26V). By doing this we are creating a further recycling process.

Using the power to run the four lamps from the primary battery module and charging the secondary battery module on its return, the primary module will eventually become discharged. To increase the time taken to discharge the primary module, the power from the secondary module, is passed back to the primary battery.

Desulphator

The desulphator illustrated in Fig 3 is arranged to break up the crystals that form in the cells, and in particular on the lead plates, of the battery during its working life. When a kettle is switched on for example, for the short time that this appliance is consuming power from the mains supply via socket Fig 3, 11, the waste electricity is fed to the primary battery module to remove the lead sulphate crystals. The ac pulsating current flowing is coupled at the mains socket 14 to a socket disposed on the desulphator device to cause the ac current to pass through the battery modules. The power is processed via the control panel 4 and made suitable for the batteries.

I decided on developing a device that would create heat, collect some of the heat and transfer it into hot water, collect the waste electricity and feed the primary battery module to keep the system operating. This piece of equipment contains heating elements, while the electricity is flowing through the elements kettles are placed over them, heating the room and slowly boiling the kettles as a by-product of heating the room. This hot water can be used for any domestic purpose. More to the point this power once again is processed via the control panel and made suitable for the batteries, creating the desulphating process.

Connecting the desulphator.

This part of the arrangement requires two 1kW elements to be mounted onto an insulated frame. These are connected via a rectifier on the control, being fed an ac current from the mains via a residual current detector of the correct value. The dc current is fed to the primary battery module via the rectifier. Current flowing through the rectifier and the elements allows the elements to act as a resistor, controlling current flowing through the primary battery module. Switches must be connected before the elements to switch them on and off.

Place a full kettle of water over each of the elements, switch one element on with an ammeter connected, current flowing will be approximately 4A and this will depend on the state of charge of the primary battery. Switch the second element on and the reading will rise to approximately 8A. With both elements switched on the elements will glow dimly due to the resistance of the primary battery module and the kettles will eventually boil. During this time the primary module voltage would rise until they have reached their optimum voltage and would be desulphating in the process, over time they will become more efficient. During this process, inverter L1 Fig 1, 6, would switched on running the lights and other appliances, using some of the power created by the desulphator.

Portable Multi-voltage Desulphator/Charger

This device works on the same principle. With an appliance plugged into the socket, current flowing through the unit will allow any cells to be charged, ranging from 2V up to 48V, good for equalising cells and batteries. As with the desulphator on the control panel, while a fridge is connected for example, and switches itself on and off, this allows the charging process to be more efficient. The current being fed to the cell or battery will be switched on and off on proportion with the fridge. Switching the supply on and off allows the chemical reaction to become more efficient allowing the cell or battery to operate at optimum power. Solar panels also do this, not intentionally but as it gets dark and the output drops, the batteries respond favourably and as daylight approaches the output rises, the batteries start responding more efficiently and the charging process starts all over again, resulting in the day, night, on off effect of the daily cycle.

Drawings Reference

Figure 1:
1 – input
2 – primary battery module
3 – secondary battery module
4 – desulphator
5 – TV pick up
6 – output device (inverter L1)
7 – output device (inverter L2)
8 – P.T.O (power take off)
9 – Feed in Tarrif device

Figure 2:
2 – primary battery module
3 – secondary battery module
6 – output device (inverter L1)
7 – output device (inverter L2)
8 – P.T.O (power take off)
10 – recycling path of current flow

Figure 3:
14 – mains outlet socket
10 – path of current flow
11 – connections to appliances
4 – desulphator

Figure 4:
5 – TV pick up
7 – output device (inverter L2)
8 – P.T.O (power take off)
12 – electric kettle

Figure 5:
3 – secondary battery module
9 – Feed in Tarrif device
13 – output
15 – grid

Figure 6: 1 – spider battery

2 – isolated cell (disconnected cell link)

3 – isolated cell with lead post connectors

4 – lead post connector, connected to cell.

