

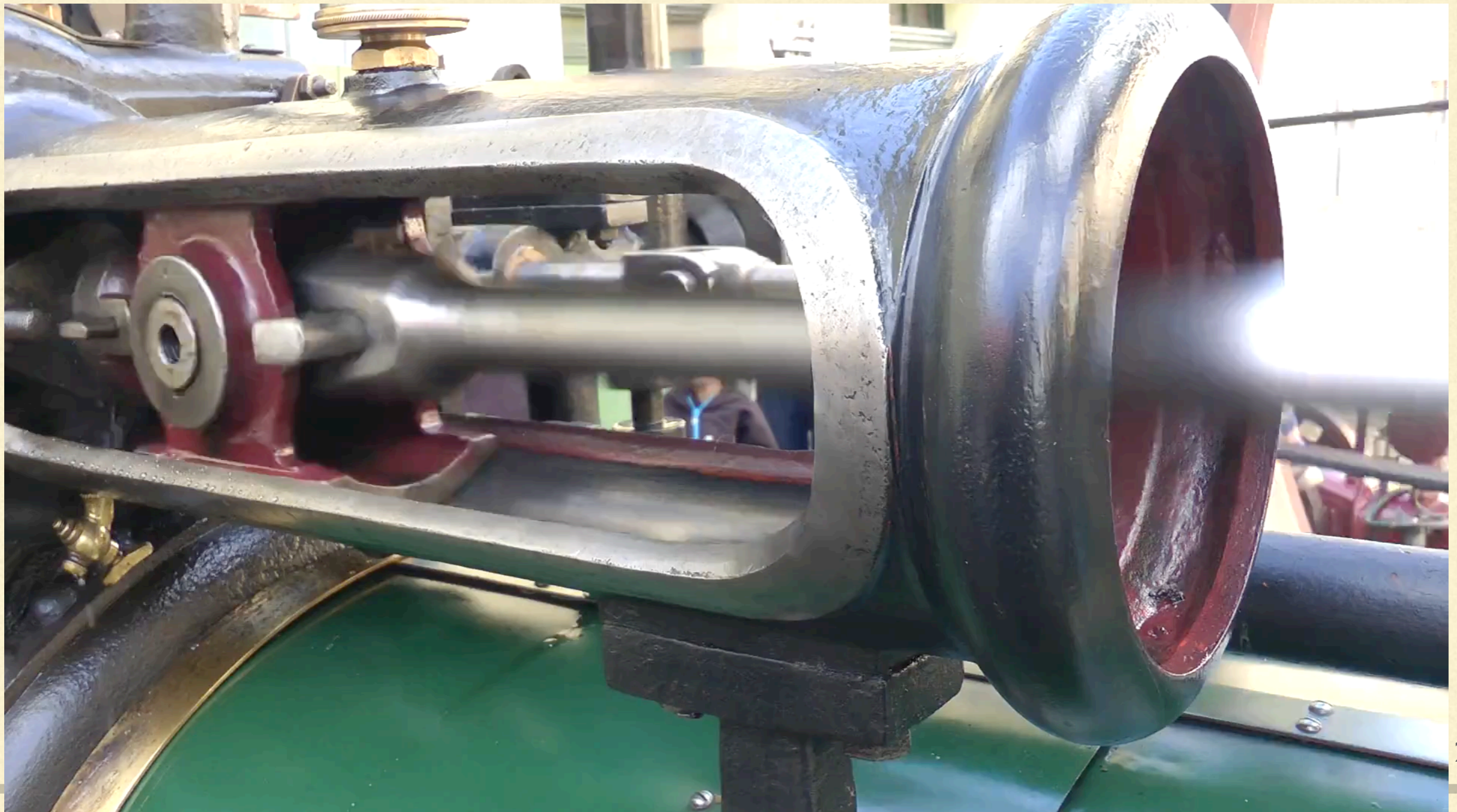
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# ES IST VORBEI! IT'S OVER

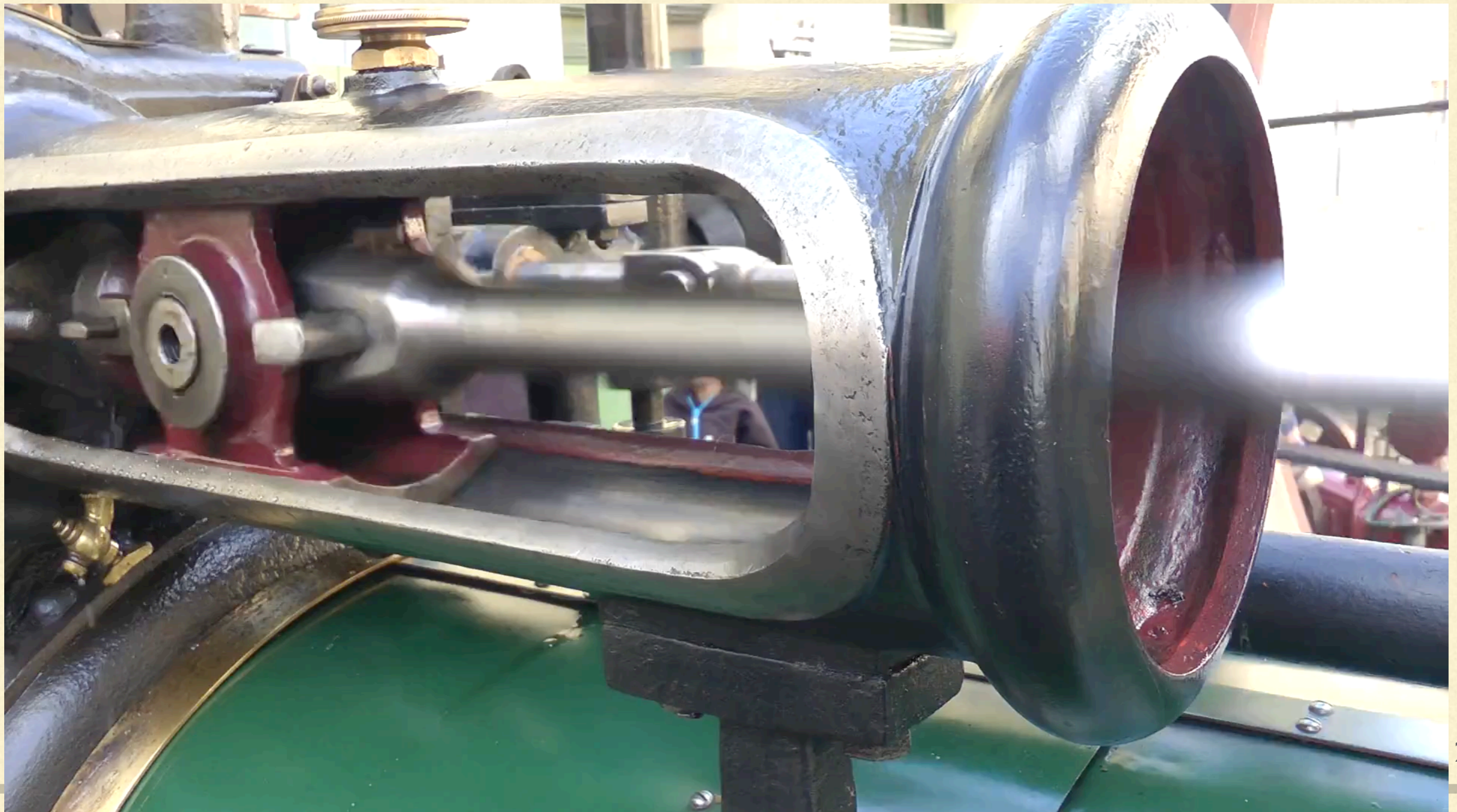
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Teil I  
Düsseldorf 10.11.17  
II. IKEK  
Michael Limburg



