



# Podstawy elektroniki

Moduł 1B

Dr inż.  
Patrik Król

V2024/1

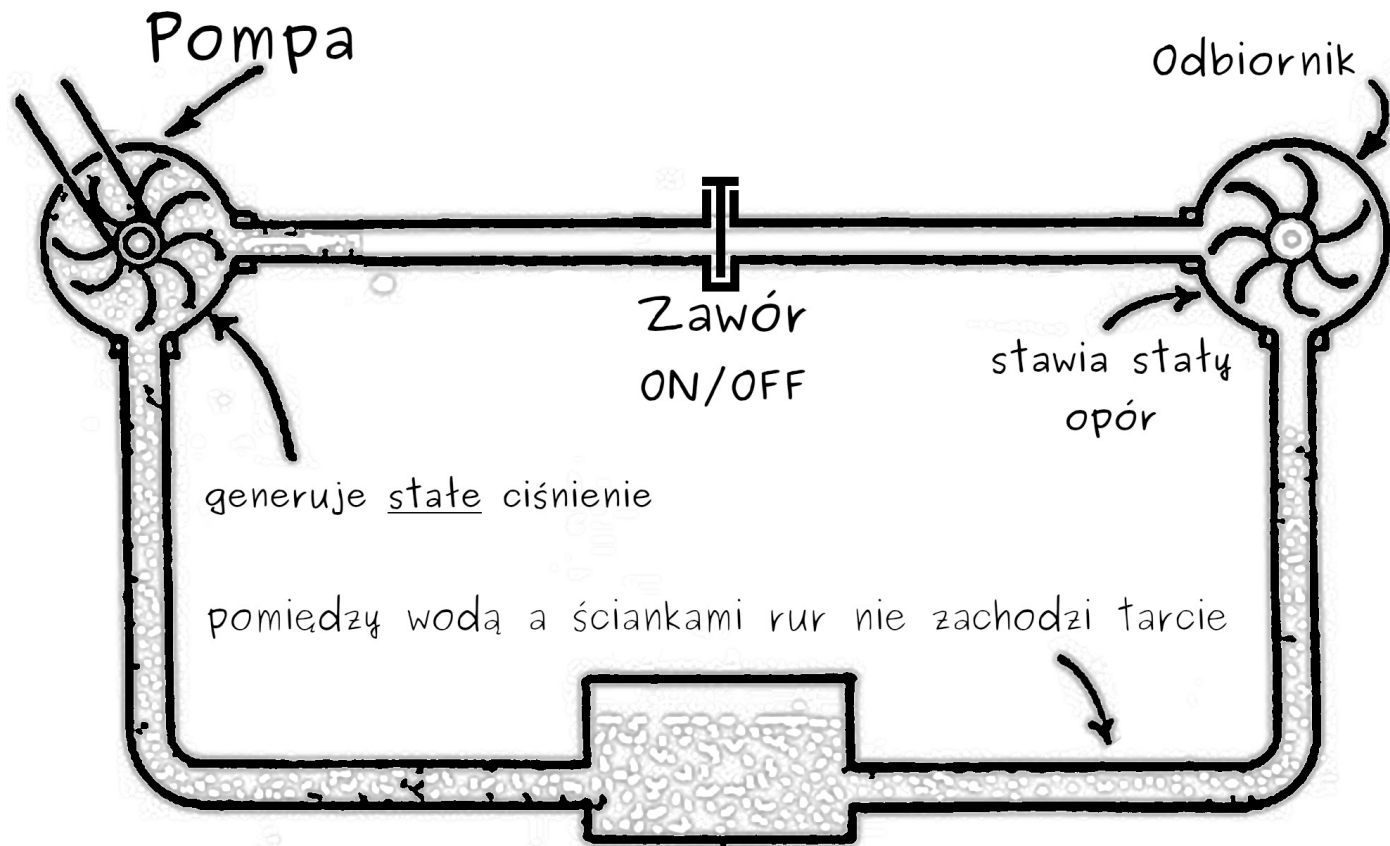
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# Moduł 1B

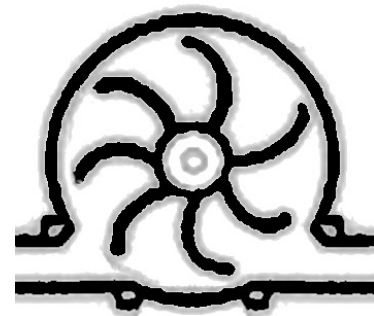
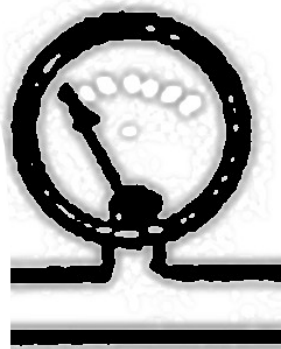
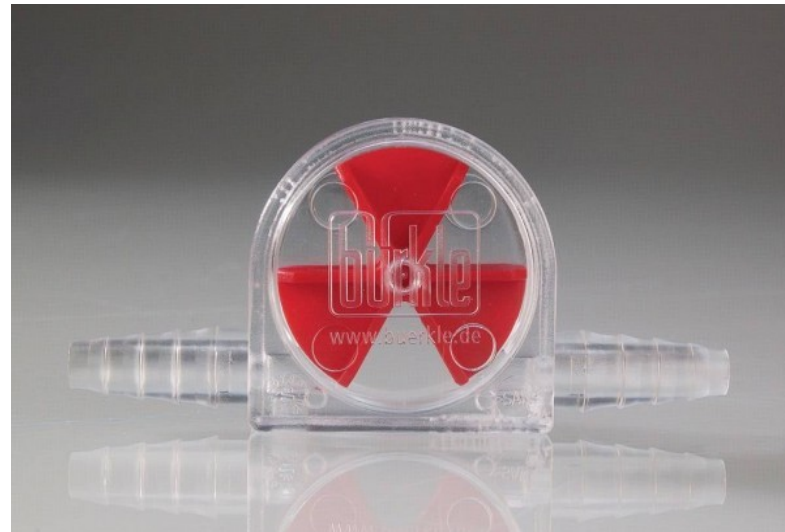
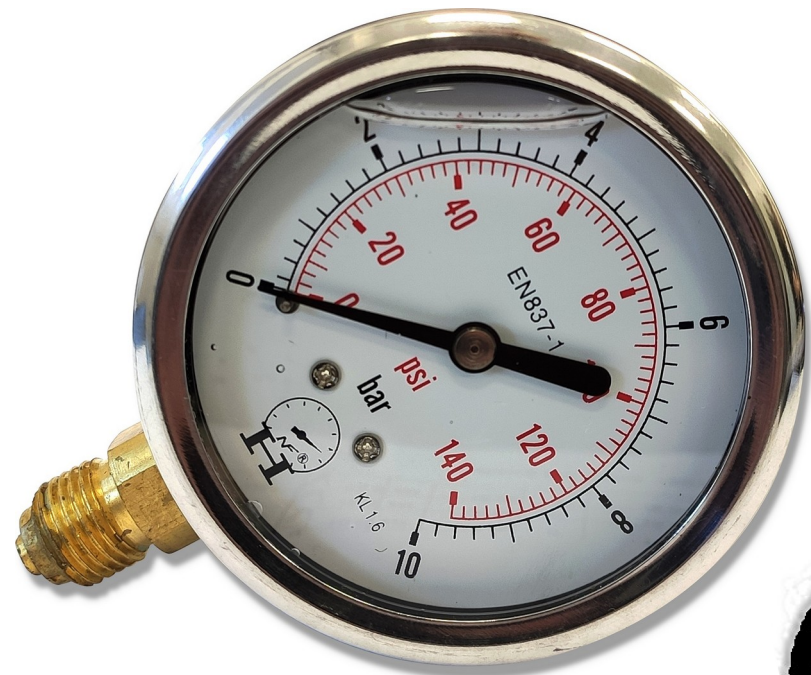
- Napięcie i natężenie (analogia do układu z wodą c.d.)
- Pole elektromagnetyczne
- Podstawowe podzespoły cd.: przekaźnik (elektromagnes), tranzystory