Claims

1. A combined electrical power source and storage arrangement, the arrangement comprising:
   - a primary battery module comprising a positive and negative electrical terminal, the primary module being arranged to provide electrical power to an electrical appliance;
   - a secondary battery module comprising a positive and negative electrical terminal, the secondary module being arranged to receive electrical power from the primary battery which is surplus to that required to power the electrical appliance;

   wherein

   the primary and secondary terminals are electrically coupled such that the surplus electrical power is arranged to charge the secondary battery module as the primary battery module becomes discharged in powering the appliance.
2. An arrangement according to claim 1, wherein the primary battery module comprises a plurality of batteries arranged in a series configuration.
3. An arrangement according to claim 1 or 2, wherein the secondary battery module comprises a plurality of batteries arranged in a parallel configuration.
4. An arrangement according to any preceding claim, further comprising a primary inverter coupled between the positive terminal of the primary module and the positive terminal of the secondary module.
5. An arrangement according to any preceding claim, further comprising a secondary inverter coupled between the positive terminal of the primary module and the positive terminal of the secondary module.
6. An arrangement according to any preceding claim, wherein the primary module comprises a voltage difference between the positive and negative terminals which is greater that the voltage difference between the positive and negative terminals of the secondary module.
7. An arrangement according to any preceding claim, wherein the primary and secondary battery modules comprise a lead-acid type battery module.
8. An arrangement according to claim 7, further comprising means for reducing the accumulation of lead sulphate crystals which otherwise reduces the electrical energy storage capacity of the battery modules.

9. An arrangement according to claim 8, wherein the means for reducing the accumulation of lead sulphate crystals comprises a socket which is arranged to receiving an alternating current that is applied to the terminals of the battery modules.
10. An arrangement according to any preceding claim, wherein the secondary battery module is arranged to re-charge the primary battery module.
11. An arrangement according to any preceding claim, wherein the secondary battery module is arranged or further arranged to power an electrical appliance.
12. An arrangement according to any preceding claim, further comprising a solar panel which is arranged to charge the primary battery module.