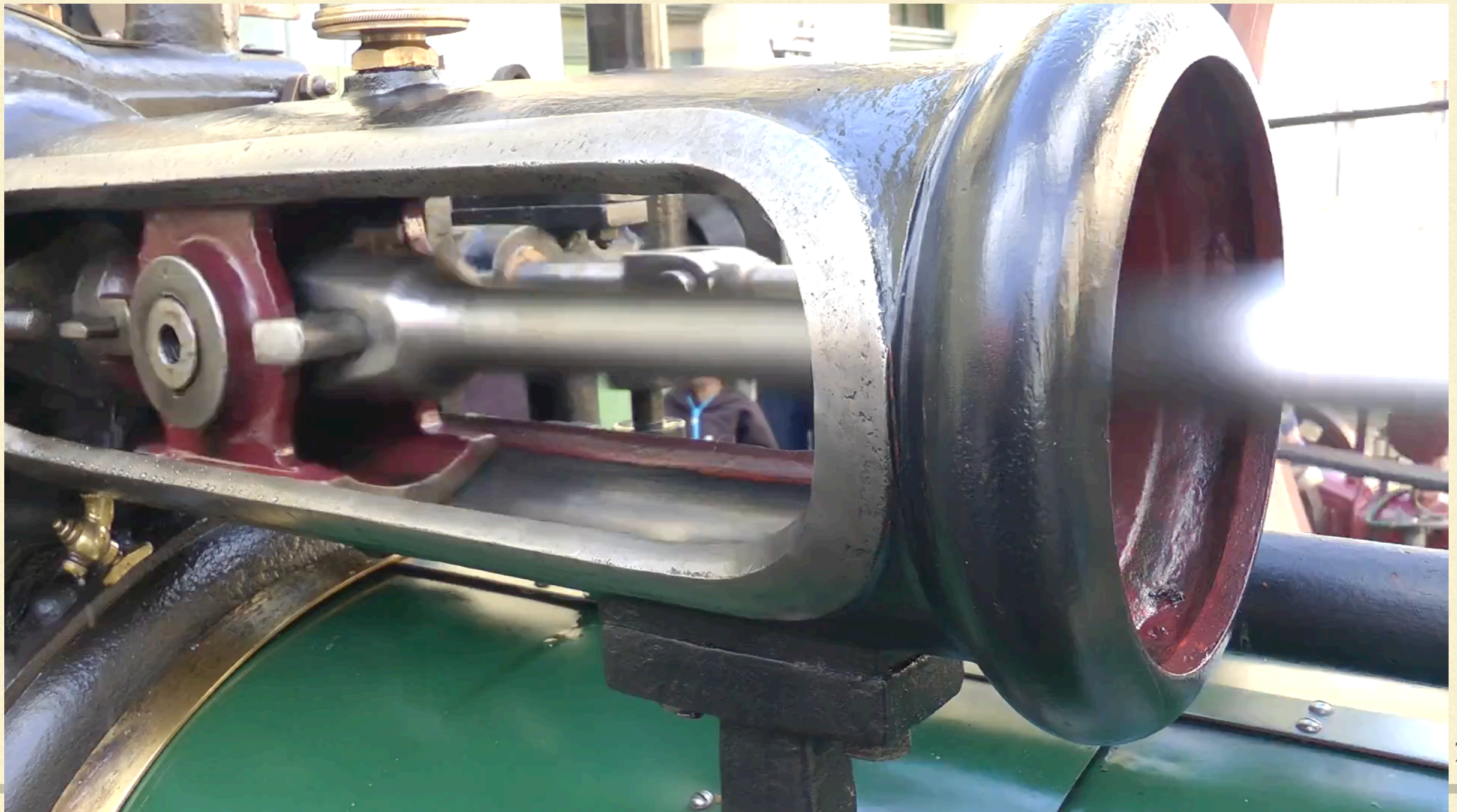








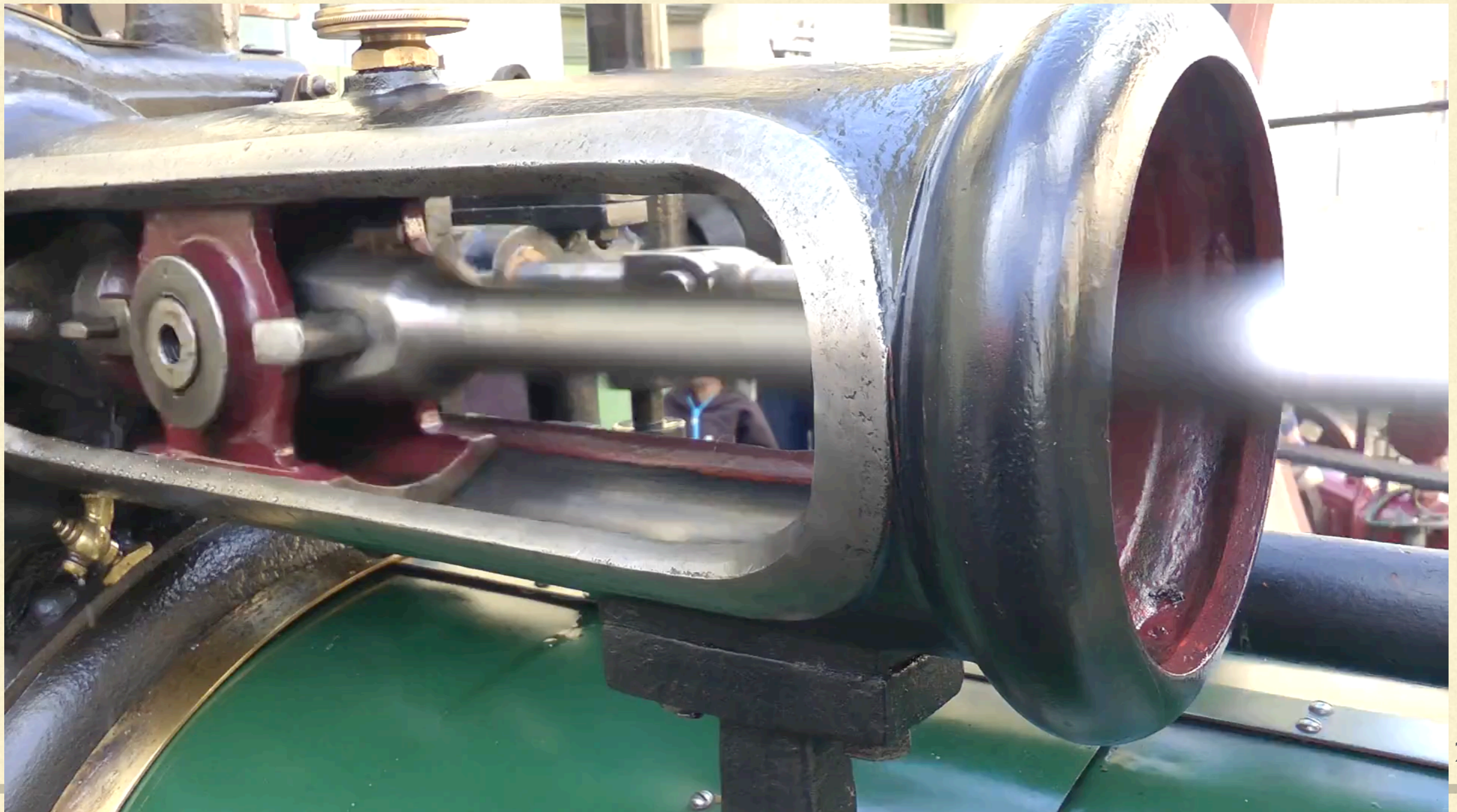
# DER FLIEHKRAFTREGLER EINER DAMPFMASCHINE





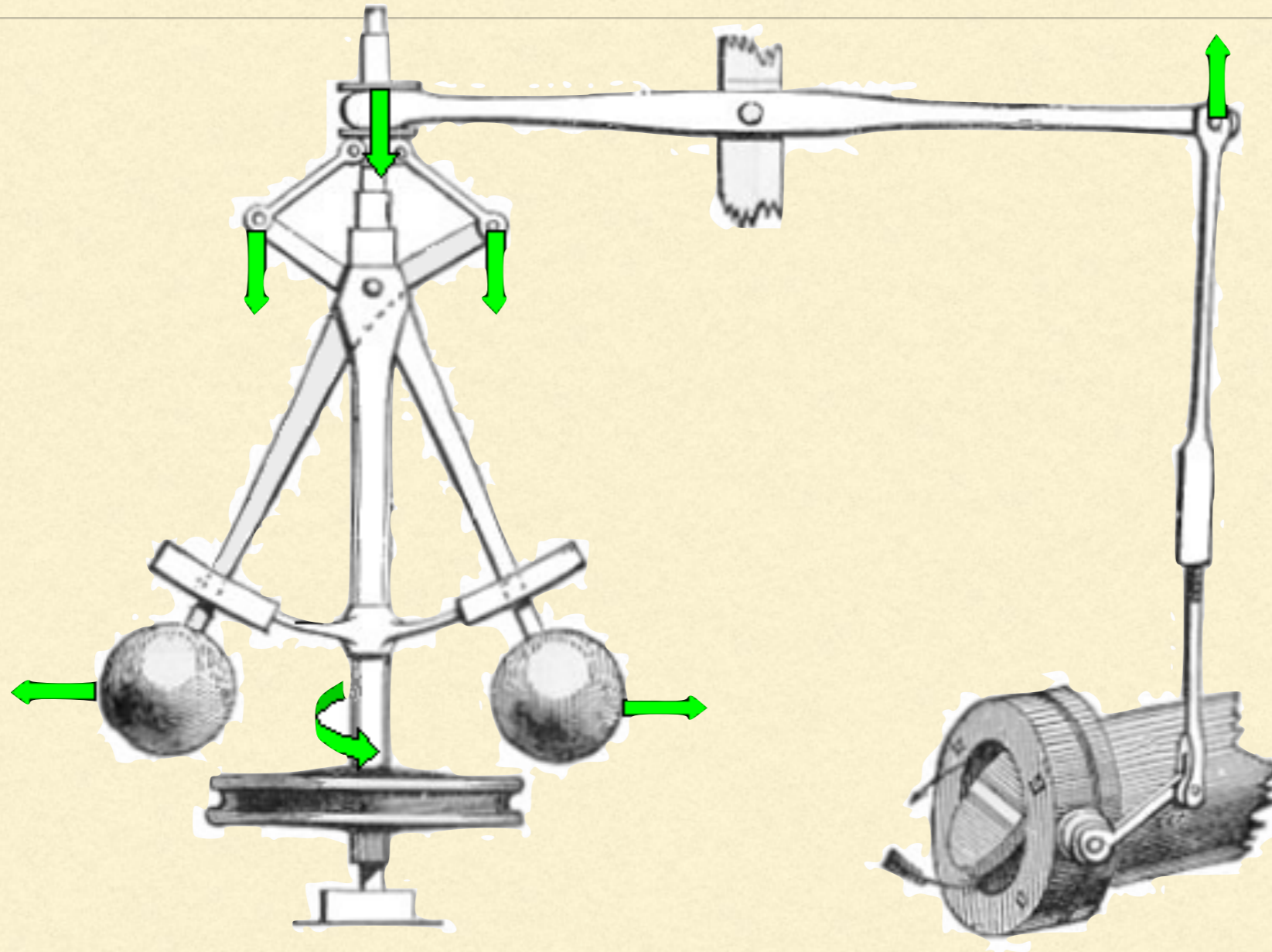
# DER FLIEHKRAFTREGLER EINER DAMPFMASCHINE

Der Vater der Kybernetik



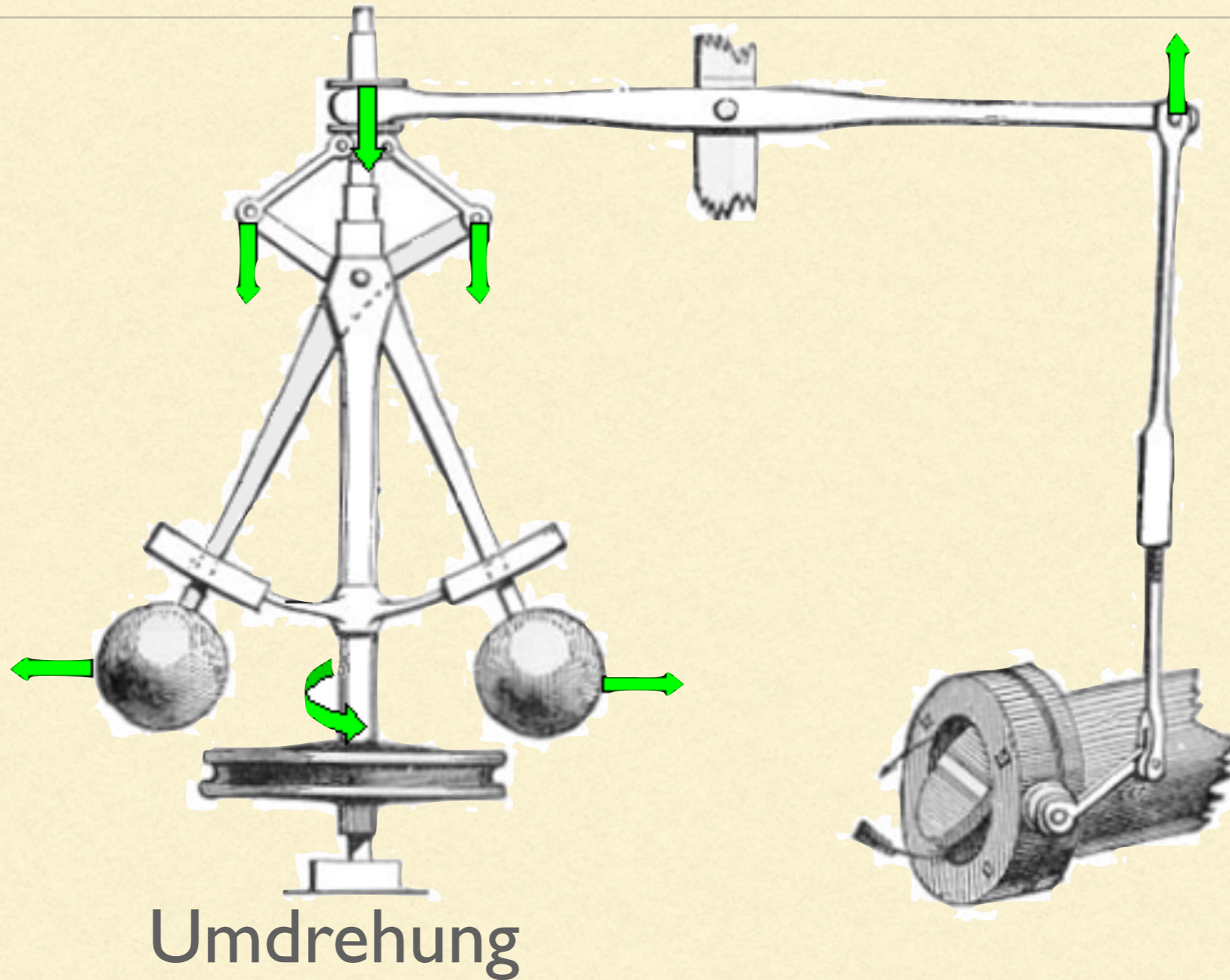


# FLIEHKRAFTREGLER WIRKT AUF DIE DROSSELKLAPPE



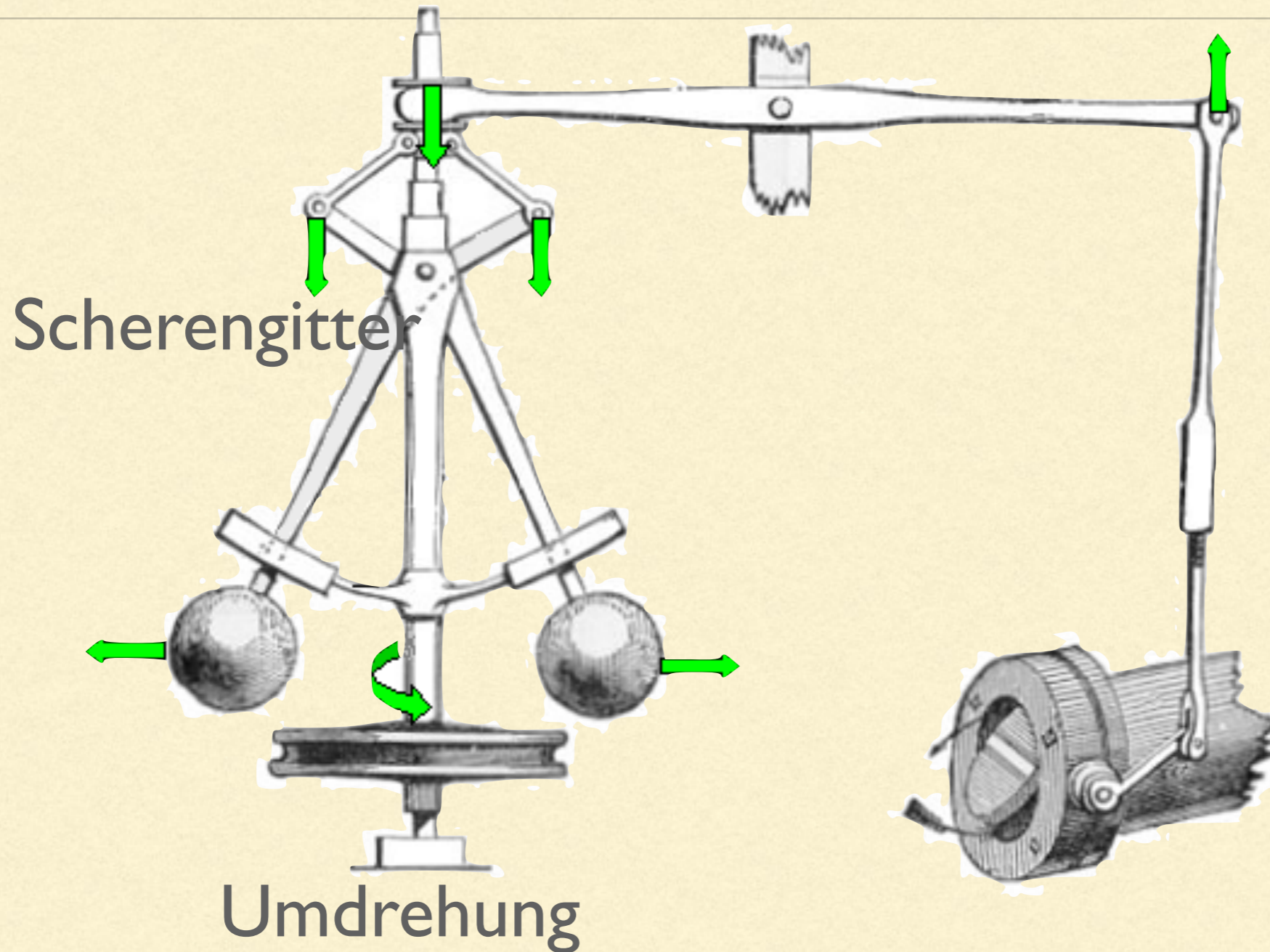


# FLIEHKRAFTREGLER WIRKT AUF DIE DROSSELKLAPPE



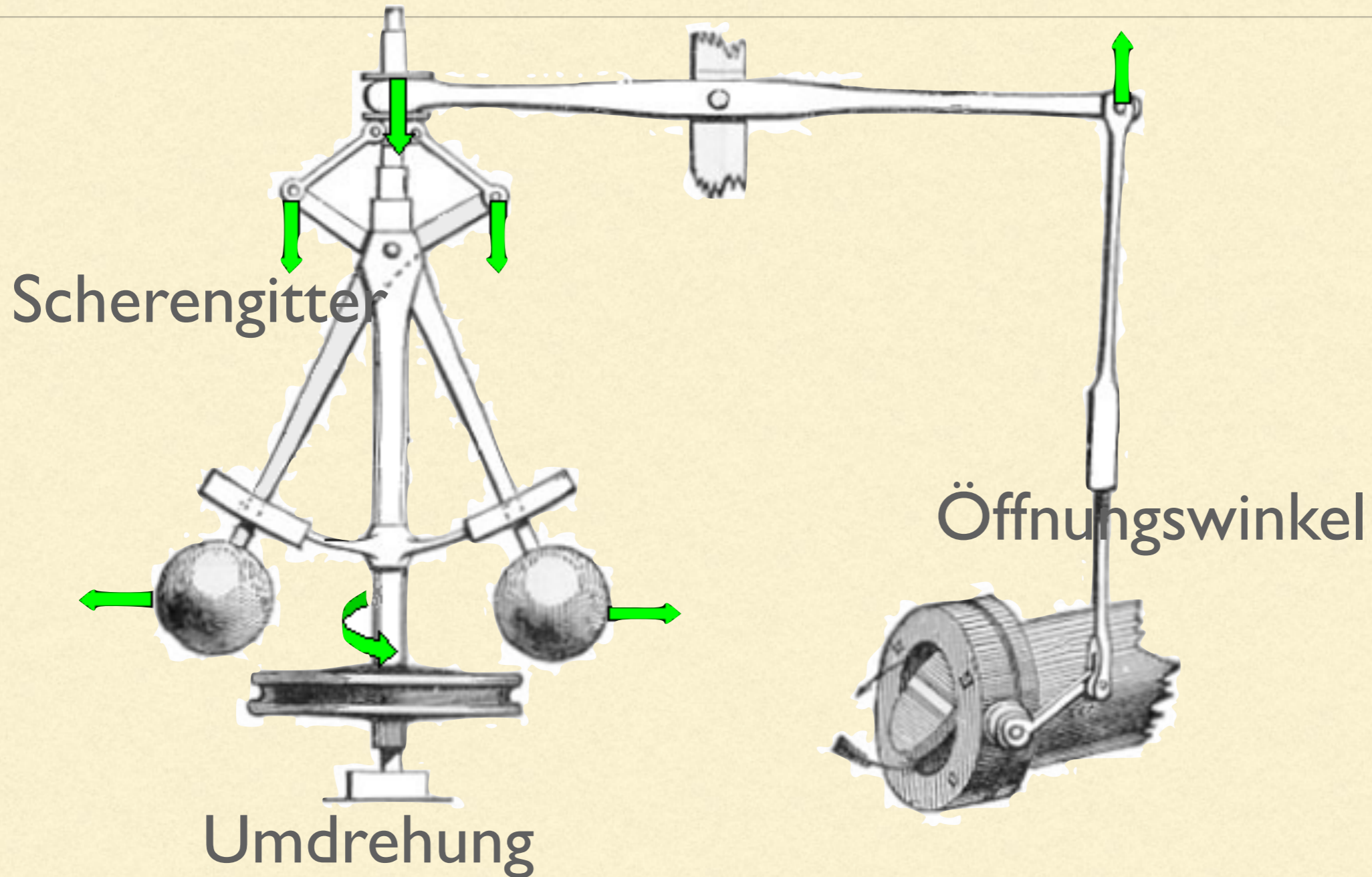


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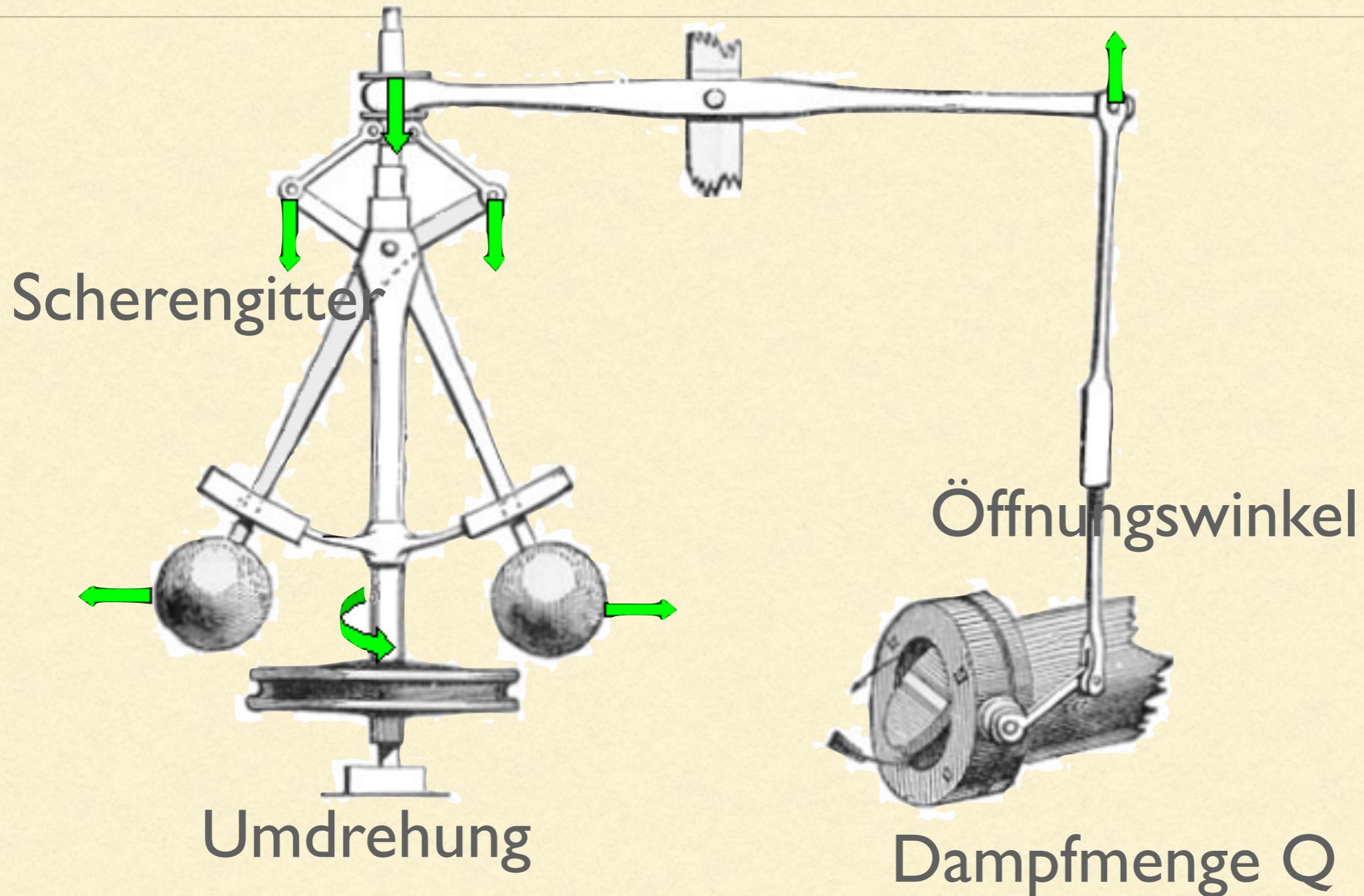


# FLIEHKRAFTREGLER WIRKT AUF DIE DROSSELKLAPPE





# FLIEHKRAFTREGLER WIRKT AUF DIE DROSSELKLAPPE





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# ÜBERNOMMEN VON MATTHEW BOULTON 1788\*

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eingebaut in eine Watt'sche Dampfmaschine um  
