The two-stage transistor amplifier (Item No.: P1402100)

Curricular Relevance

Area of Expertise: Physics
Education Level: Age 16-19
Topic: Electricity
Subtopic: Electronics
Experiment: The two-stage transistor amplifier

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

Additional Requirements:

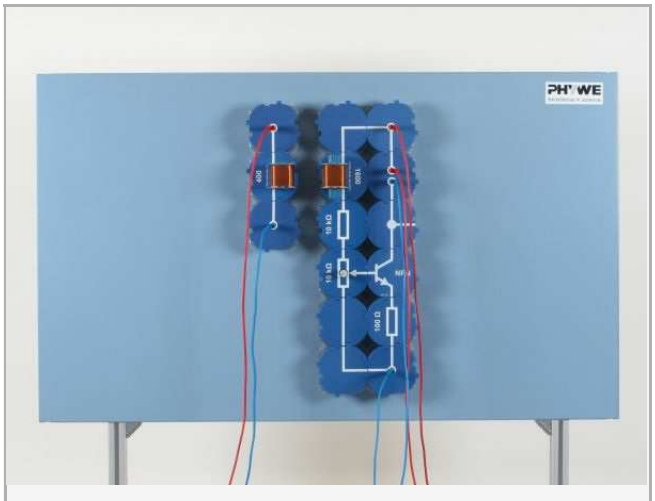
Experiment Variations:

Keywords:

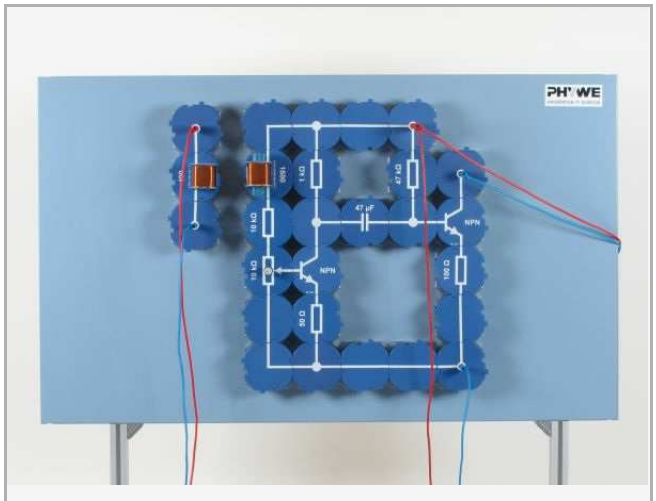
Principle and equipment

Principle

It is to be shown that voltage amplification can be substantially increased by the series connection of a number of amplification stages.



Experimental set-up Part 1



Experimental set-up Part 2

Equipment

Position No.	Material	Order No.	Quantity
1	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
2	Demo Physics board with stand	02150-00	1
3	Loudspeaker,8 Ohm/5 kOhm	13765-00	1
4	Coil 400 turns, module DB	09472-01	1
5	Coil 1600 turns, module DB	09472-02	1
6	Potentiometer 10 kOhm,module DB	09425-10	1
7	Transistor BC337,module DB	09456-00	2
8	Connector interrupted, module DB	09401-04	1
9	Junction, module DB	09401-10	3
10	Resistor 50 Ohm,module DB	09412-50	1
11	Resistor 100 Ohm,module DB	09413-10	2
12	Resistor 1 kOhm,module DB	09414-10	1
13	Resistor 10 kOhm,module DB	09415-10	1
14	Resistor 47 kOhm,module DB	09415-47	1
15	Capacitor(ELKO)0.047 mF,module DB	09445-47	1
16	Yoke	07833-00	1
17	Connector, straight, module DB	09401-01	5
18	Connector, angled, module DB	09401-02	2
19	Connector, T-shaped, module DB	09401-03	4
20	Connector, angled with socket, module DB	09401-12	2
21	Connecting cord, 32 A, 1000 mm, red	07363-01	2
22	Connecting cord, 32 A, 1000 mm, blue	07363-04	4

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Set-up and procedure

1st. Experiment

- Set up the experiment as shown in Fig. 1; bring the 400 turn coil close beside the 1600 turn coil
- Adjust the potentiometer until a humming noise is to heard from the loudspeaker; pay attention to the loudness of it (1)