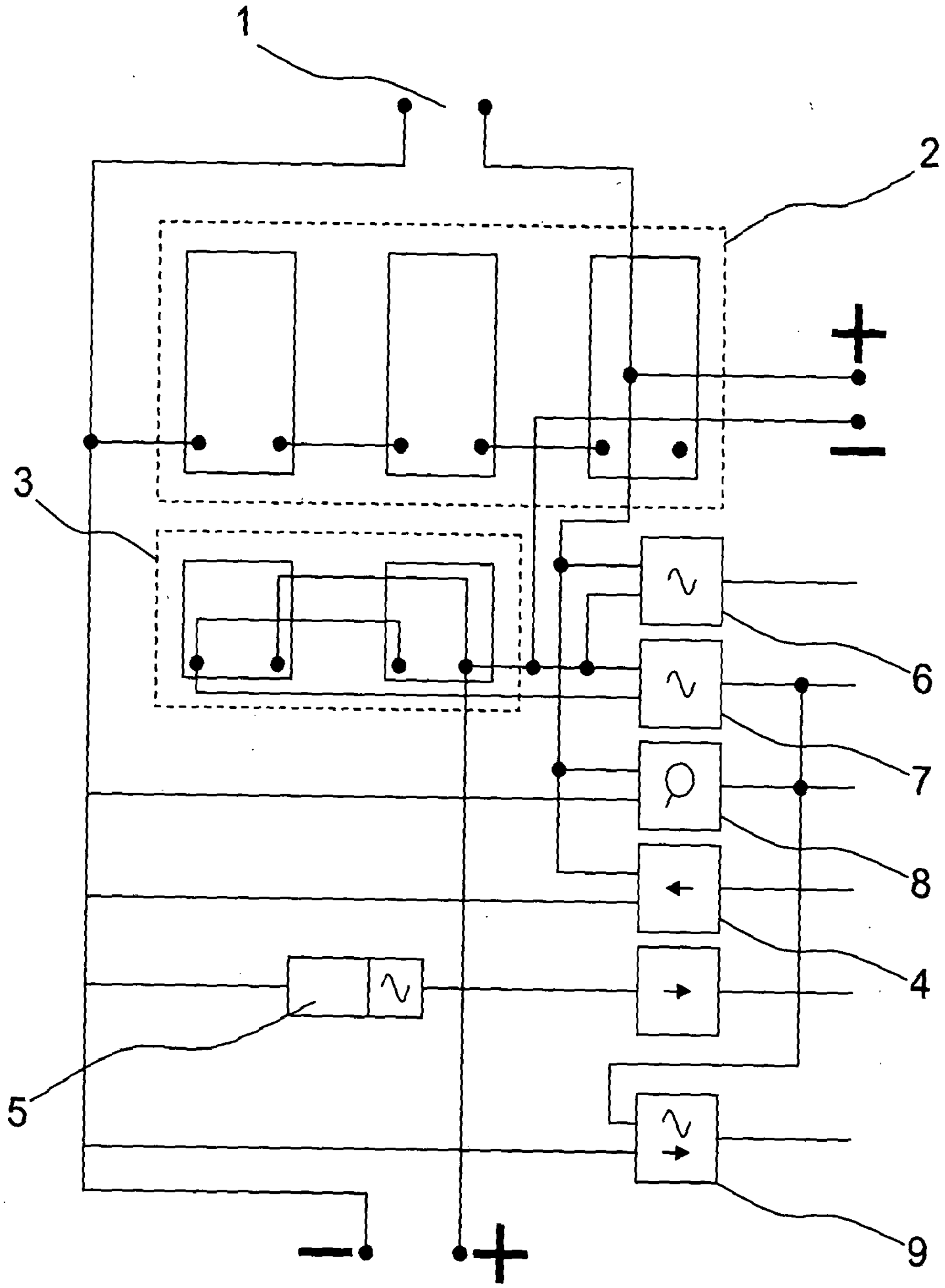

Figure 1