die Drehzahl konstant zu halten



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# ÜBERNOMMEN VON MATTHEW BOULTON 1788\*

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eingebaut in eine Watt'sche Dampfmaschine um  
die Drehzahl konstant zu halten

Das war die Geburtsstunde der  
Regelungstechnik/Theorie



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$$Q_o = f(Q_i; A; B)$$

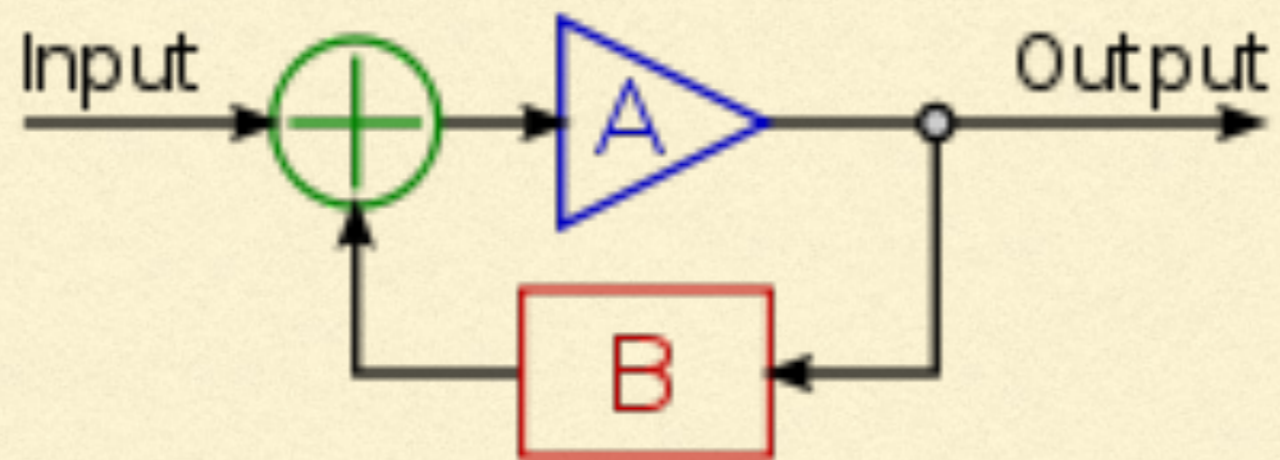
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$$Q_o = f(Q_i; A; B)$$

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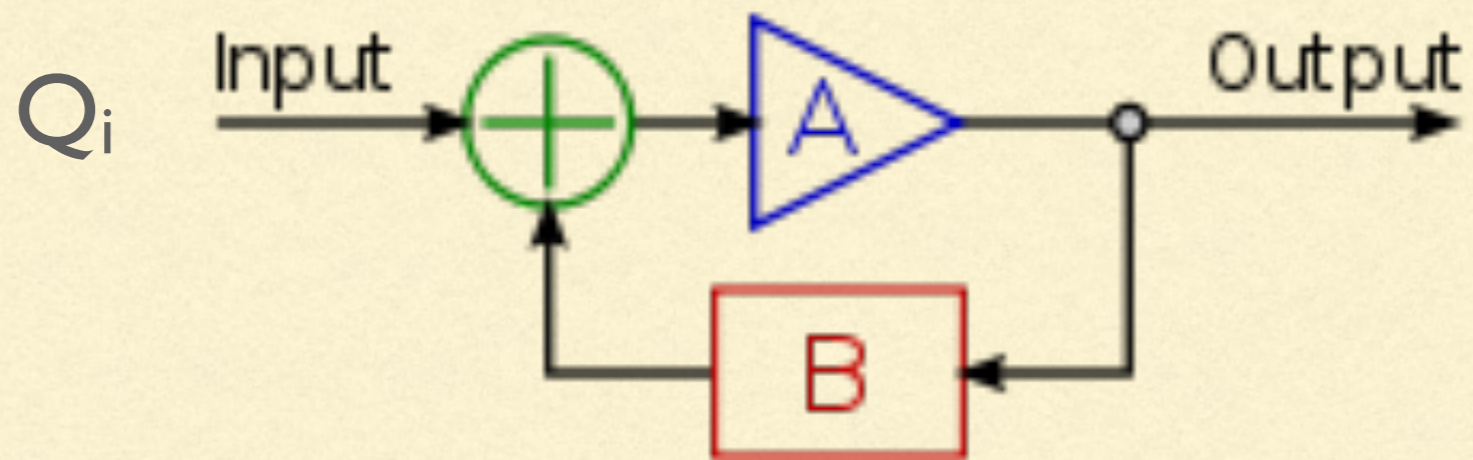




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$$Q_o = f(Q_i; A; B)$$

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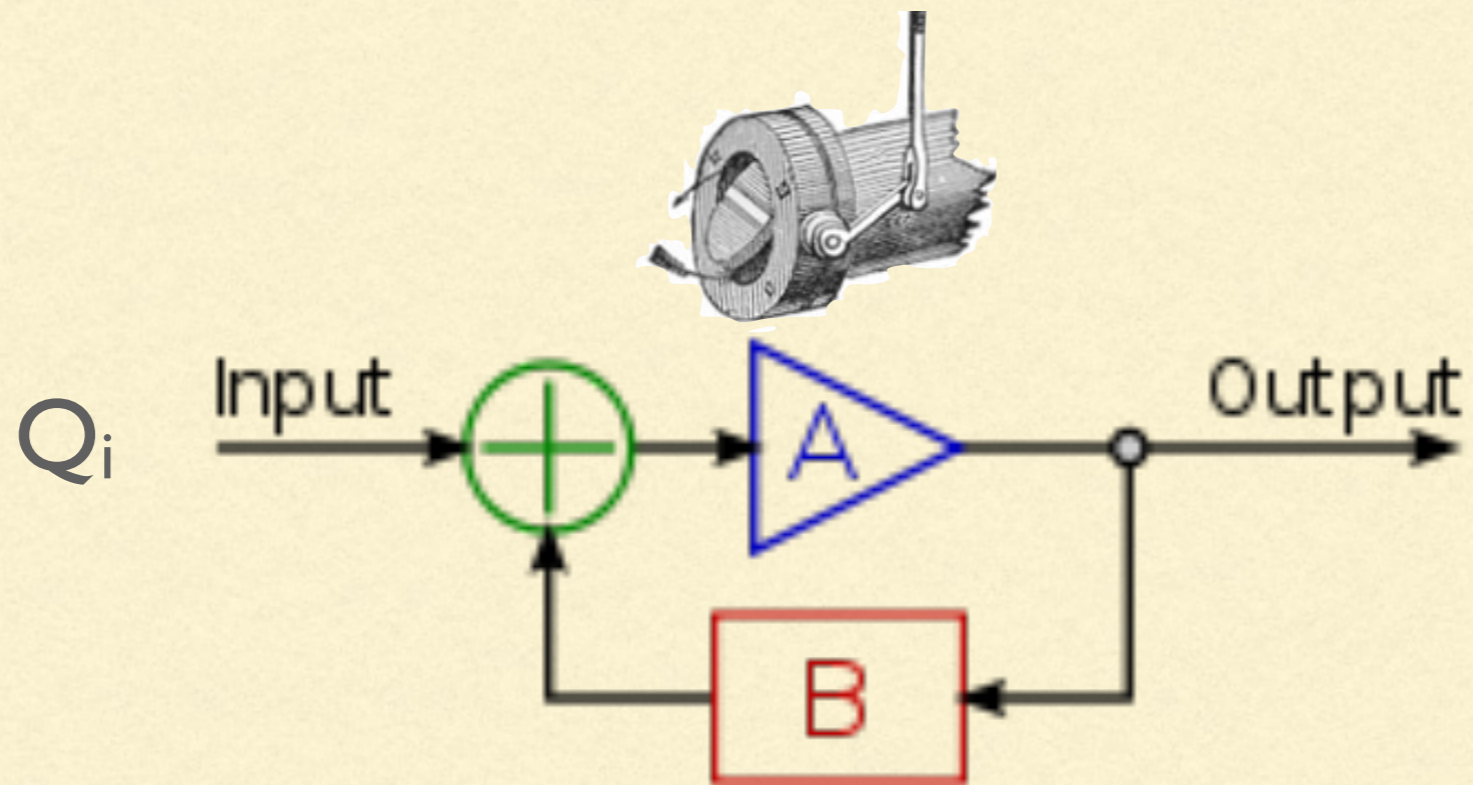




