The behaviour of a direct current generator under load (Item No.: P1399400)

Curricular Relevance

Area of Expertise: Physics

Education Level: Age 14-16

Topic: Electricity

Subtopic: Electric generator, motor, transformer

Experiment: The behaviour of a direct current generator under load

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	10 Minutes	2 Students

Additional Requirements:

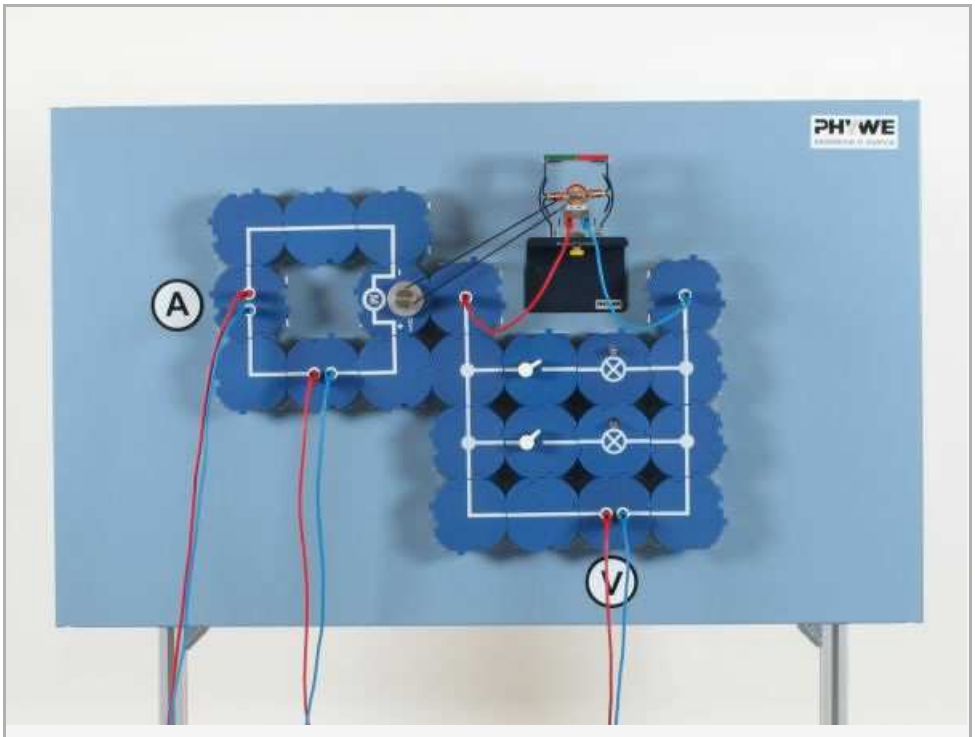
Experiment Variations:

Keywords:

Principle and equipment

Principle

An investigation is to be made into the behaviour of a direct current generator, that is first running idle, when it is run under load.



Experimental set-up

Equipment

Position No.	Material	Order No.	Quantity
1	Multimeter ADM2, demo., analogue	13820-01	2
2	PHYWE power supply, universal DC: 0...18 V, 0...5 A / AC: 2/4/6/8/10/12/15 V, 5 A	13500-93	1
3	Demo Physics board with stand	02150-00	1
4	Motor model f. magnet board	07850-20	1
5	Motor 12 V, module DB	09475-01	1
6	Switch on/off, module DB	09402-01	2
7	Socket for incandescent lamp E10 ,module DB	09404-00	2
8	Connector interrupted, module DB	09401-04	3
9	Junction, module DB	09401-10	2
10	Electr.symbols f.demo-board,12pcs	02154-03	1
11	Connector, straight, module DB	09401-01	2
12	Connector, angled, module DB	09401-02	6
13	Connector, T-shaped, module DB	09401-03	4
14	Holder f.electr.motor,magn.board	07849-00	1
15	Magnet, bar-shaped, d = 18 mm, l = 70mm	06318-00	1
16	Filament lamps 4V/0.04A, E10, 10	06154-03	1
17	Connecting cord, 32 A, 1000 mm, red	07363-01	2
18	Connecting cord, 32 A, 1000 mm, blue	07363-04	2
19	Connecting cord, 32 A, 500 mm, red	07361-01	1
20	Connecting cord, 32 A, 500 mm, blue	07361-04	1
21	Connecting cord, 32 A, 750 mm, red	07362-01	1
22	Connecting cord, 32 A, 750 mm, blue	07362-04	1