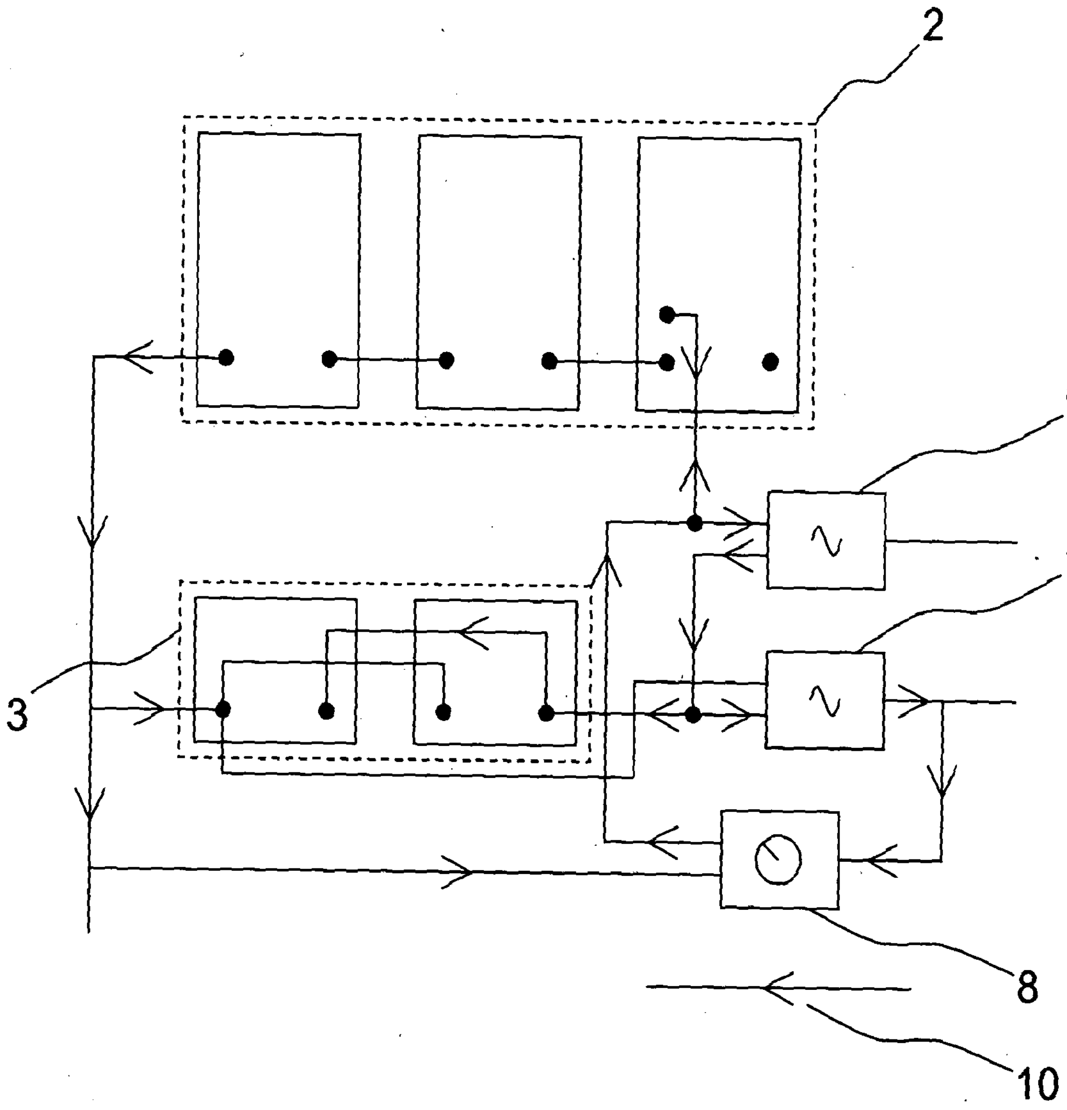

Figure 2