# Prąd, dobra analogia?

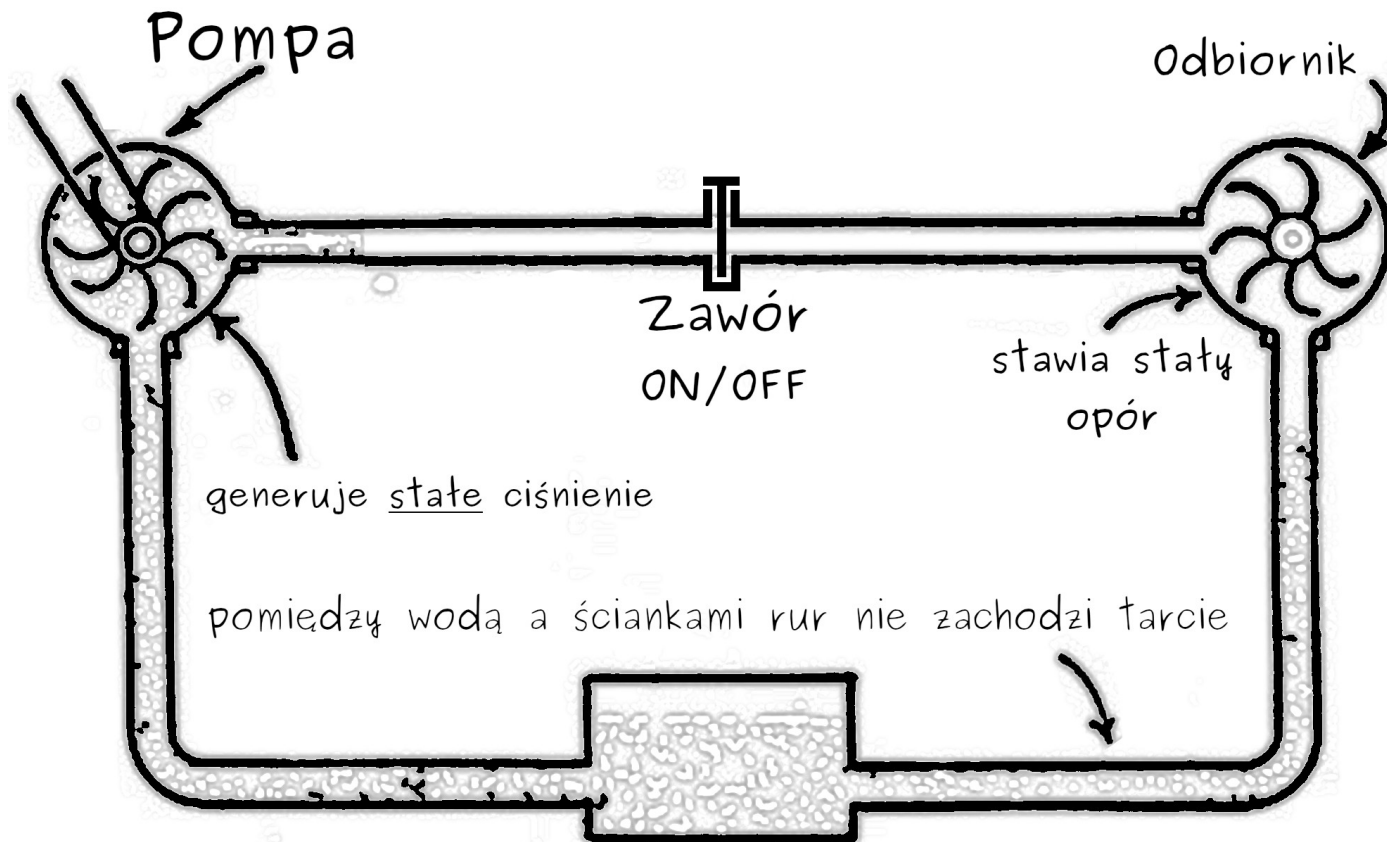
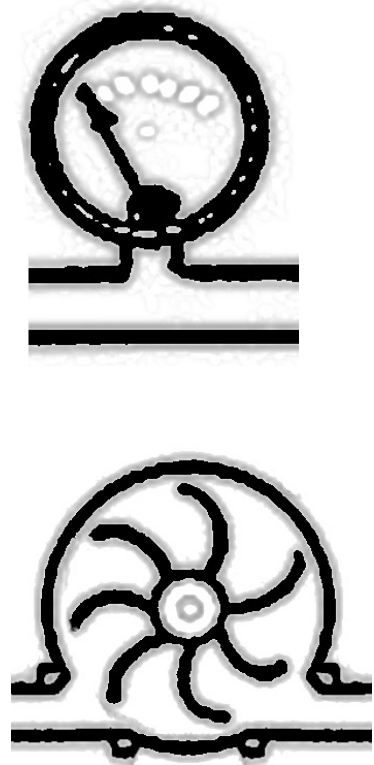


Jakie dwie rzeczy  
można tu zmierzyć?