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Set-up and procedure

- Set up the experiment as shown in Fig. 1 ; leave both switches open at first; select the 1 A- measurement range for the ADM 2 in the motor circuit, and the 3 Vmeasurement range for the ADM 2 in the generator circuit
- Set the power supply to 0 V and switch it on
- Increase the voltage of the power supply until the generator generates a voltage of 2.0 V; enter the values for U and l in the motor circuit in Table 1
- Pay attention to the running noise of the generator when first switching on one lamp, and then both lamps (1) and note the measured values for U (at the power supply) and l in the motor circuit, as well as U in the generator circuit; enter the measured values in Table 1
- Reduce the power supply voltage to 0 V, switch off the lamps and increase the operating voltage of the motor until the generator again generates 2.0 V
- Switch on one lamp, and then both lamps (1) and increase the operating voltage of the motor until the generator generates 2.0 V; enter the measured values both when idling and under load in Table 1

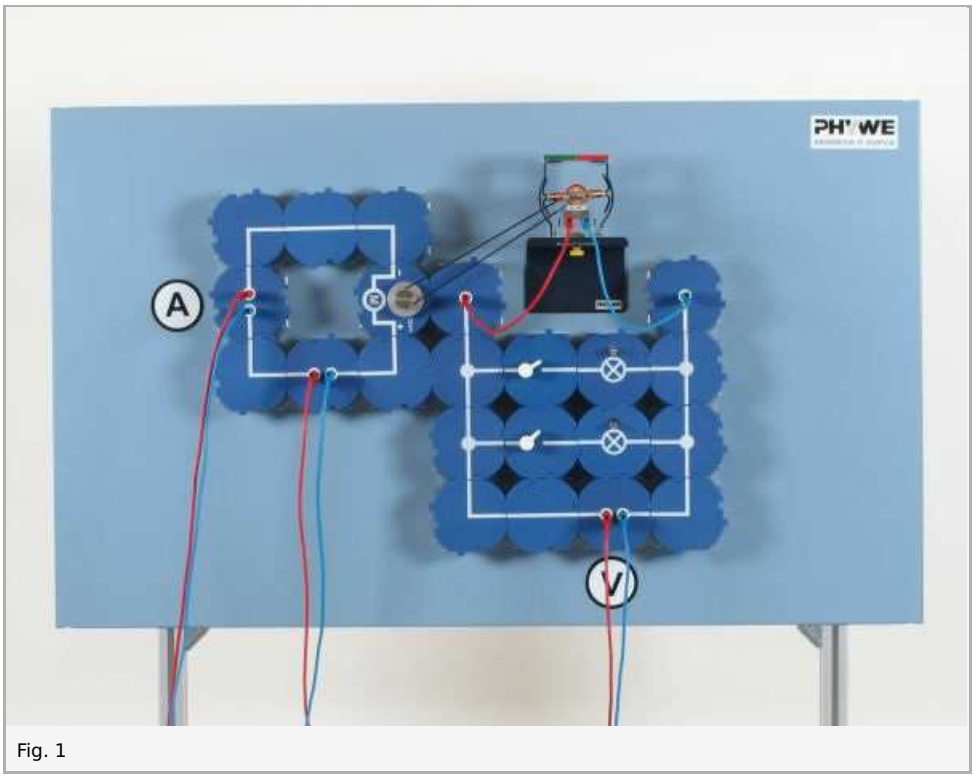

Fig. 1

Observation and evaluation

Observation

1. The generator runs slower, the greater the load that is placed on it.

Table 1

Load on the generator	Motorcircuit		Generator circuit
	U/V	I/A	U/V
None	4.8	0.65	2.00
1 lamp	4.8	0.66	0.90
2 lamps	4.8	0.68	0.56

Table 2

Load on the generator	Motor circuit			Generator circuit
	U/V	I/A	P/VA	U/V
None	4.8	0.65	3.1	2.00
1 lamp	6.6	0.85	5.6	2.00
2 lamps	7.7	0.95	7.3	2.00

Evaluation

With increasing load, the generator runs continually slower, and the voltage it generates continually drops.

This is the case as long as the performance required to drive the generator does not increase to a corresponding amount as the load (first part of the experiment, Table 1).

By matching the driving performance for the generator to the load (second part of the experiment, Table 2) the wanted or necessary terminal voltage of the generator can be kept constant.

Remarks

If three demonstration measuring instruments are available, then a voltmeter can be additionally switched in parallel to the motor. The operating voltage for the motor could then be more accurately read than from the power supply. The performance necessary for the operation of the generator in idling mode is mainly due to frictional losses. The measured values can so be considered to be dependent on the tension of the driving belt. This is why the values in Tables 1 and 2 are only to be regarded as examples.