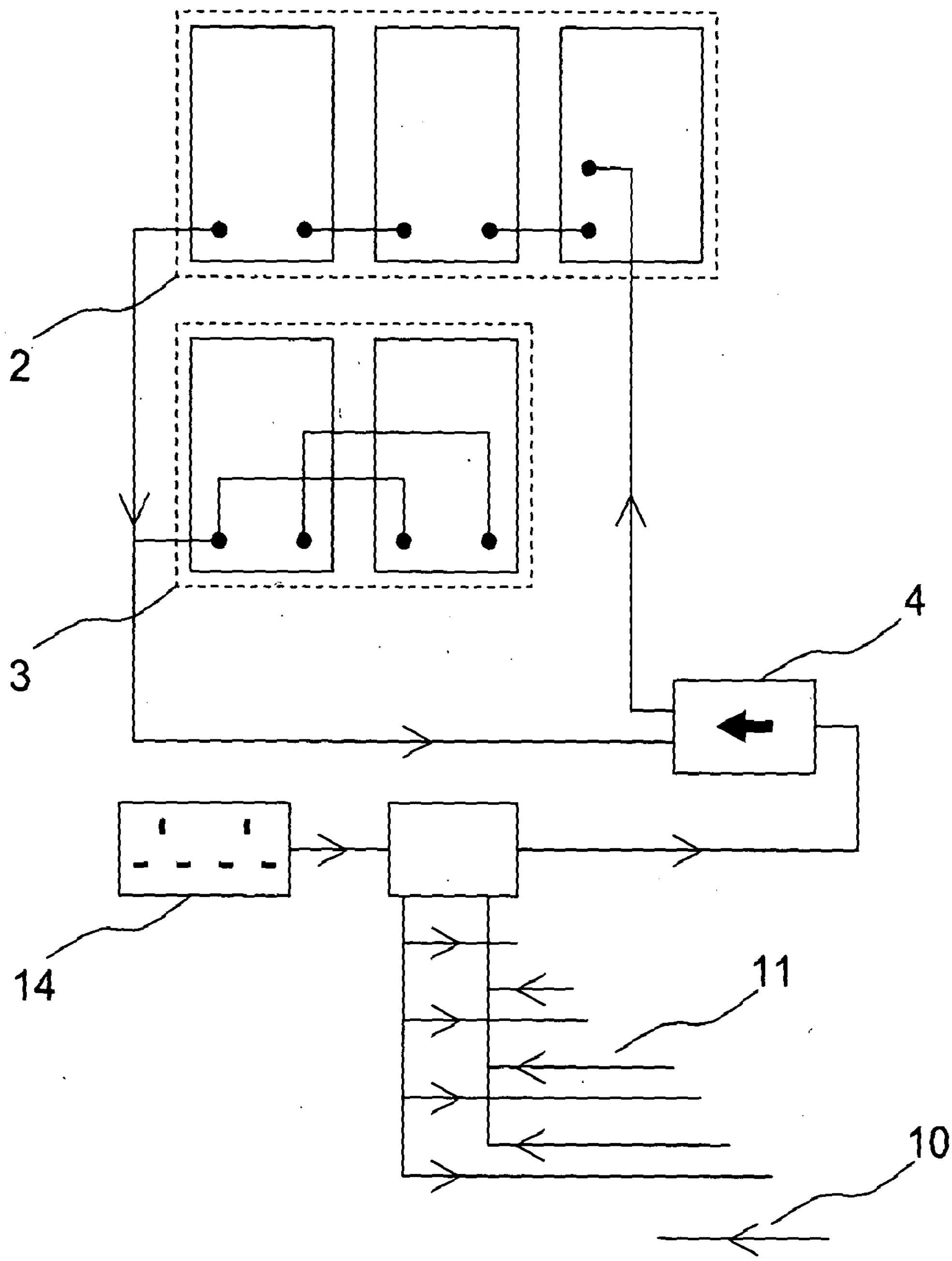

Figure 3

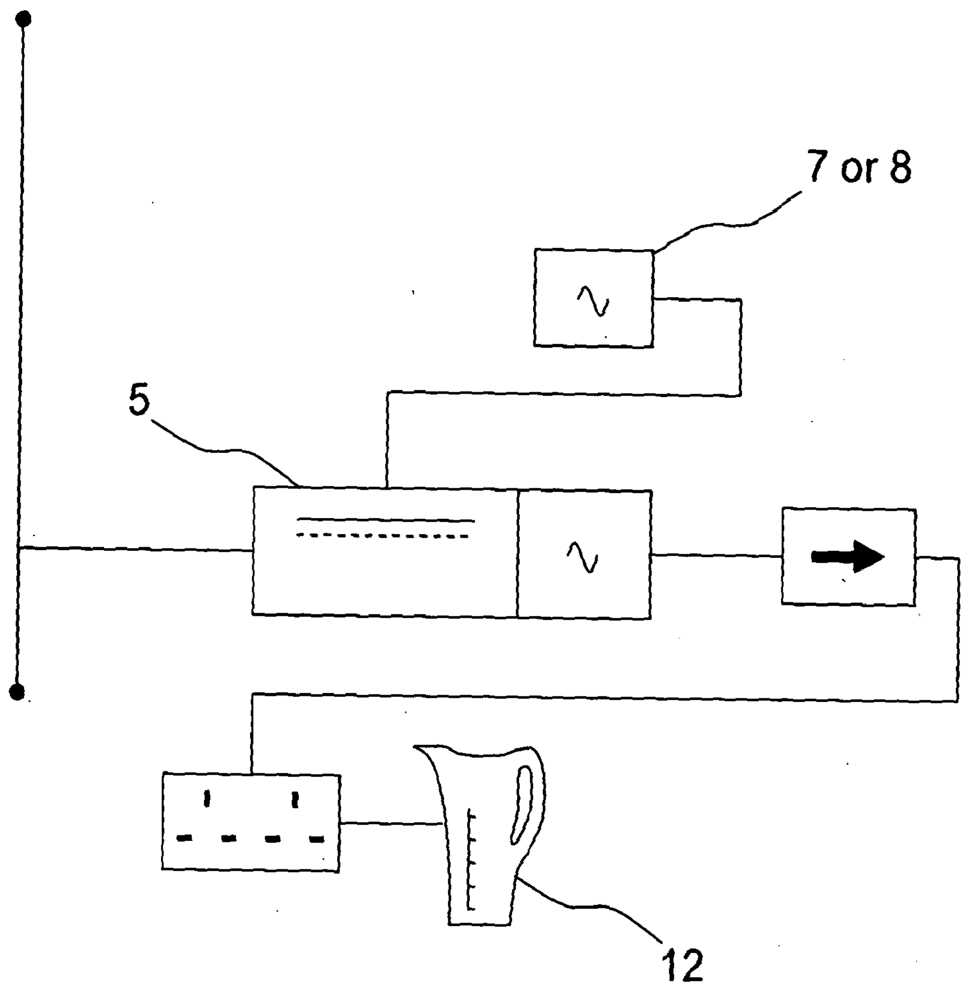