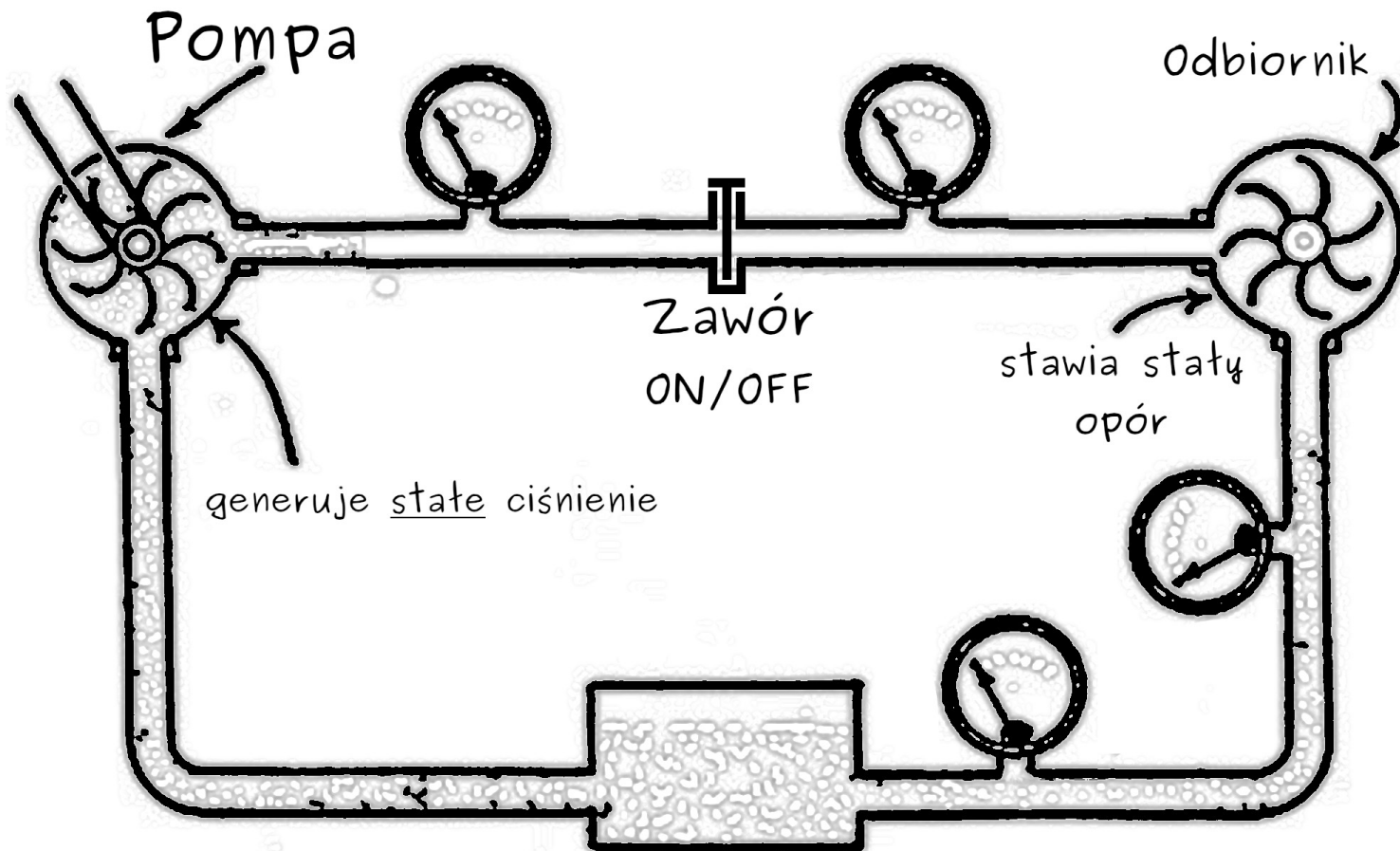
# Ciśnienie i przepływ



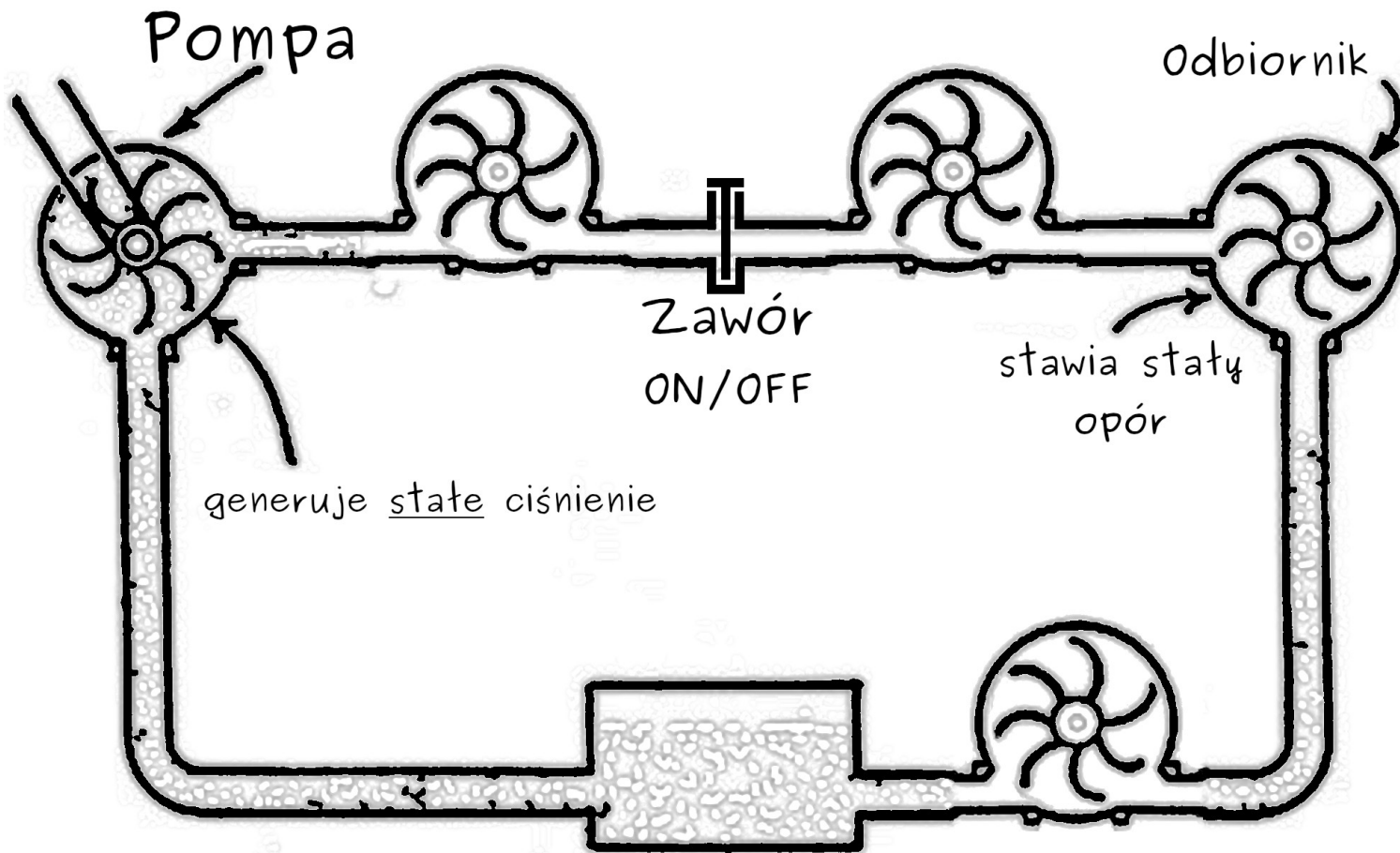
# Gdzie i jak wstawić przepływomierz i manometr?