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$$Q_o = f(Q_i; A; B)$$

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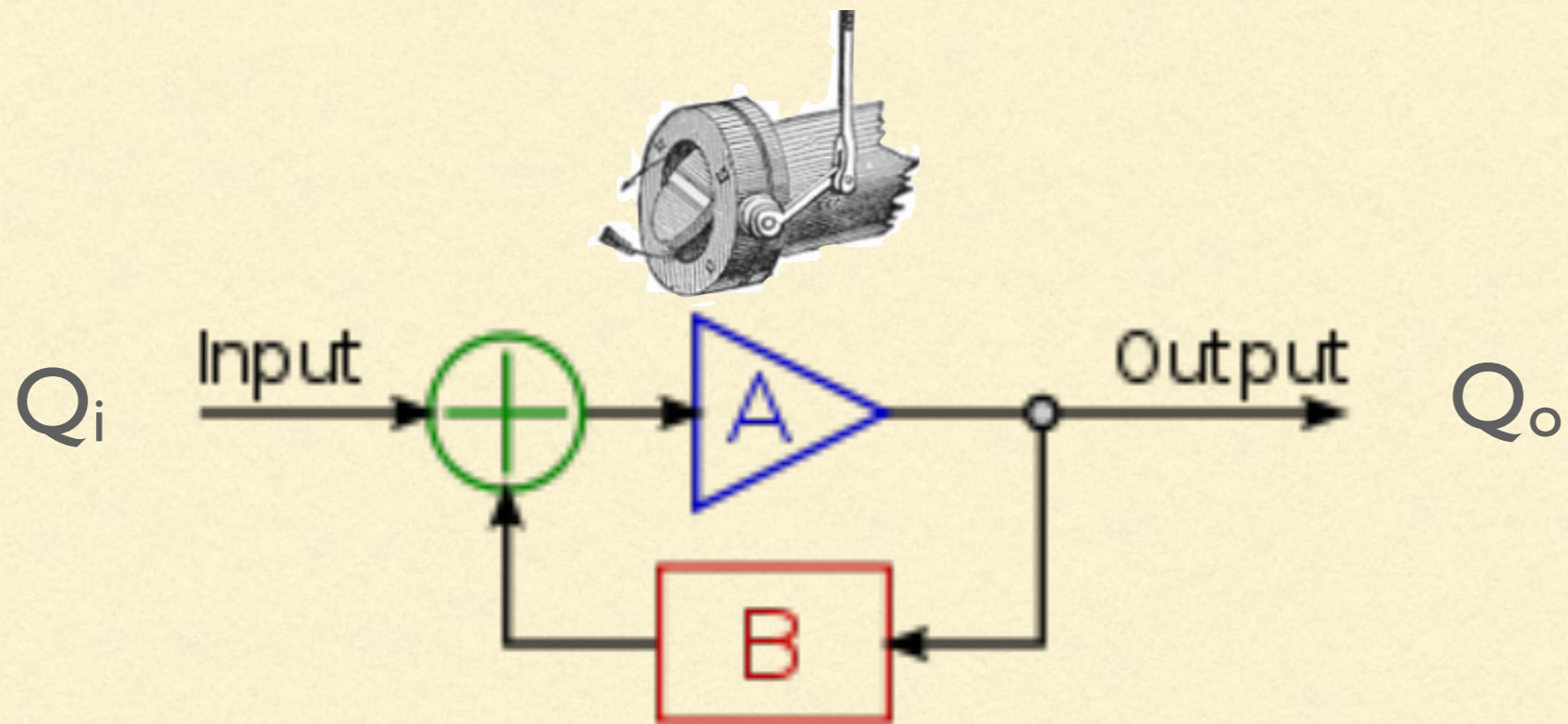




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$$Q_o = f(Q_i; A; B)$$

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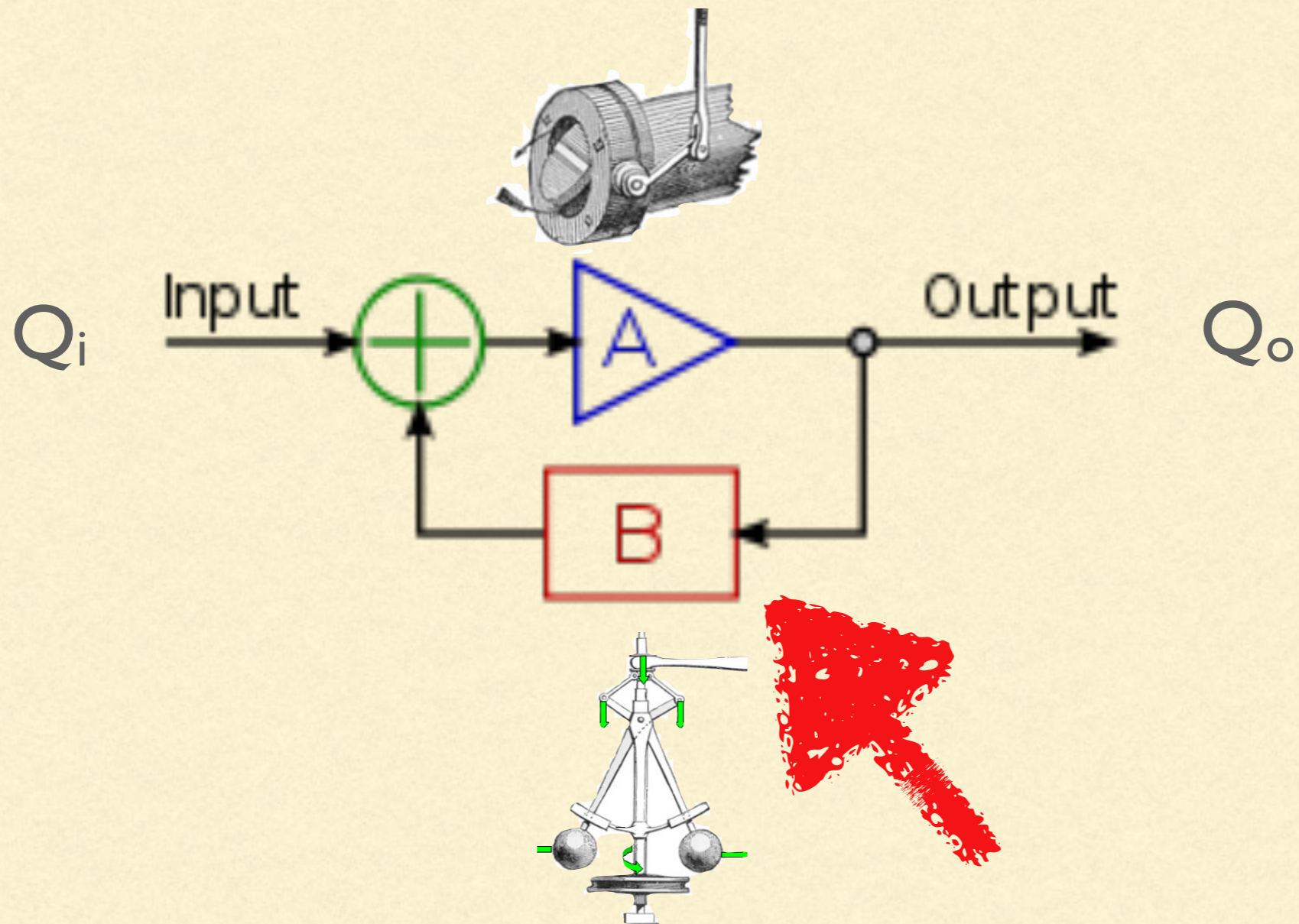




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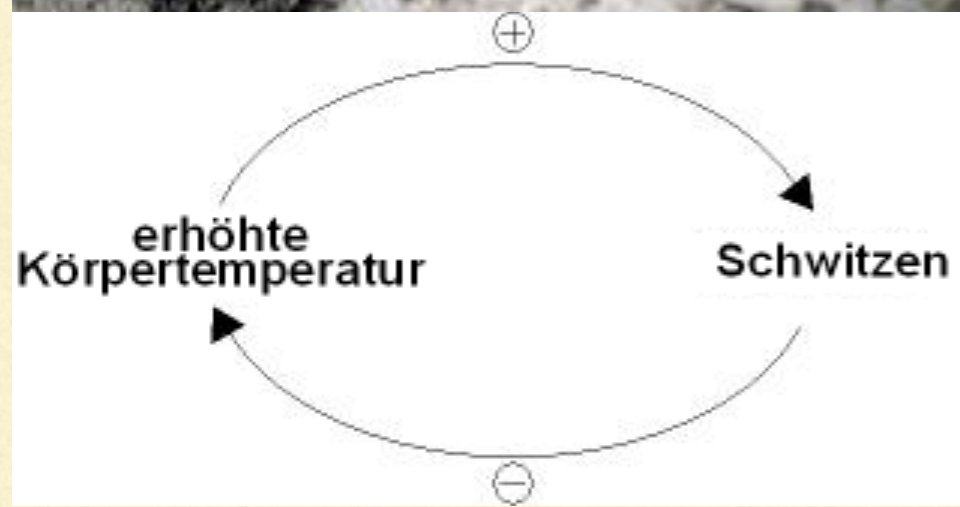
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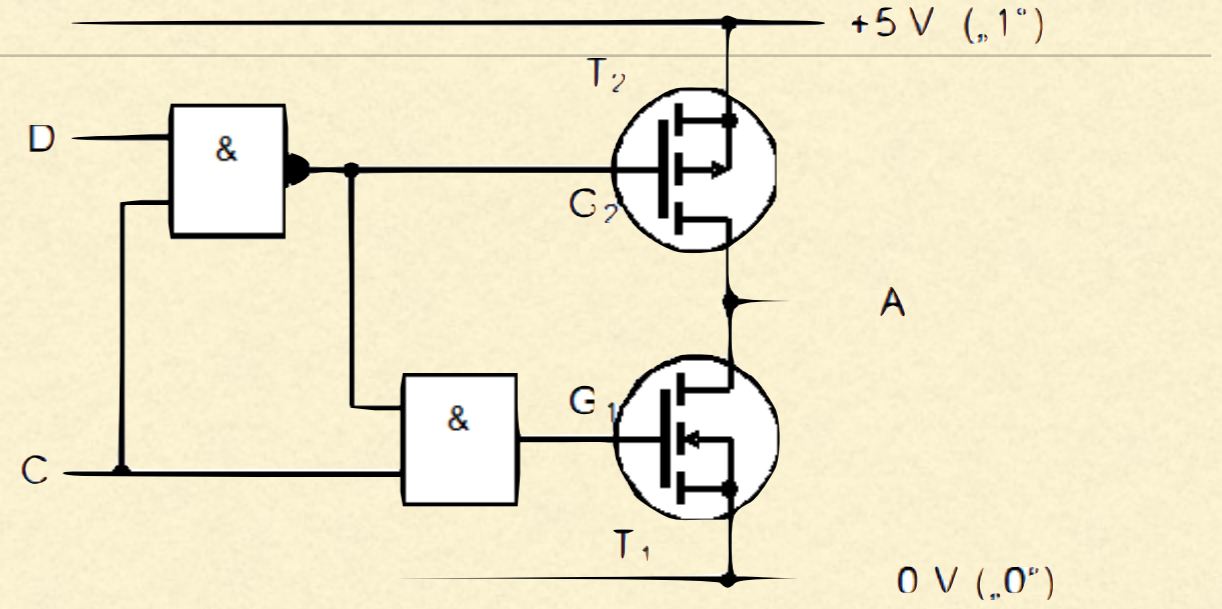
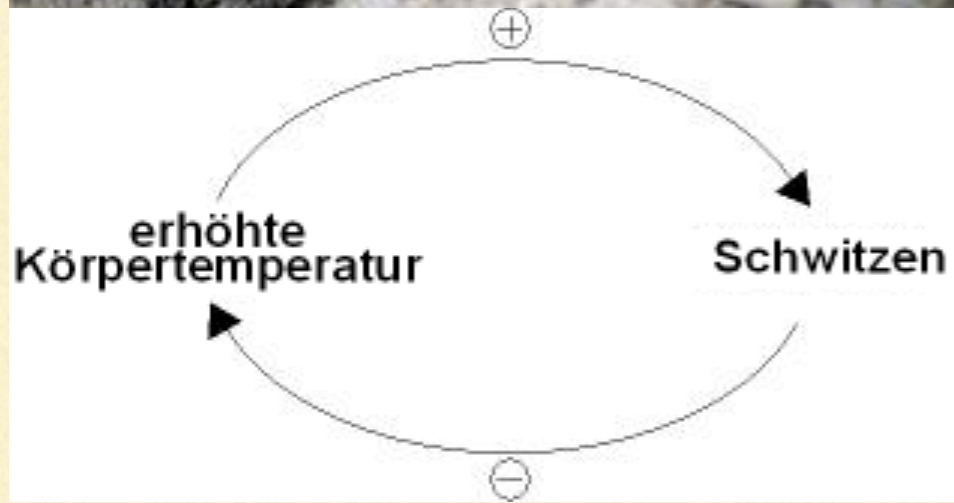