Figure 4

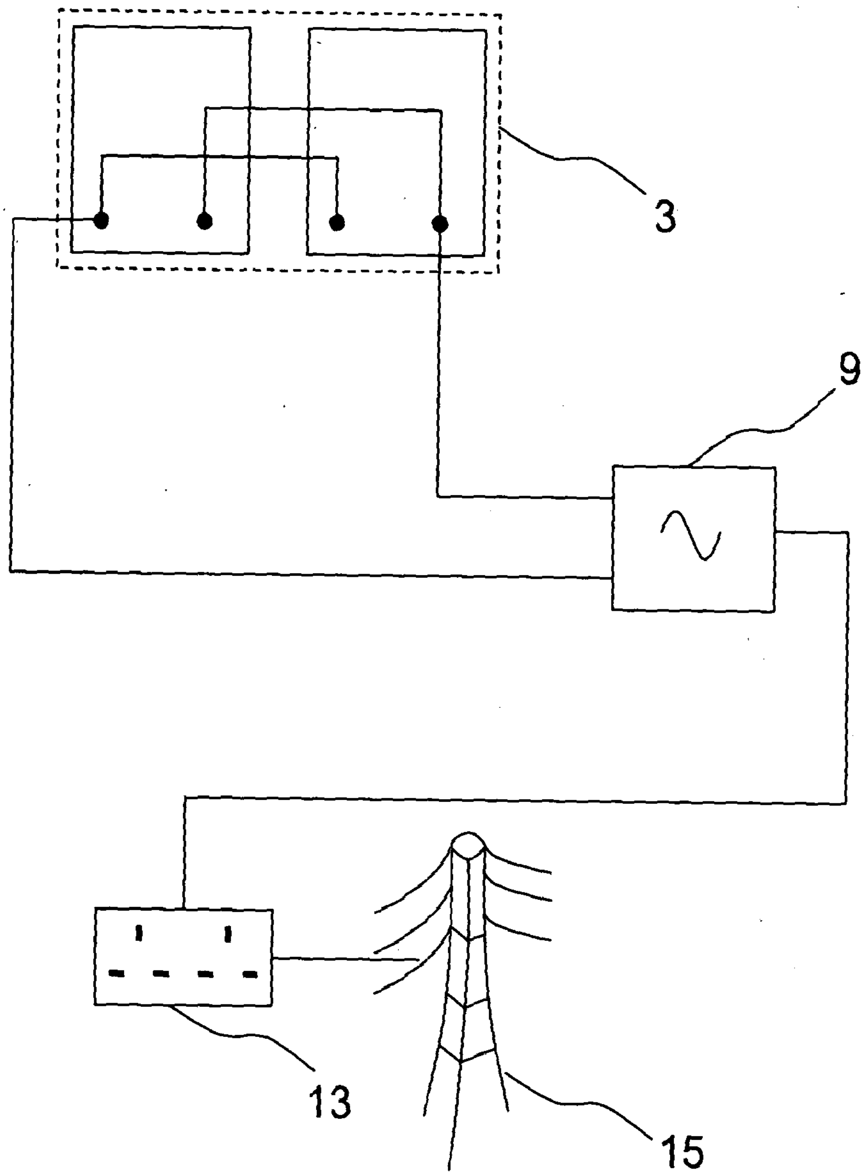