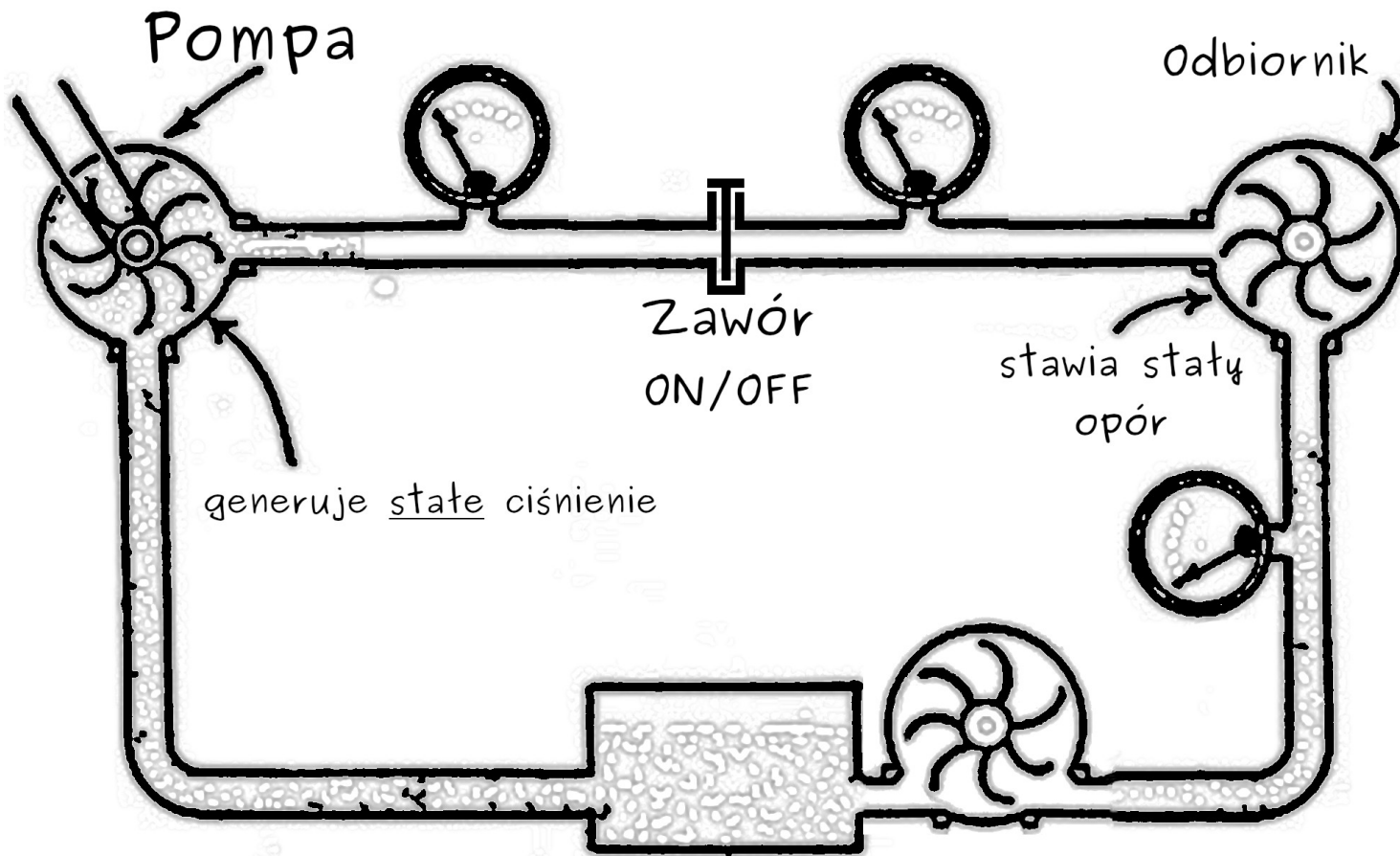
# Gdzie podłączyć manometr?



# Gdzie podłączyć przepływomierz?

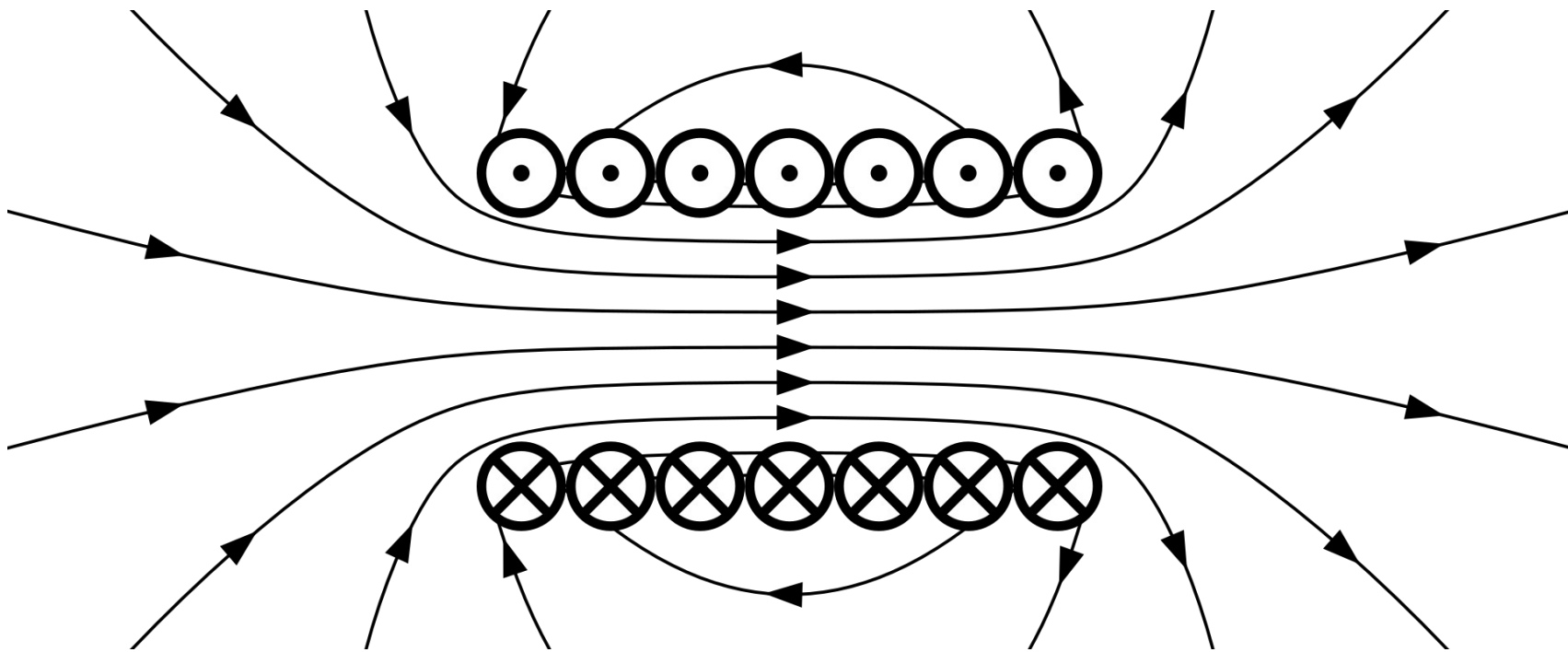


# Czy istnieje jakaś zależność pomiędzy przepływem a ciśnieniem?





# Pole elektromagnetyczne



# Cewka



[loudspeakershop.eu](http://loudspeakershop.eu)

