# The forces between the primary and secondary coils of a transformer (Item No.: P1399700)

## Curricular Relevance

**Area of Expertise:** Physics
**Education Level:** Age 14-16
**Topic:** Electricity
**Subtopic:** Electromagnetism
**Experiment:** The forces between the primary and secondary coils of a transformer

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

**Additional Requirements:**

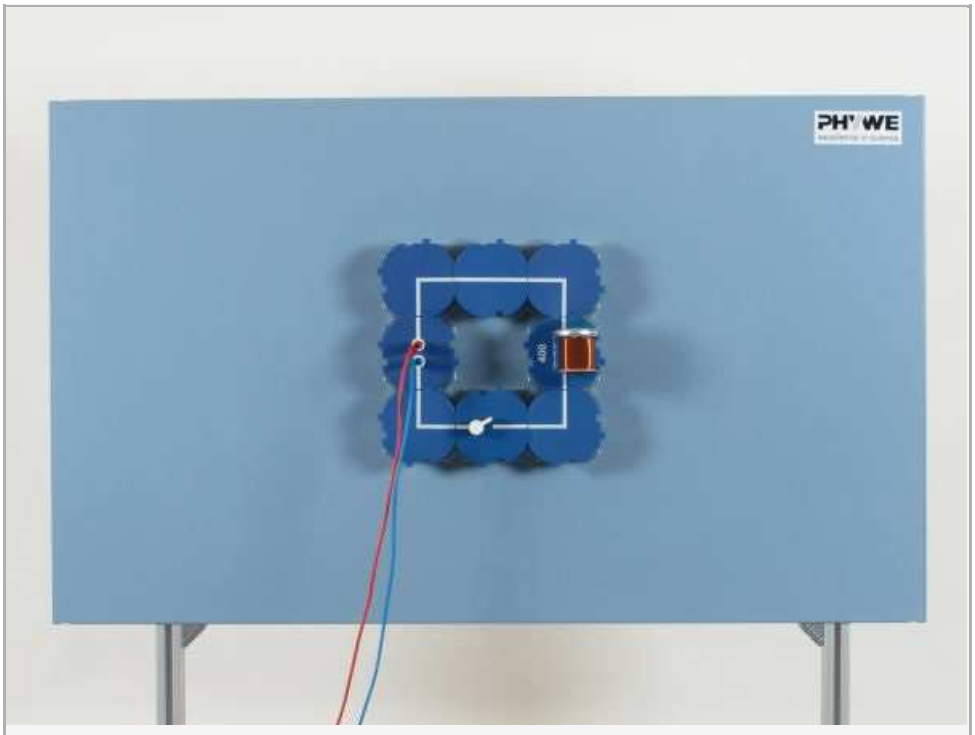
**Experiment Variations:**

**Keywords:**

## Principle and equipment

### Principle

It is to be demonstrated, that the primary and secondary coil of a transformer repel each other.




Experimental set-up

## 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 | Coil 400 turns, module DB | 09472-01 | 1 |
| 4 | Switch on/off, module DB | 09402-01 | 1 |
| 5 | Connector interrupted, module DB | 09401-04 | 1 |
| 6 | Electr.symbols f.demo-board,12pcs | 02154-03 | 1 |
| 7 | Yoke | 07833-00 | 1 |
| 8 | Connector, straight, module DB | 09401-01 | 1 |
| 9 | Connector, angled, module DB | 09401-02 | 4 |
| 10 | Circular trough | 07835-00 | 1 |
| 11 | Connecting cord, 32 A, 1000 mm, red | 07363-01 | 1 |
| 12 | Connecting cord, 32 A, 1000 mm, blue | 07363-04 | 1 |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## Set-up and procedure

- Set up the experiment as shown in Fig. 1
- With the switch open, switch on the power supply and set it to a voltage of 15 V~
- Briefly close the switch and observe the circular trough
- Repeat this procedure; note the observations
  Note: The maximum operating current of the coil is $I$ = 1 A. At a voltage of $U$ = 15 V~, a current of about 3 A flows through it. This current strength is necessary to be able to clearly demonstrate the action of the prevailing force; but it would lead to destruction of the coil if the switch were kept closed for a longer time.

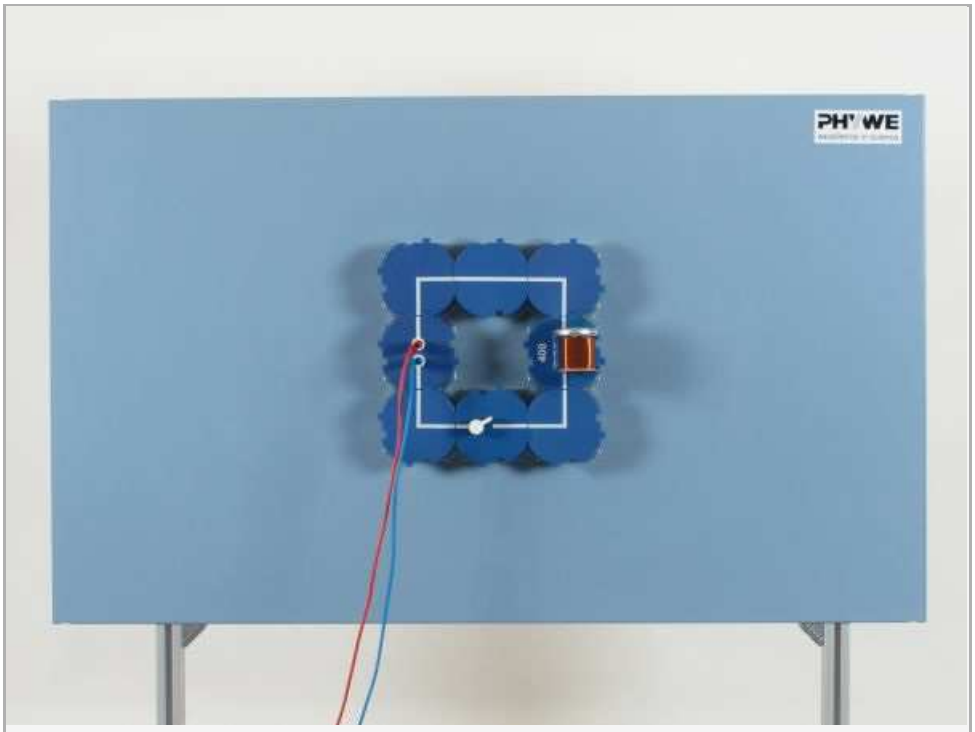

Fig. 1

# Observation and evaluation

## Observations

The primary and the secondary coil, the circular trough, repel each other as long as the primary circuit is closed.

## Evaluation

The secondary circuit of the transformer used has a number of turns $N_s$ = 1 and is realised here by the circular trough.

As long as the primary coil is flown through by an alternating current, an alternating magnetic field is built up. This field is also spanned by the secondary coil, the circular trough. An alternating current is therefore induced in the circular trough, which itself builds up an alternating magnetic field which is, however, directed in the opposite direction to the alternating magnetic field of the primary coil. This explains the repelling force between the primary coil and the secondary coil. The induction current is so induced, that it acts against its cause (Lenz's law).

## Remarks

This experiment is suitable as an introduction to Lenz's law, or to confirm it.


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