Figure 5

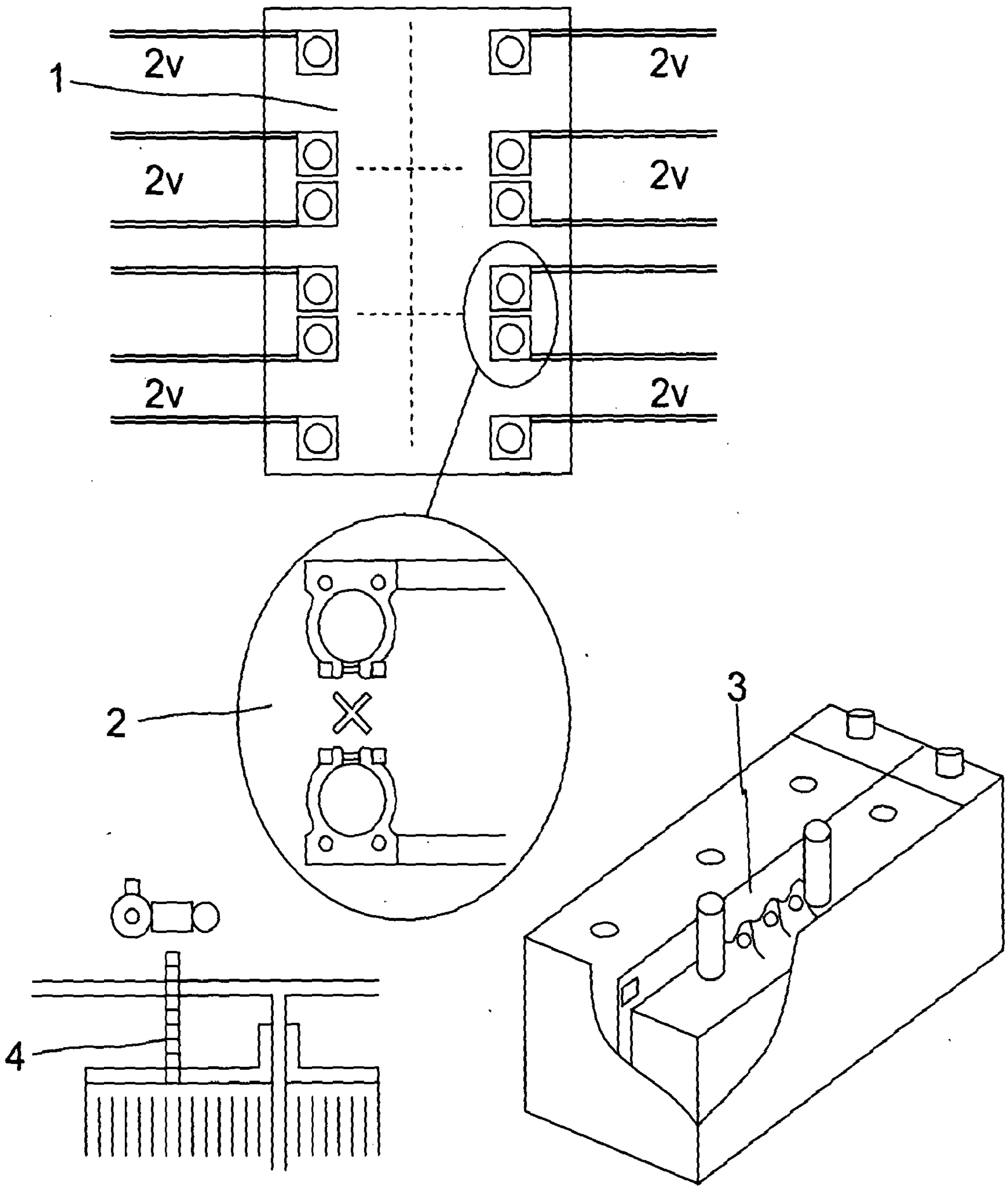

Figure 6