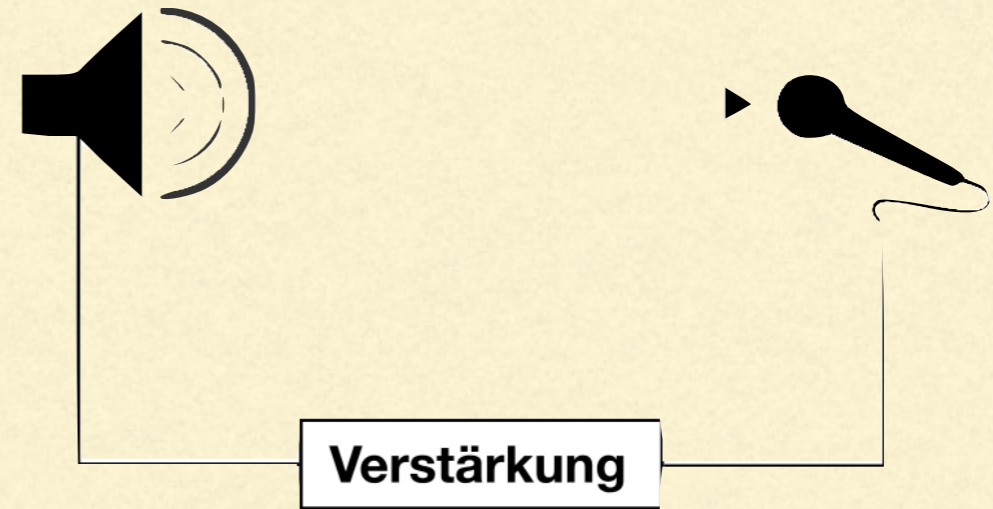
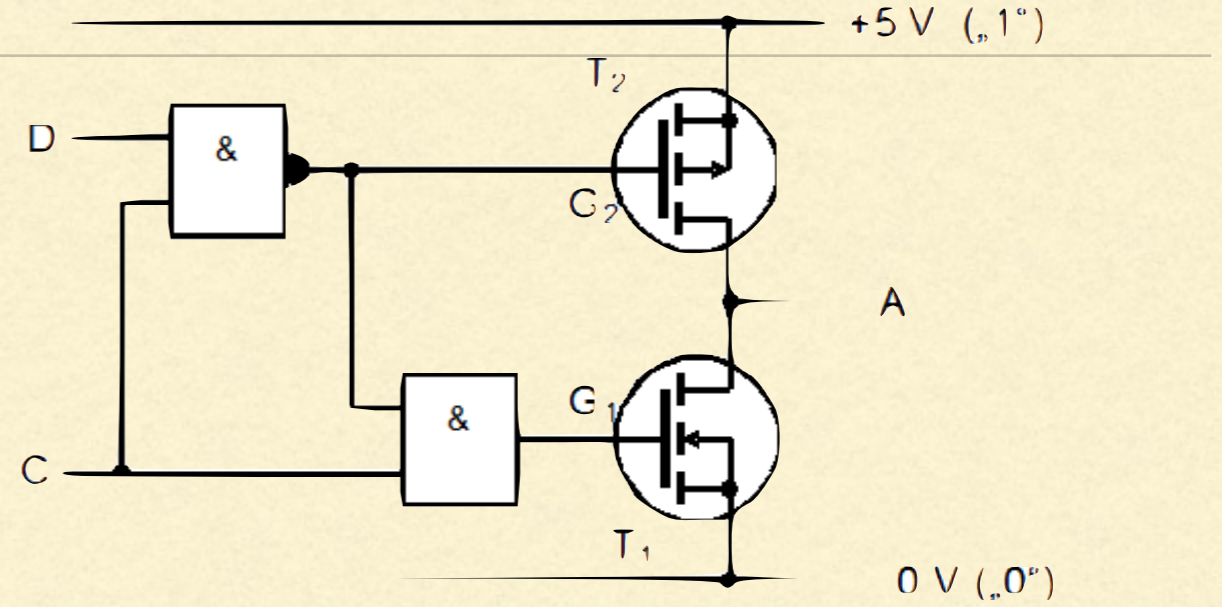
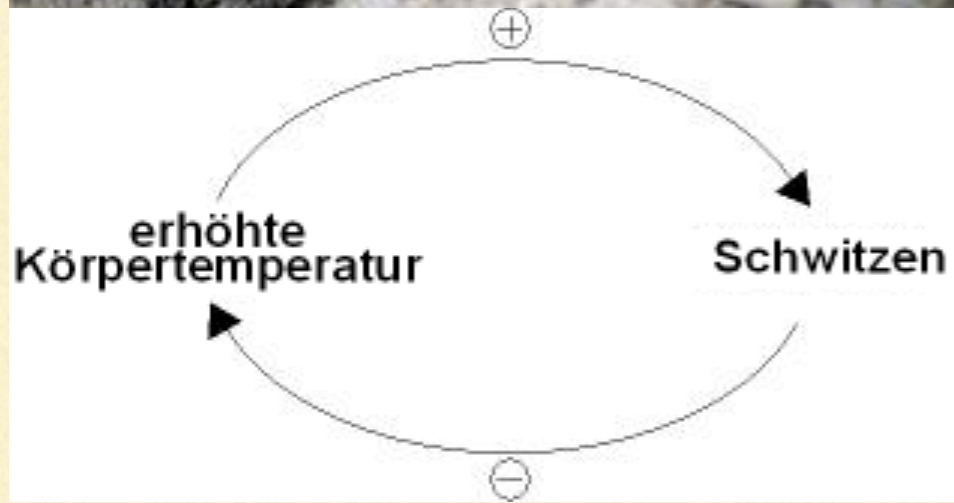




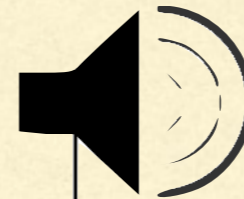
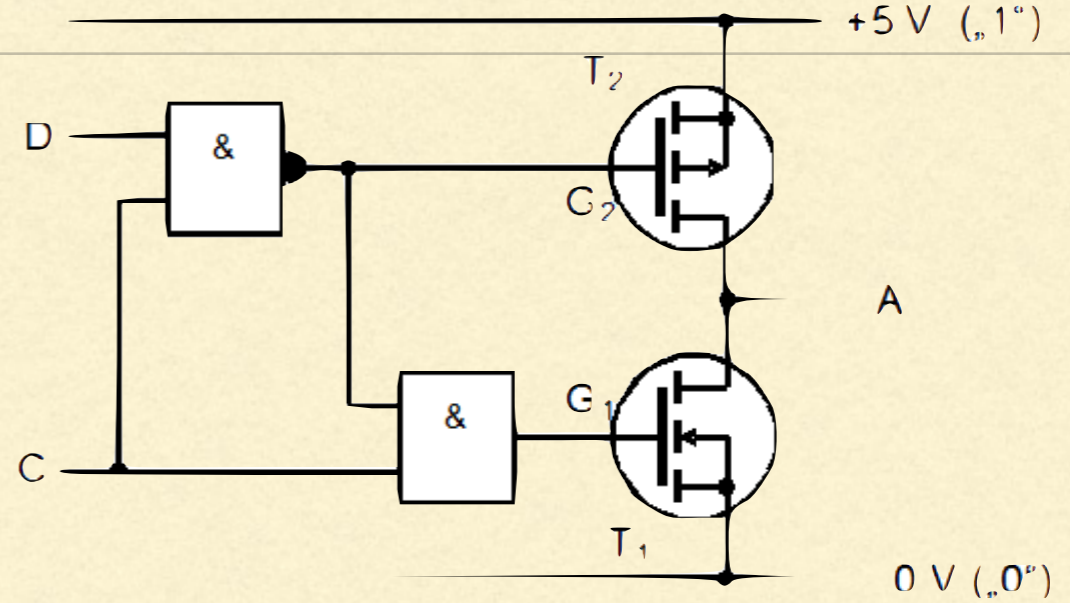
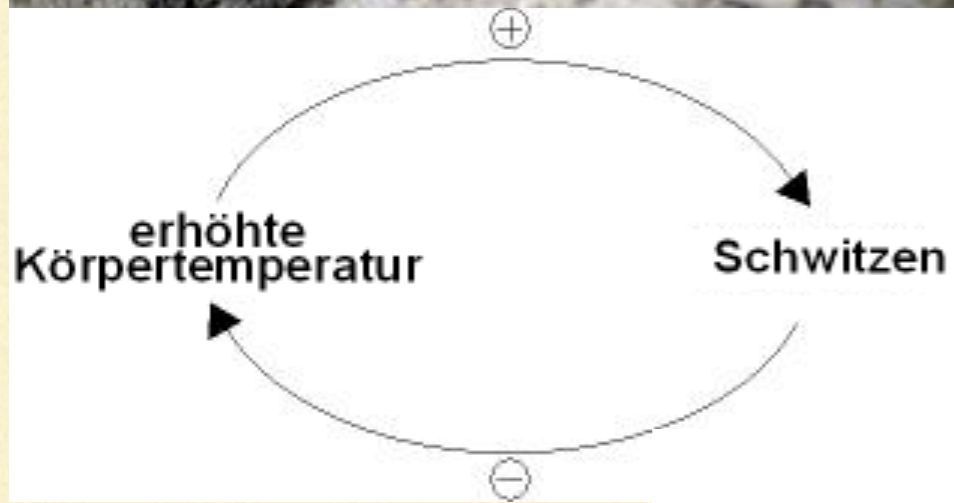




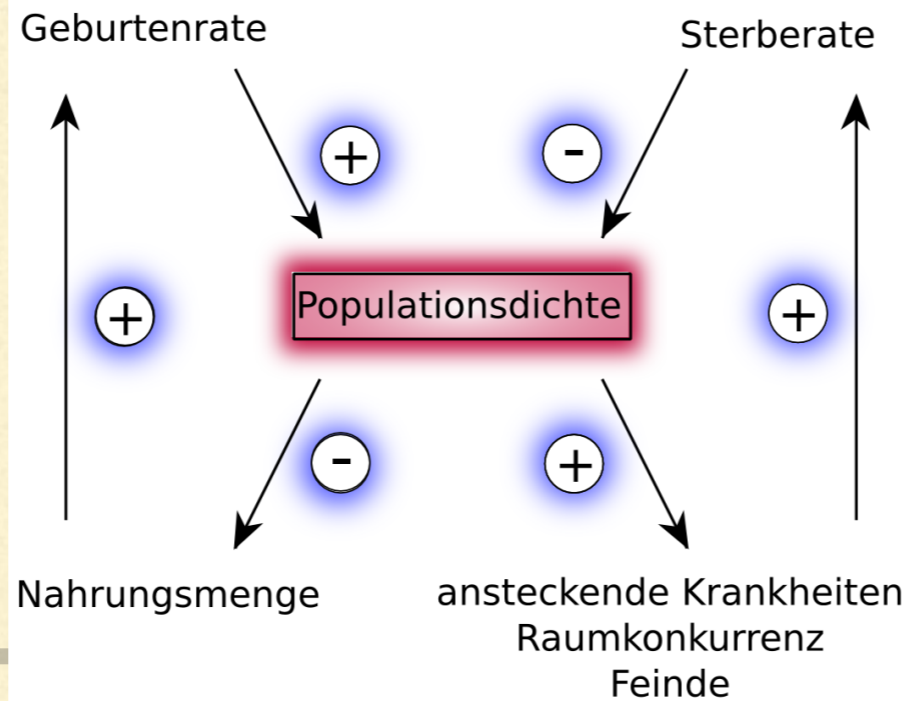








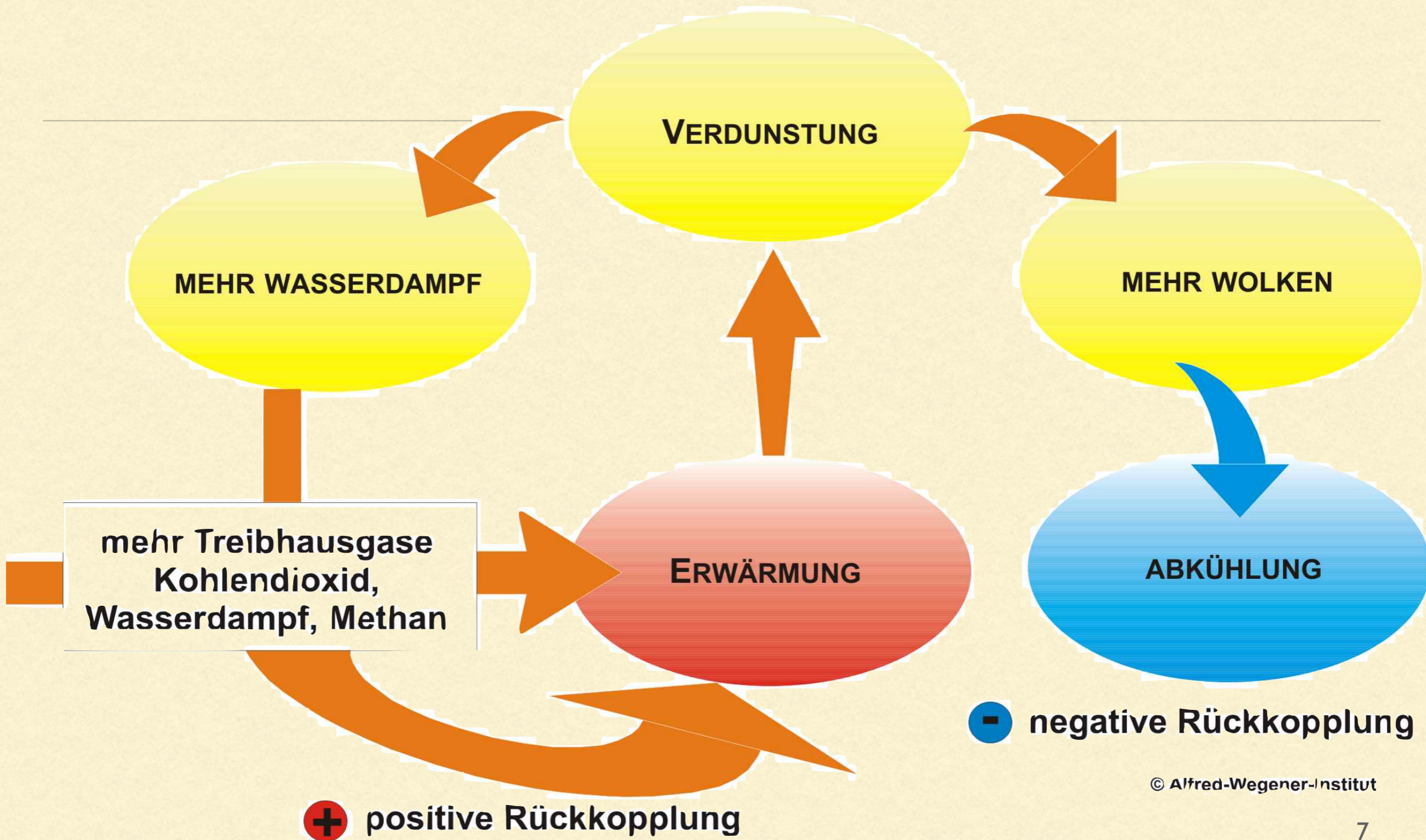
### Regulation der Populationsdichte



Verstärkung



# Rückkoppelungen im Klimasystem





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# Rückkopplung ist ein universelles Prinzip