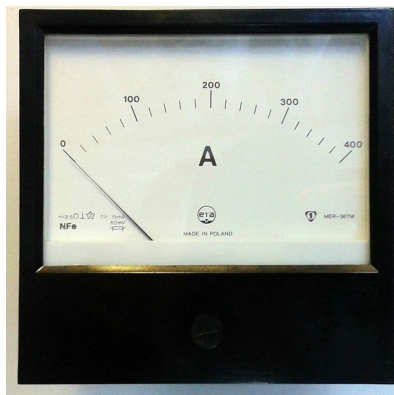
# Elektromagnes



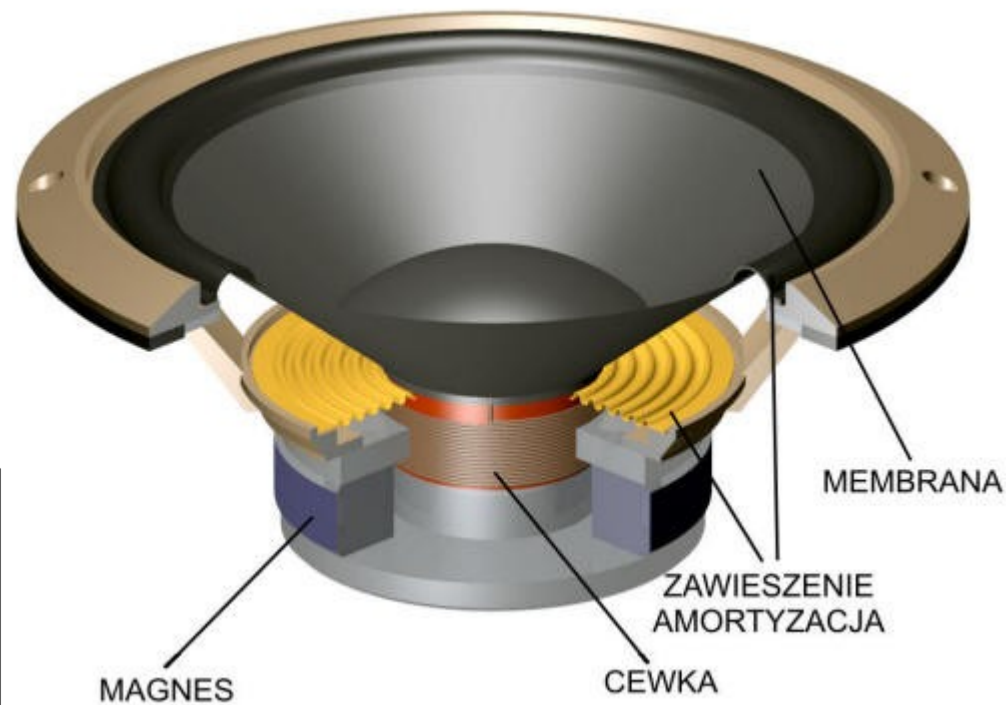
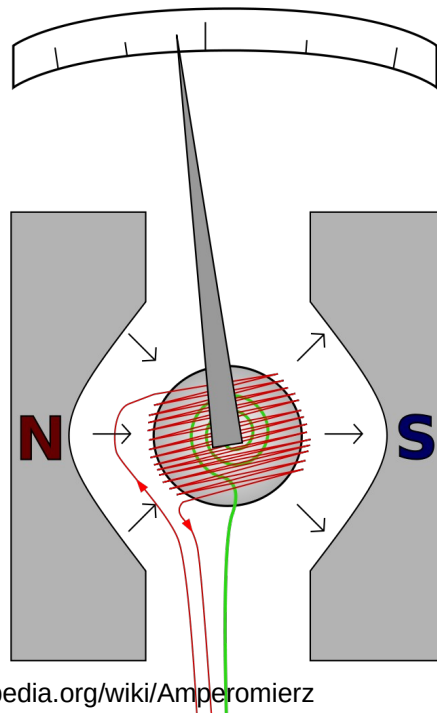
# Gdzie jeszcze może być wykorzystywane to zjawisko?



Źródło: electricmobile.pl

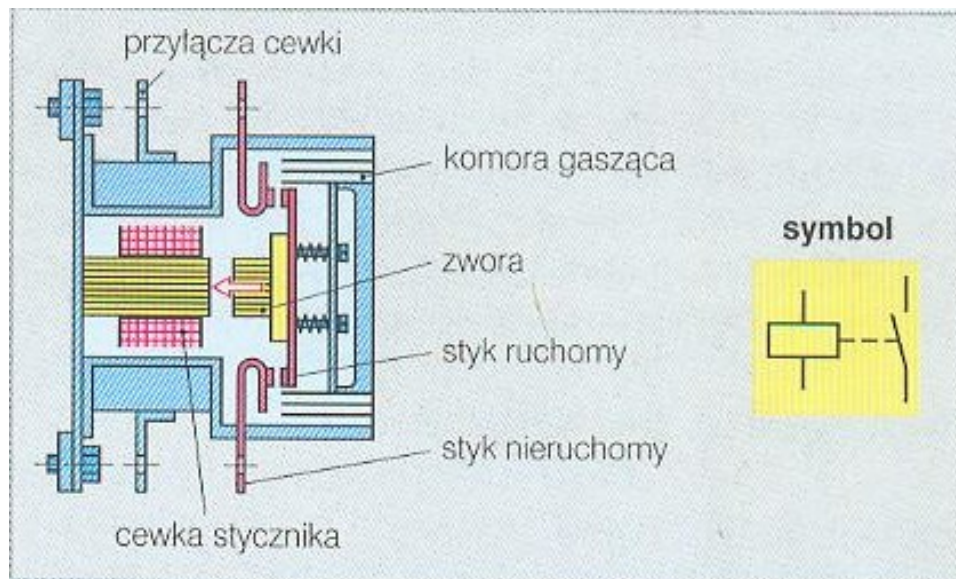


Źródło: <https://pl.wikipedia.org/wiki/Amperomierz>

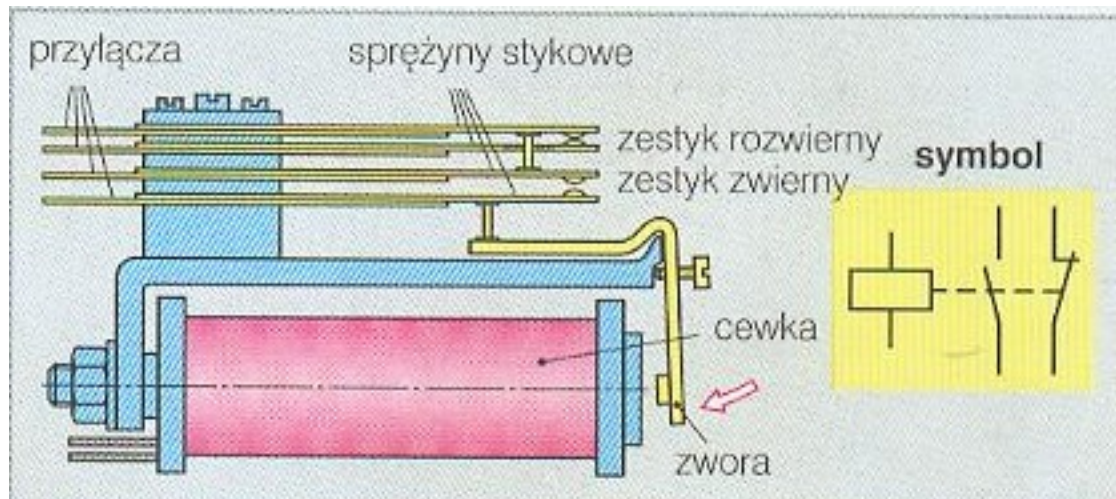


Źródło: [https://eduinf.waw.pl/inf/prg/009\\_kurs\\_avr/2015.php](https://eduinf.waw.pl/inf/prg/009_kurs_avr/2015.php)