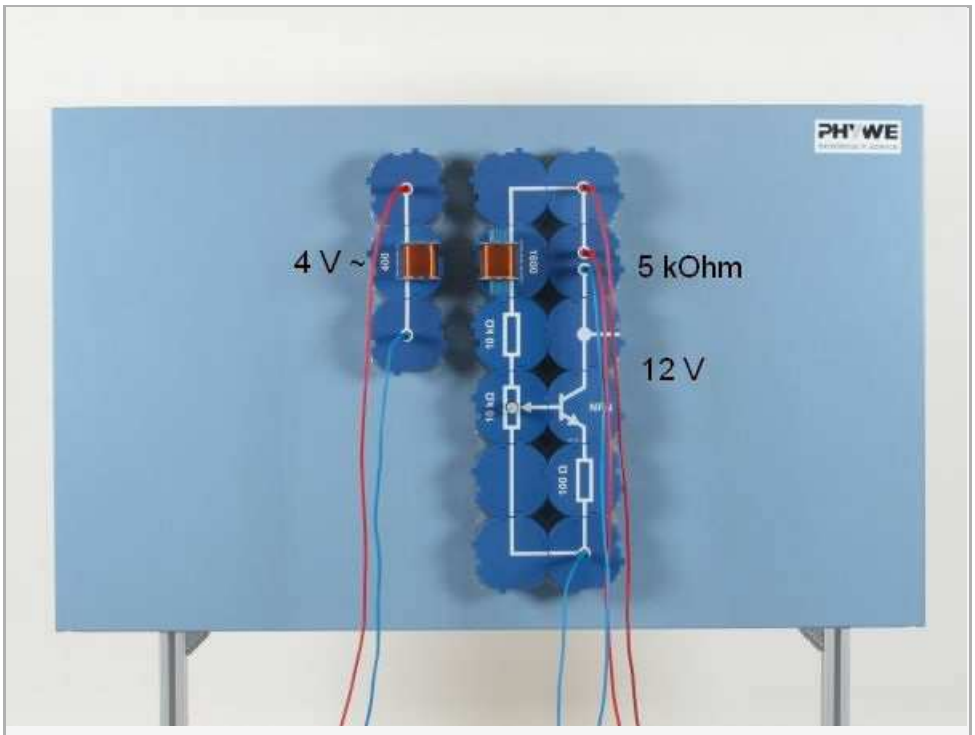

Fig. 1

2nd. Experiment

- Extend the experimental set-up as shown in Fig. 2; adjust the potentiometer until the humming noise is again to be heard; pay attention to changes in the loudness of it (2)

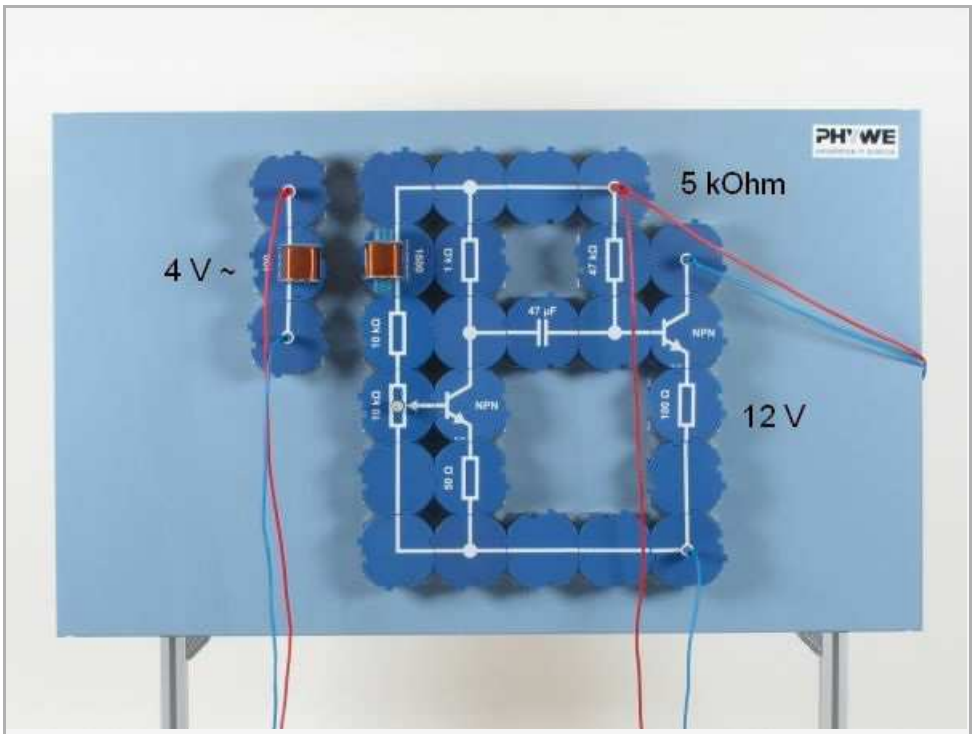

Fig. 2

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Observation and evaluation

Observation

1. At a certain position of the potentiometer, a humming noise is to be heard coming from the loudspeaker; it is not very loud however.
2. With two-stage amplification,and at a certain position of the potentiometer, a humming noise comes from the loudspeaker that is substantially louder than that heard in the 1st. experiment.

Evaluation

With this amplifying circuit, the alternating magnetic field that is generated by the coil that is driven by alternating current is detected. The alternating magnetic field generates a low induction voltage in the coil in the base circuit of the first transistor, and this is amplified by the transistor. For this to occur, however, the working point of the transistor must be so adjusted by the potentiometer, that an undistorted supply is possible. When the voltage amplification that can be so reached is insufficient, it can be increased by a second amplifying stage, in which the collector alternating voltage from the first stage is passed through a capacitor to the base of the second transistor, which amplifies it further.

Remarks

With the coupled capacitor, the two stages are separated with regard to the direct voltage and only the alternating voltage that is to be amplified is transmitted. The emitter resistance causes a degeneration of the amplifying stages, but although it reduces the attainable voltage amplification, it also reduces distortion, making it easier to adjust to the working point.

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