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1. Dynamische System sind (fast) immer rückgekoppelte Systeme
2. Das Rückkopplungssignal addiert sich zur absoluten Eingangsgröße



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# SYSTEMATISCHE THEORIE

## URSPRUNG

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# SYSTEMATISCHE THEORIE URSPRUNG

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# SYSTEMATISCHE THEORIE URSPRUNG

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- Harold S. Black 1927



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# SYSTEMATISCHE THEORIE URSPRUNG

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- Harold S. Black 1927
- Barkhausen  $\approx$  1924 & Nyquist  $\approx$  1930



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# SYSTEMATISCHE THEORIE URSPRUNG

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- Harold S. Black 1927
- Barkhausen  $\approx$  1924 & Nyquist  $\approx$  1930
- Norbert Wiener 1943

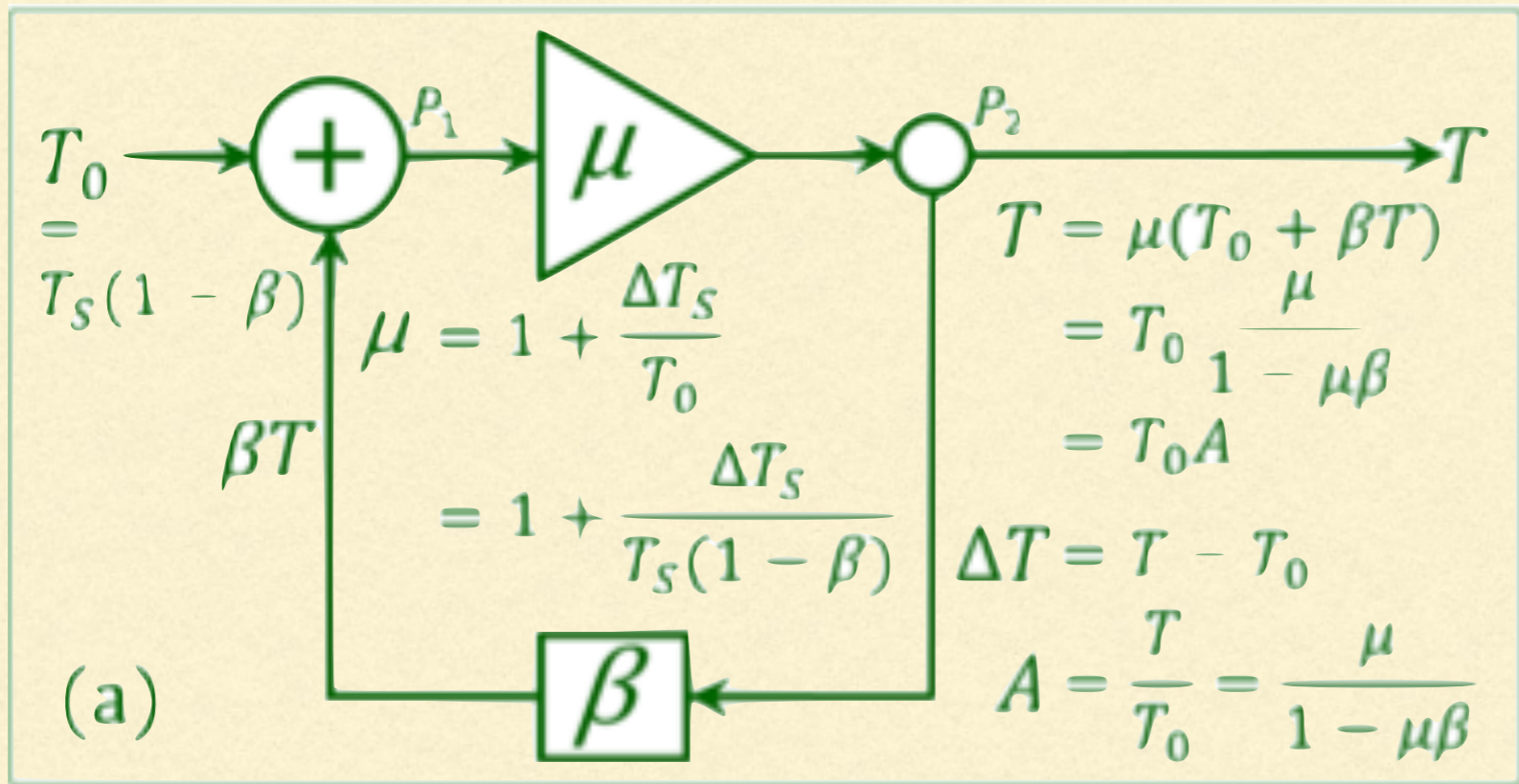




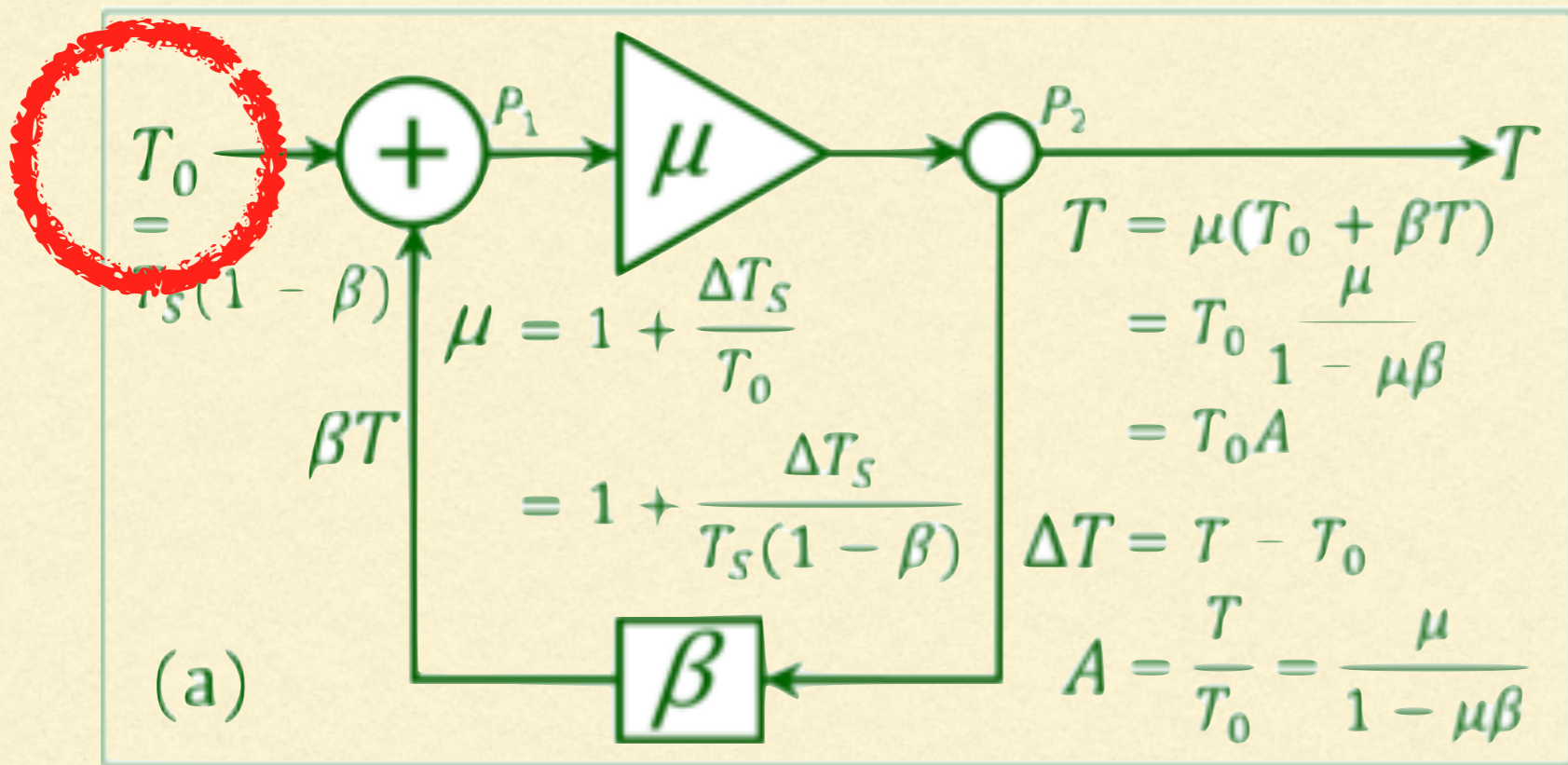




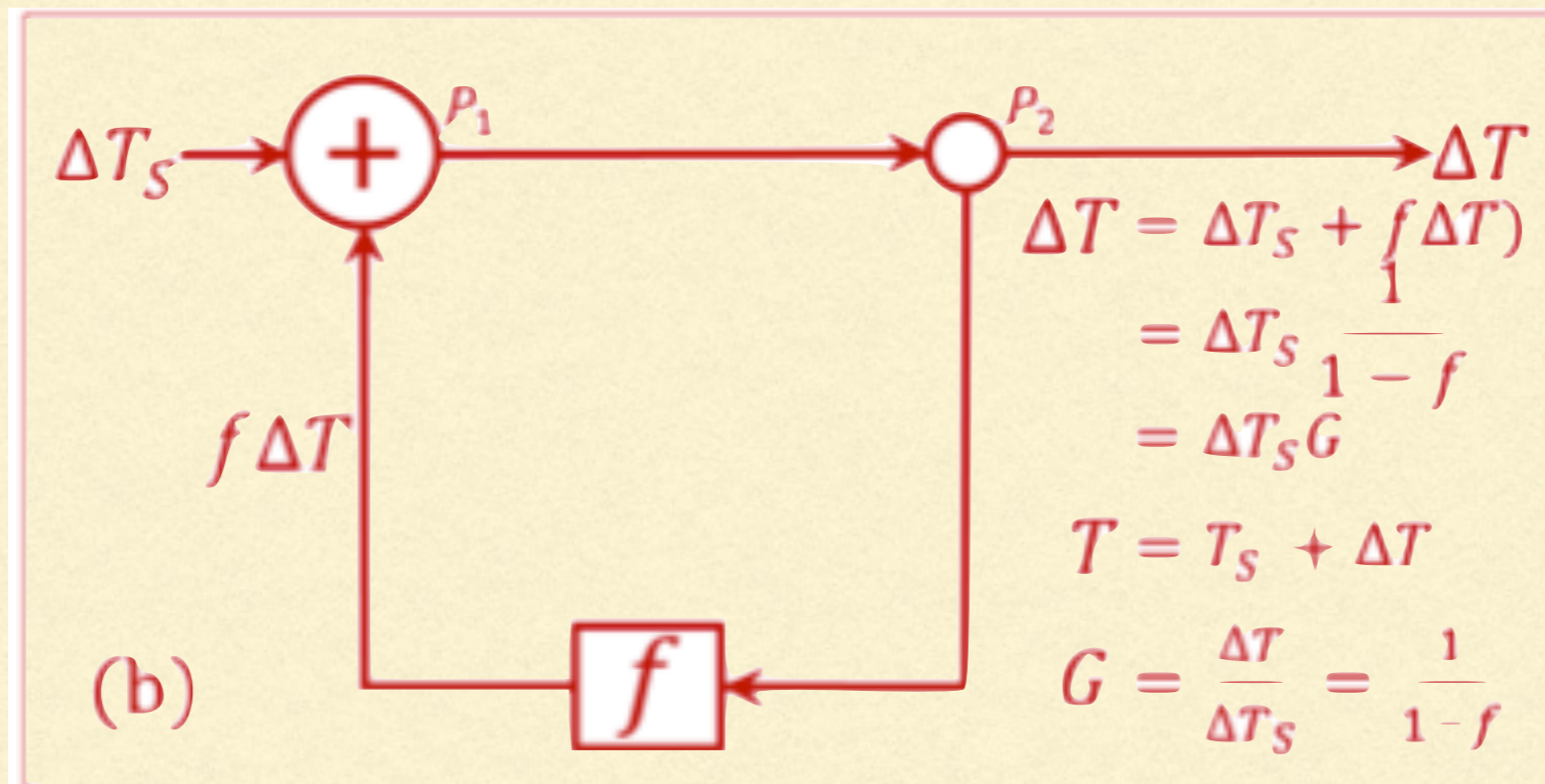
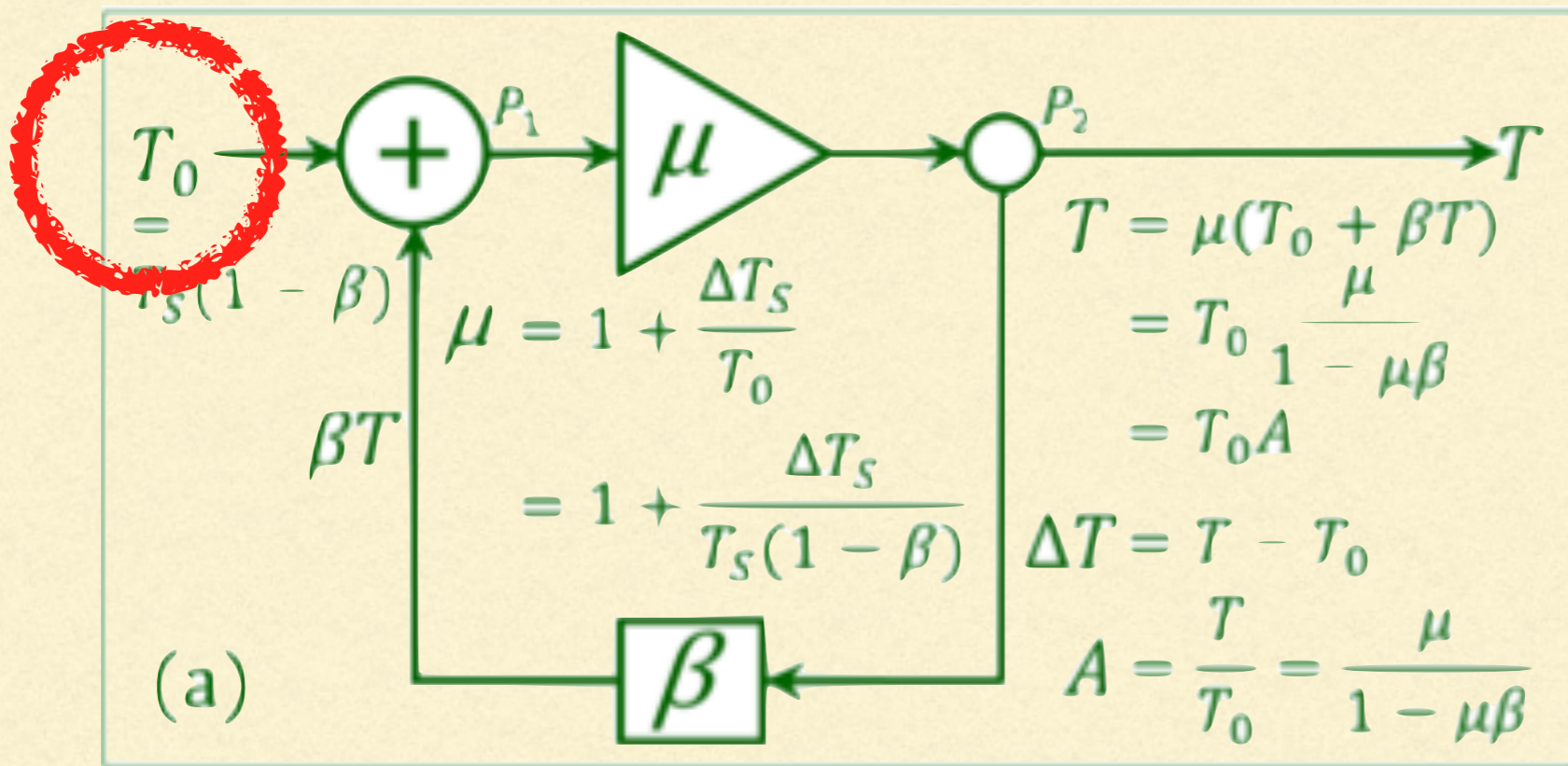