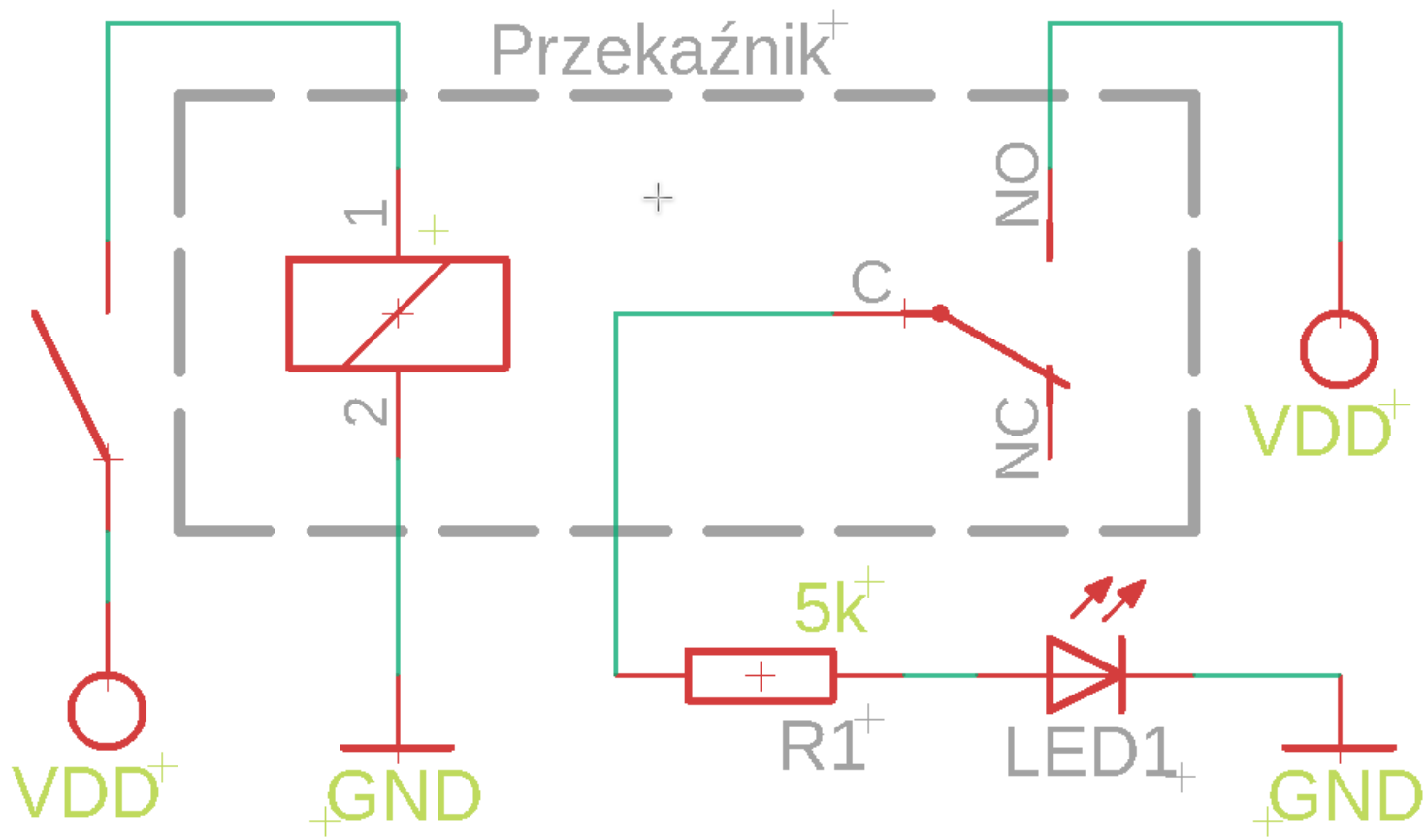
# Stycznik



# Przełącznik



# Przełącznik



# Tranzystory - historia



Replika pierwszego działającego tranzystora z 1947

(Źródło: <https://pl.wikipedia.org/wiki/Tranzystor>)

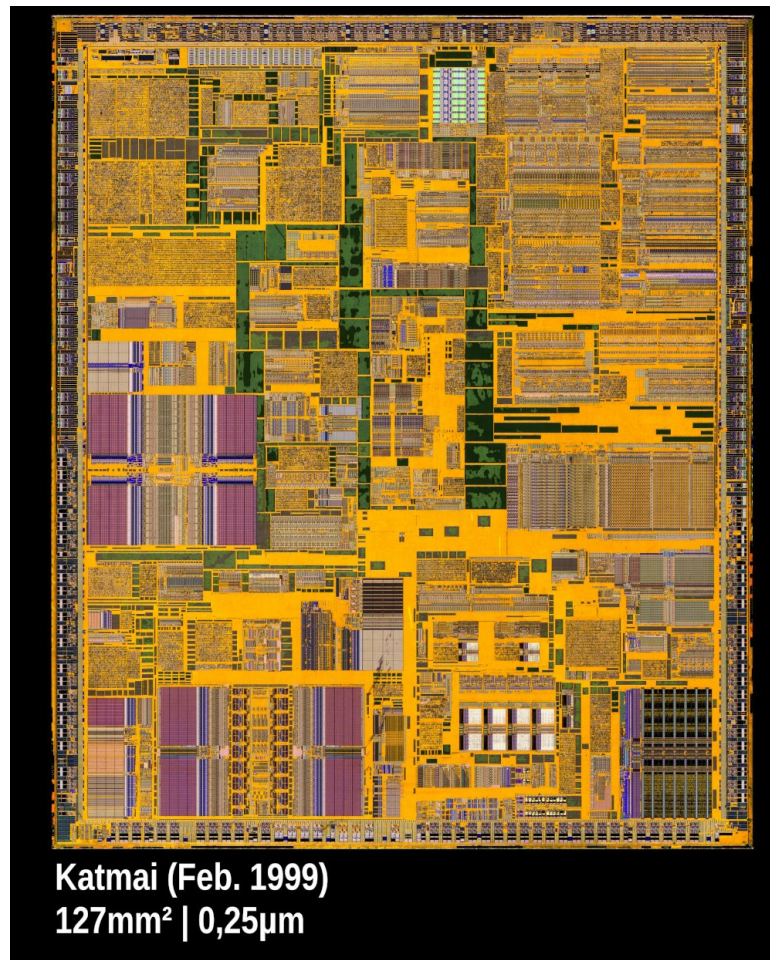


# Dygresja: o procesorach



Rok 1999: Intel Pentium III,  
9.5 + 25 milionów tranzystorów

(źródło: <https://www.purepc.pl/pamietacie-intel-pentium-iii-pierwszy-model-pojawil-sie-20-lat-temu>)



**Katmai (Feb. 1999)**  
**127mm<sup>2</sup> | 0,25µm**

Źródło: <https://www.flickr.com/photos/130561288@N04/37346274254/in/album-72157650403404920/>

Dla ciekawskich:

<https://pl.wikipedia.org/wiki/Fotolitografia> + YT

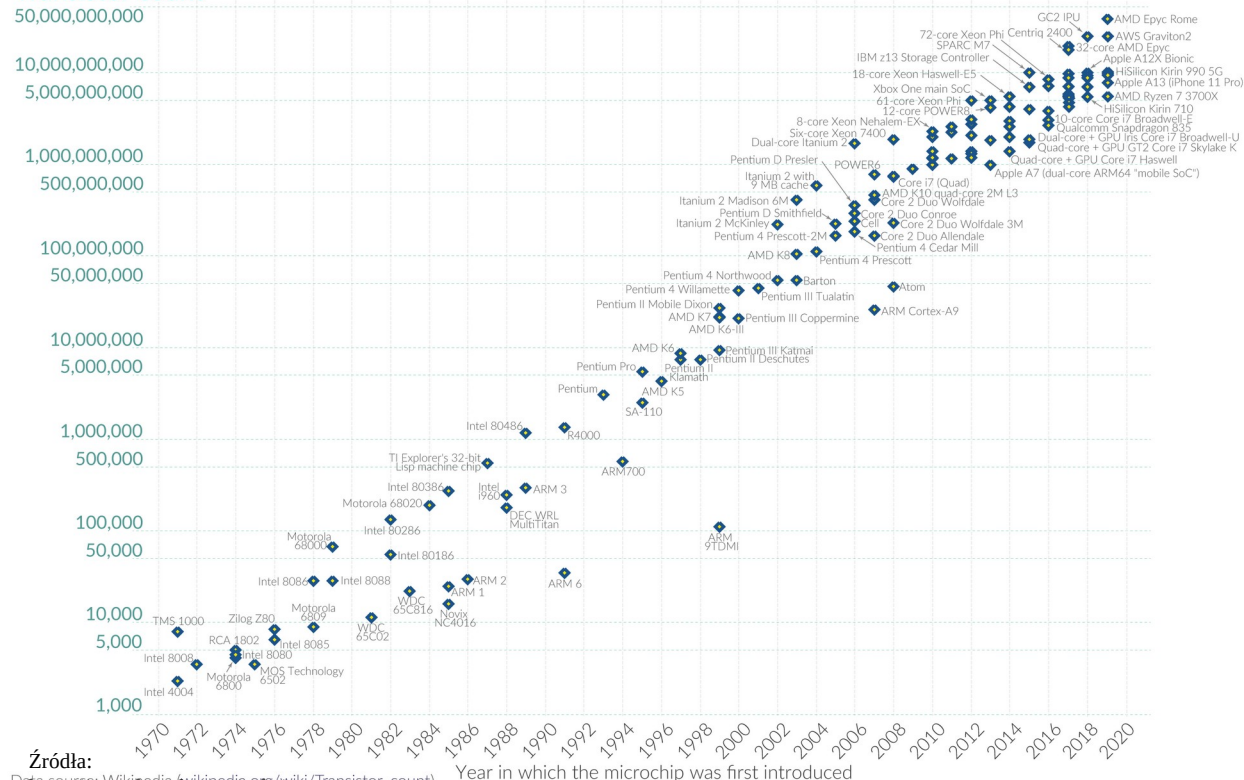
# Tranzystory – terazniejszość?

Moore's Law: The number of transistors on microchips doubles every two years

Our World  
in Data

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important for other aspects of technological progress in computing – such as processing speed or the price of computers.

## Transistor count



CPU + GPU + RAM + ANE (Neural Engine)



Apple M1 Ultra (Marzec 2022) –  
114 miliardów tranzystorów,  
powierzchnia 864 mm<sup>2</sup>

Źródła:

[https://en.wikipedia.org/wiki/Transistor\\_count](https://en.wikipedia.org/wiki/Transistor_count)

[https://en.wikipedia.org/wiki/Apple\\_M1](https://en.wikipedia.org/wiki/Apple_M1)

<https://www.geektopia.es/es/technology/2022/03/19/noticias/desmontan-el-mac-studio-mostrando-su-enorme-procesador-m1-ultra.html>

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# Komputery a sztuczna inteligencja

CPU + GPU + RAM + ANE (Neural Engine)



## Apple M1 Ultra

Liczba tranzystorów:

114,000,000,000 (114 miliardów)

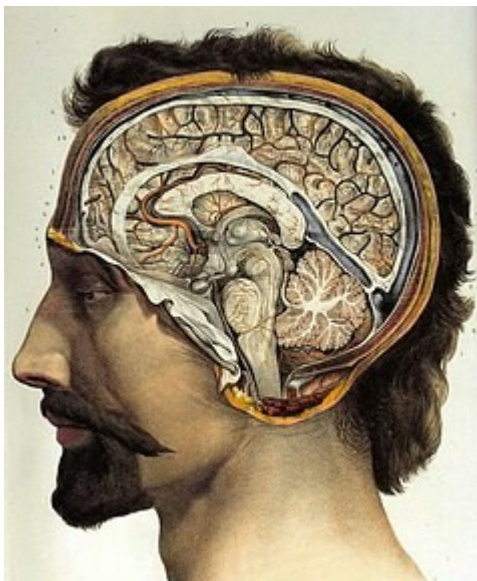


## Intel i7 6800K

L. tranzystorów:

3,200,000,000  
(3,2 miliarda)

128 Gb SDRAM – 137,438,953,472 (137 miliardów)



## Ludzki mózg

Liczba neuronów:

69-86 miliardów



## Cerebras Wafer-Scale Engine 2

Liczba tranzystorów:

2,600,000,000,000 (2,6 biliona)

Źródła:

<https://www.cerebras.net/product-chip/>

[https://en.wikipedia.org/wiki/Broadwell\\_\(microarchitecture\)](https://en.wikipedia.org/wiki/Broadwell_(microarchitecture))

<https://pl.wikipedia.org/wiki/M%C3%B3zg>

[https://en.wikipedia.org/wiki/Transistor\\_count](https://en.wikipedia.org/wiki/Transistor_count)

<https://www.pnas.org/doi/10.1073/pnas.1201895109>

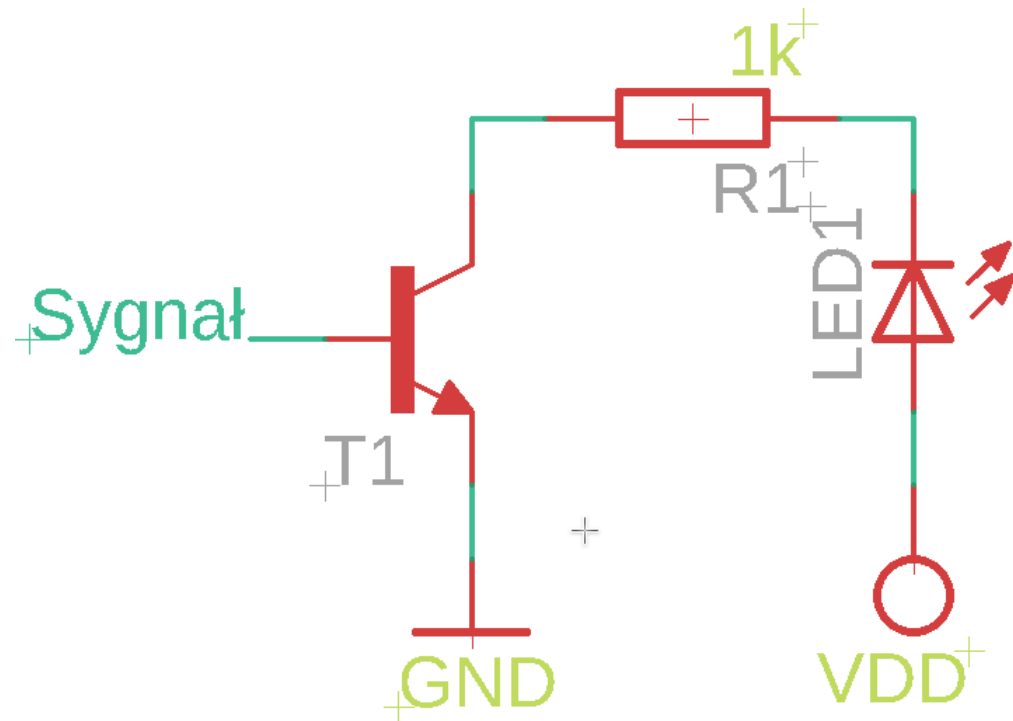
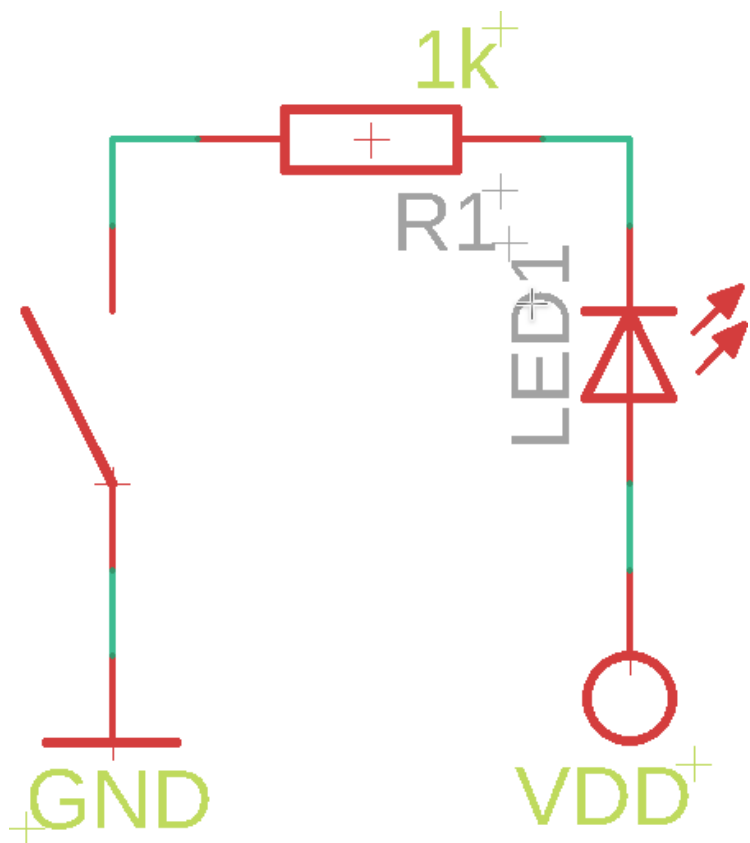
# Co robi tranzystor?