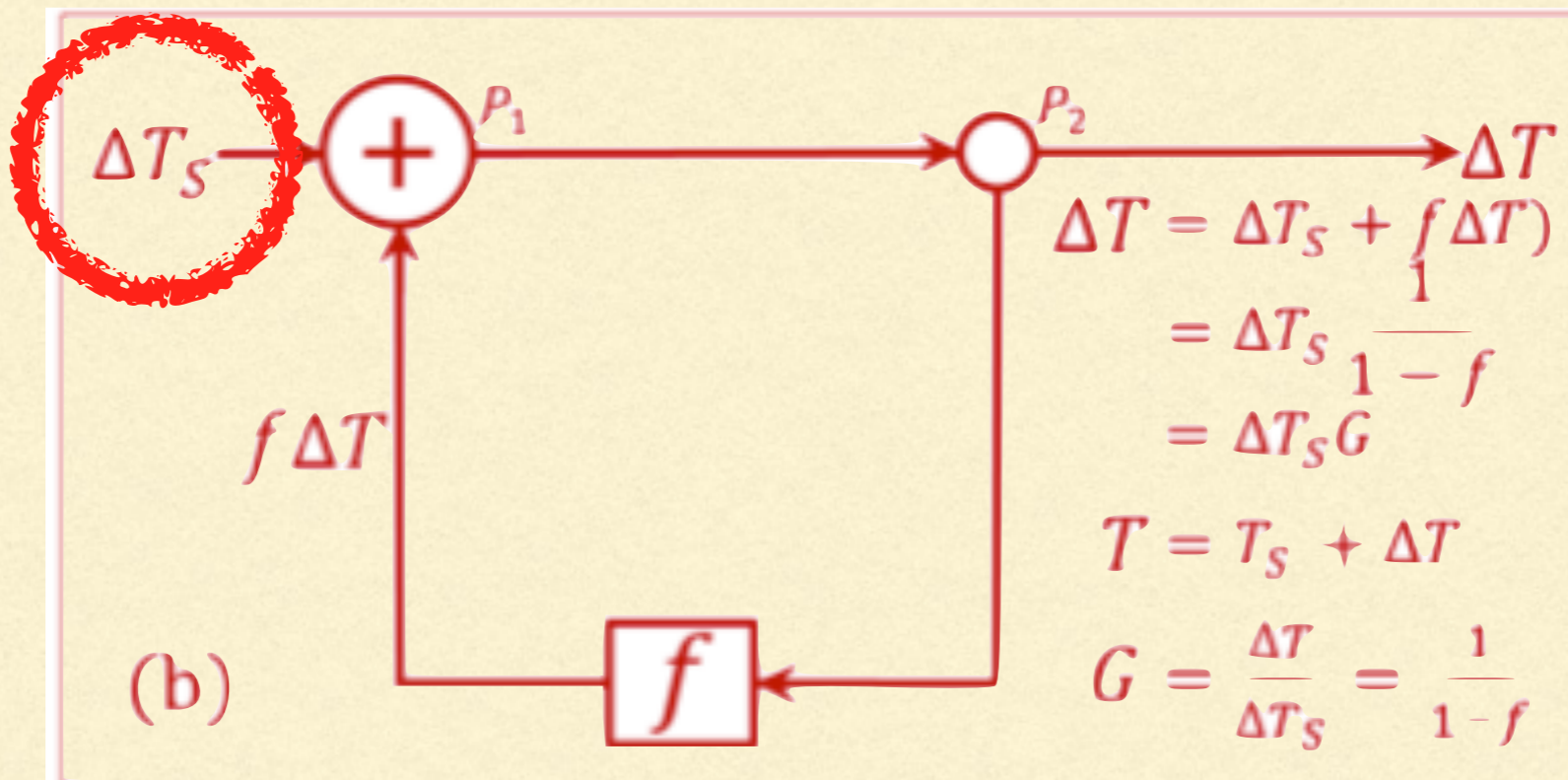
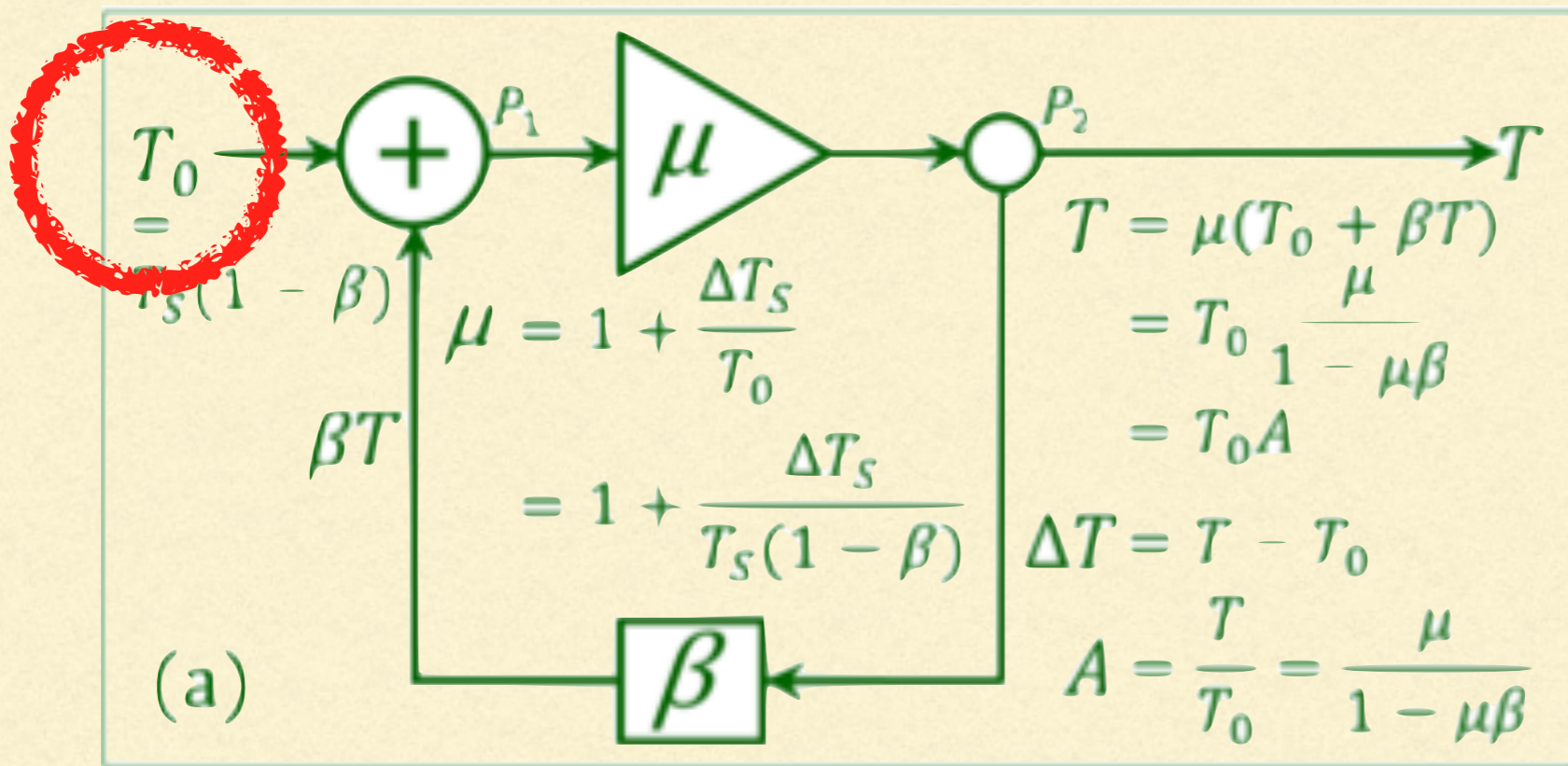




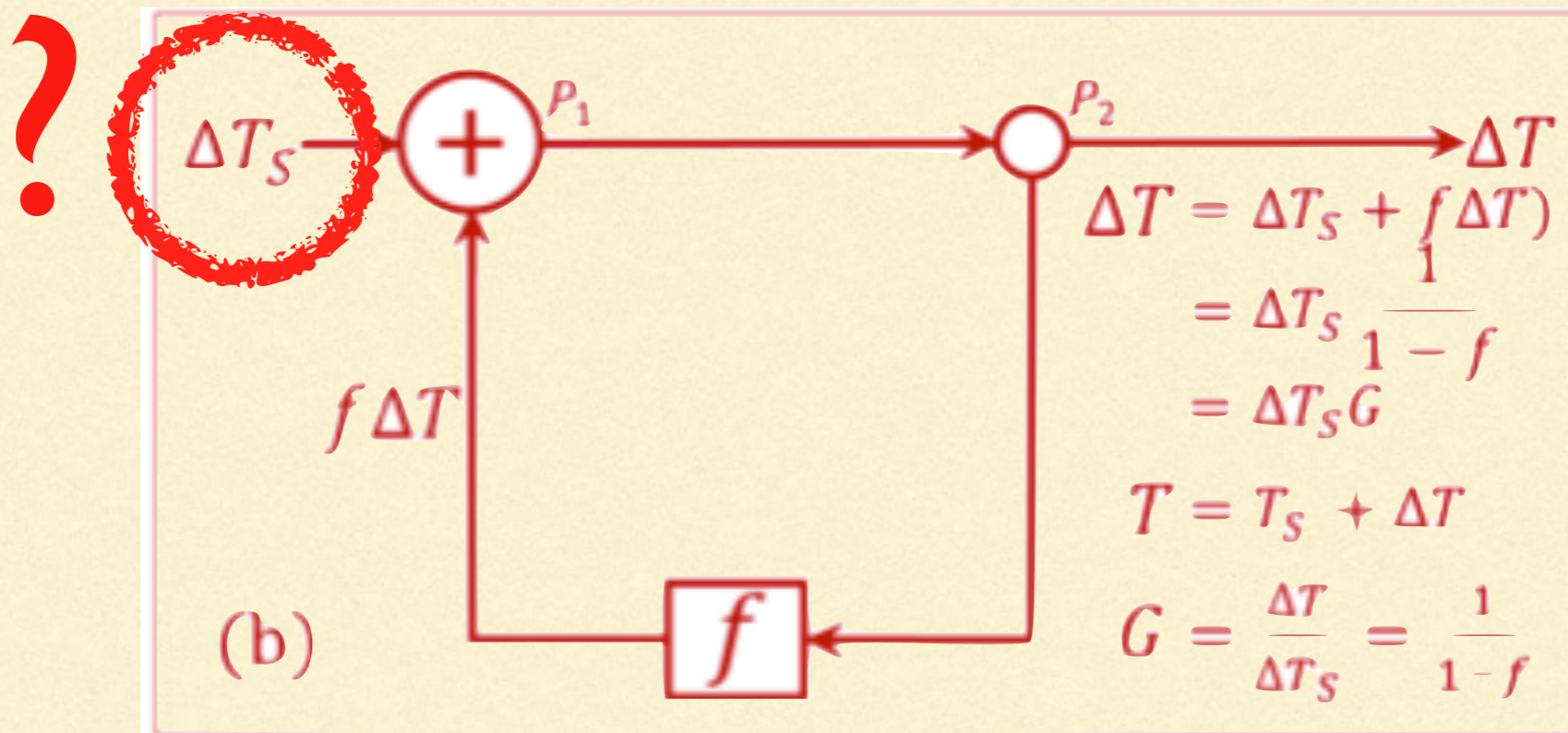
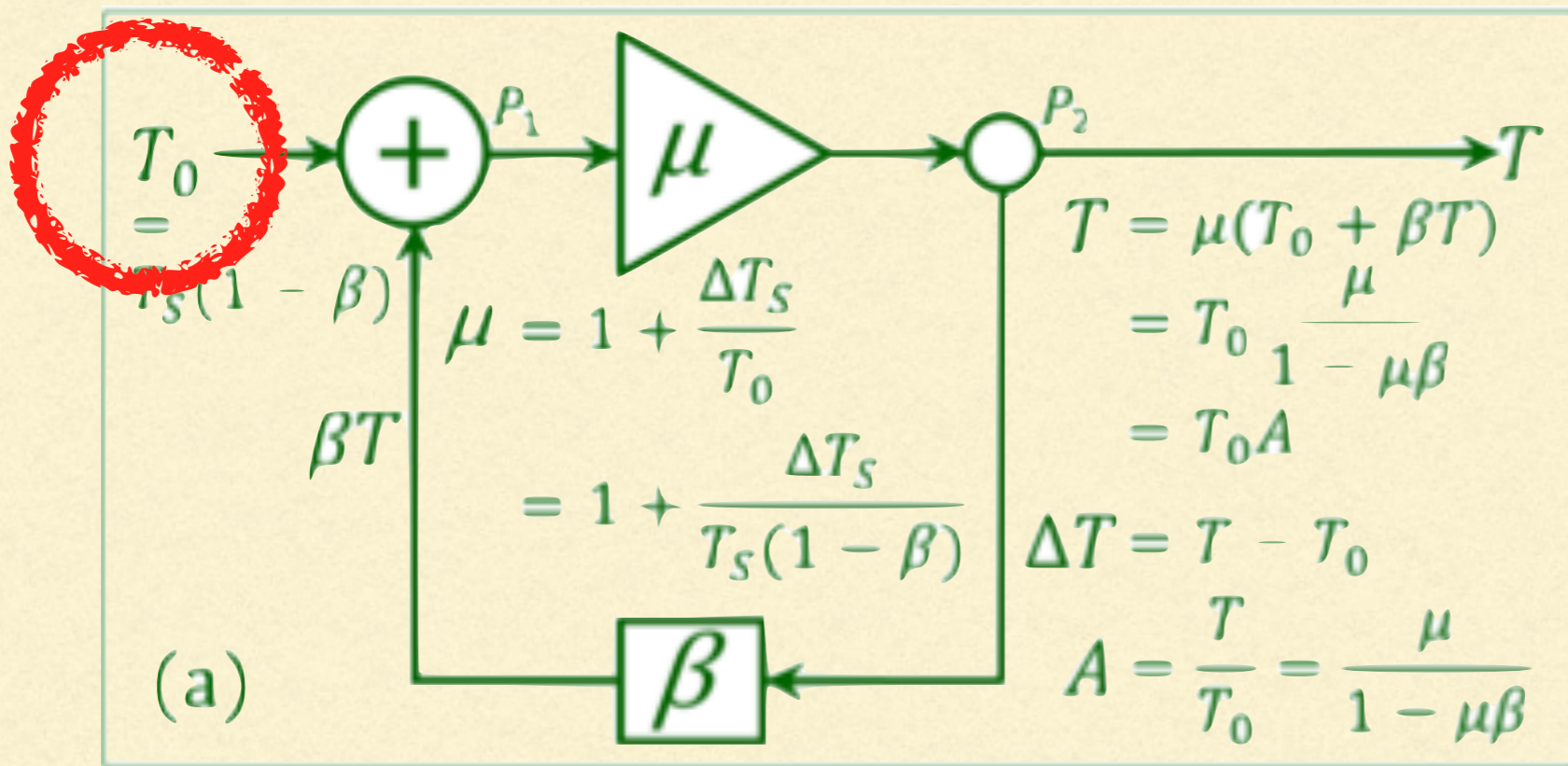