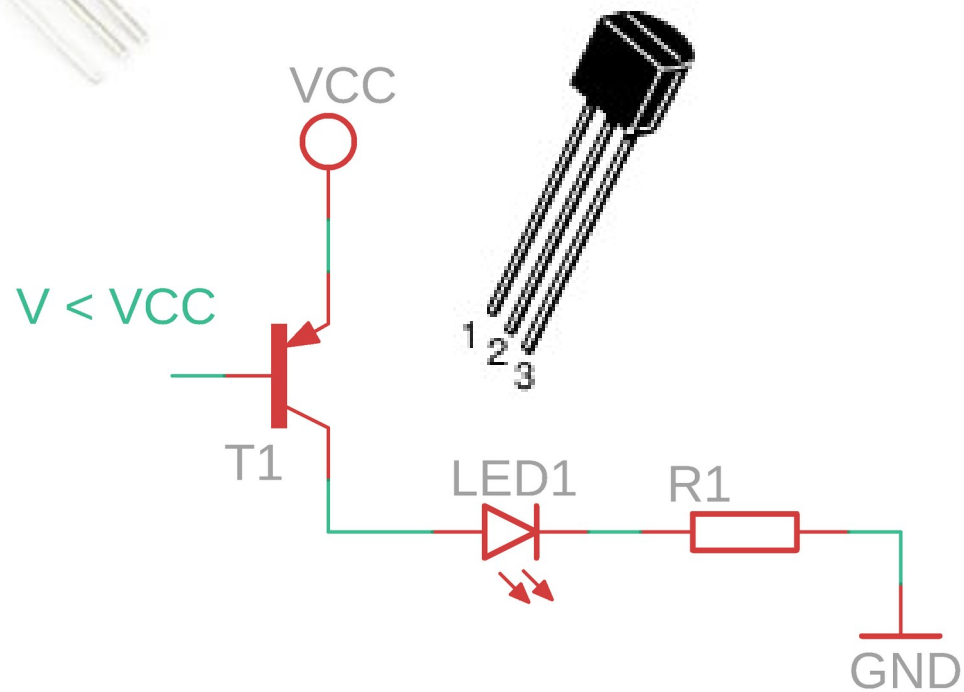
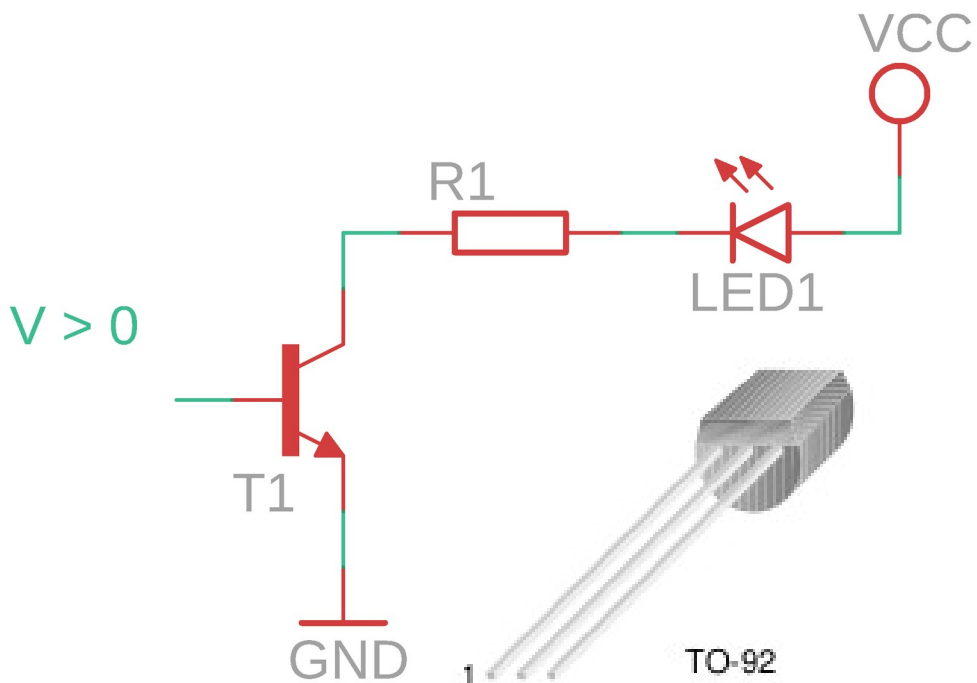
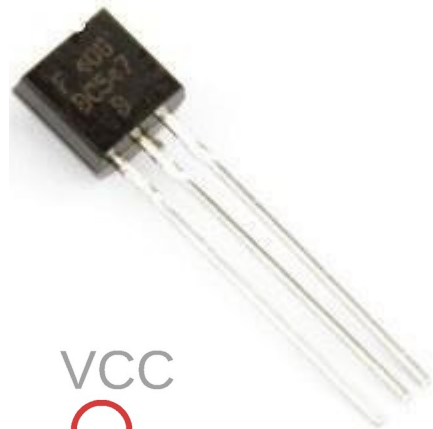
Źródło: [https://en.wikipedia.org/wiki/Audio\\_power\\_amplifier](https://en.wikipedia.org/wiki/Audio_power_amplifier)



# Tranzystor jako włącznik



# NPN i PNP



# Inne obudowy



# Jak działa tranzystor?