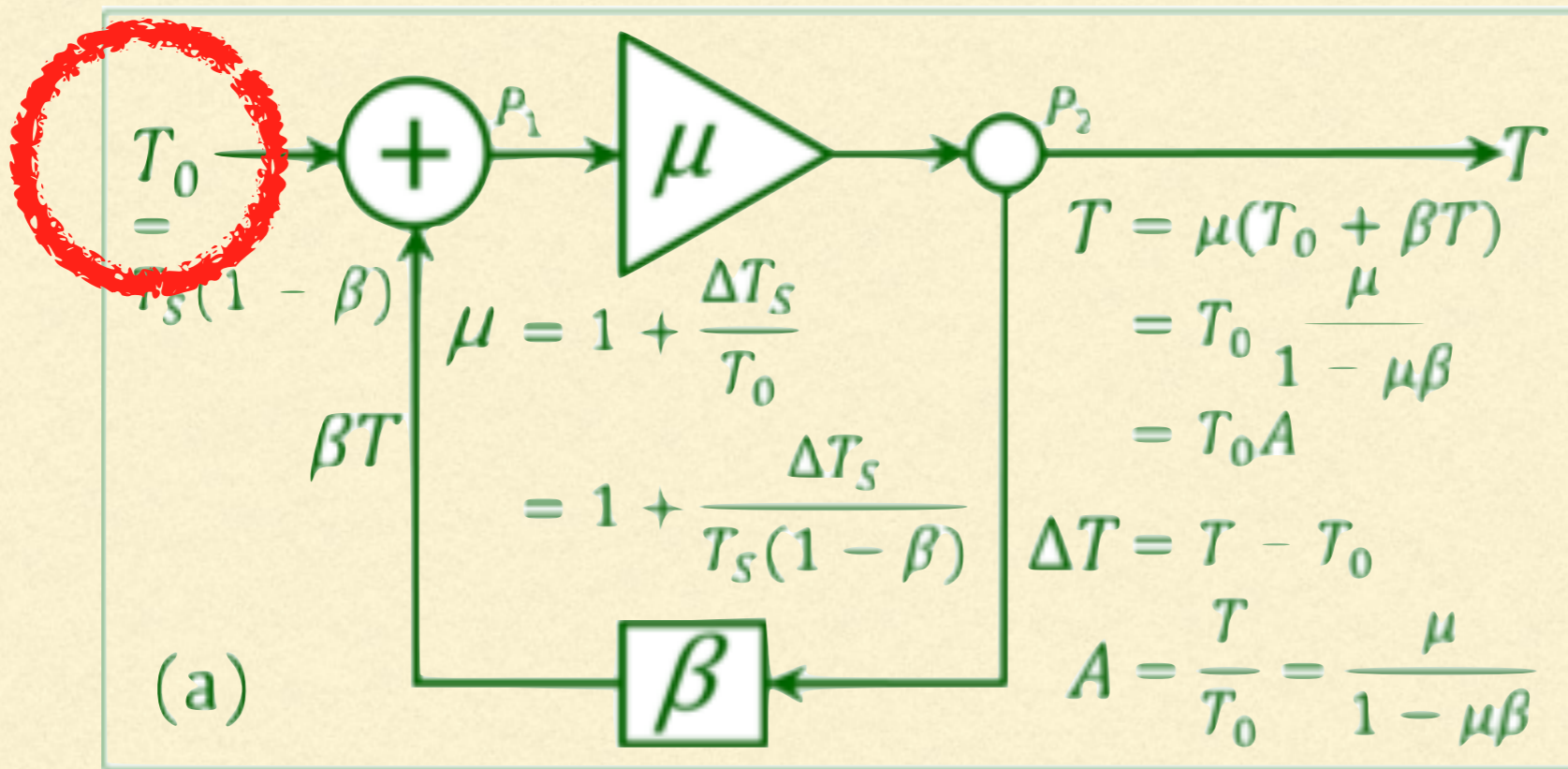




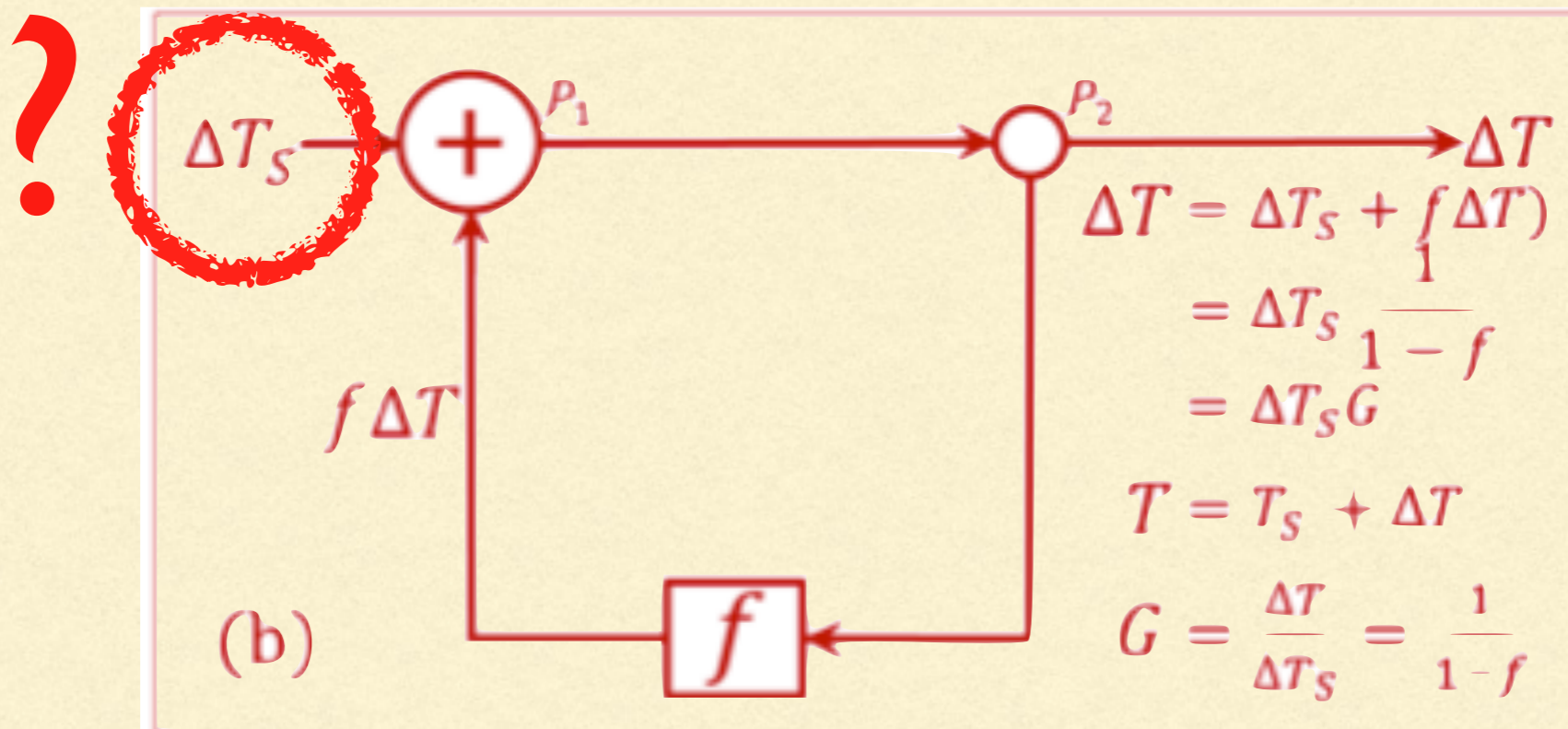




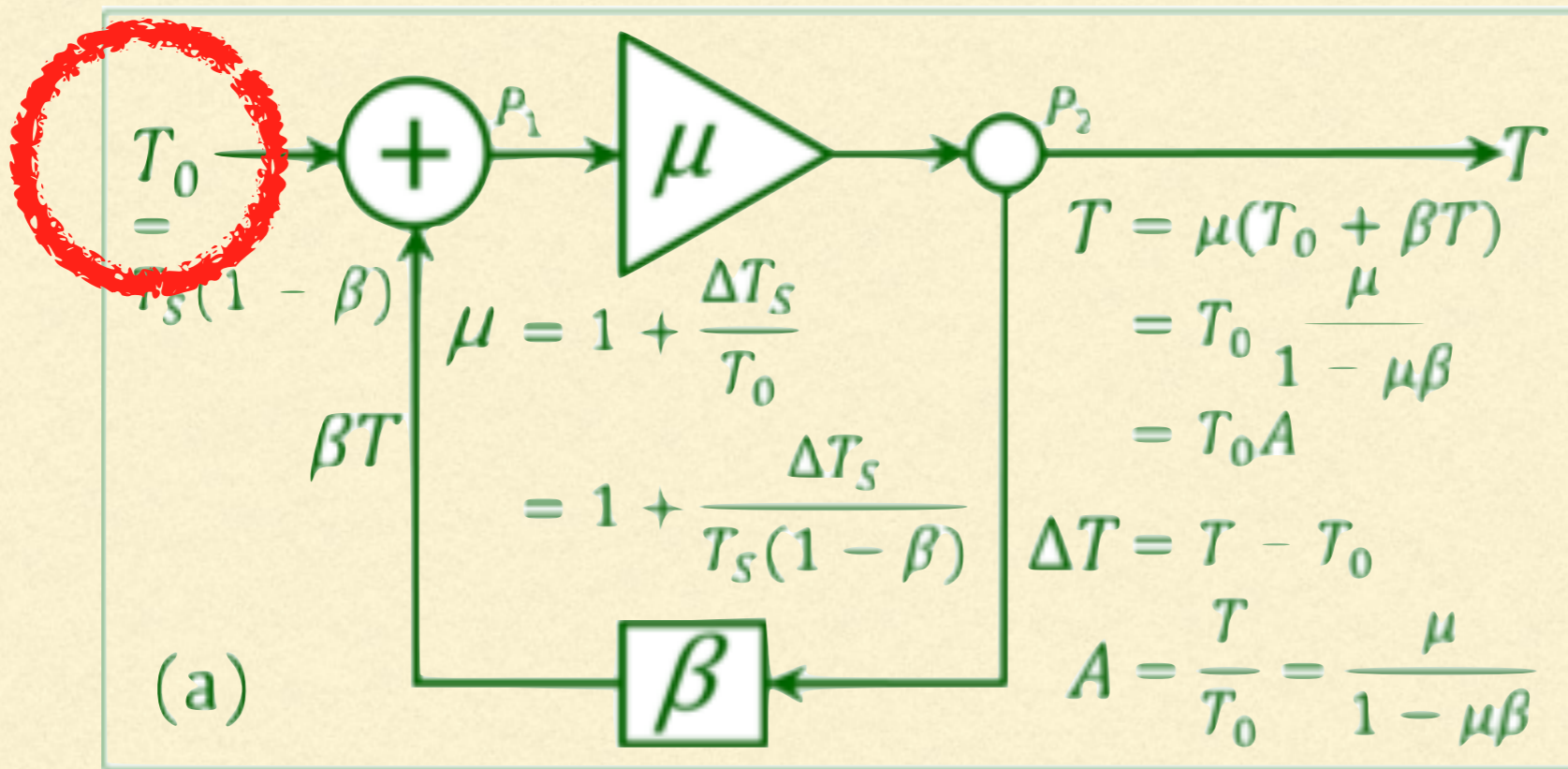




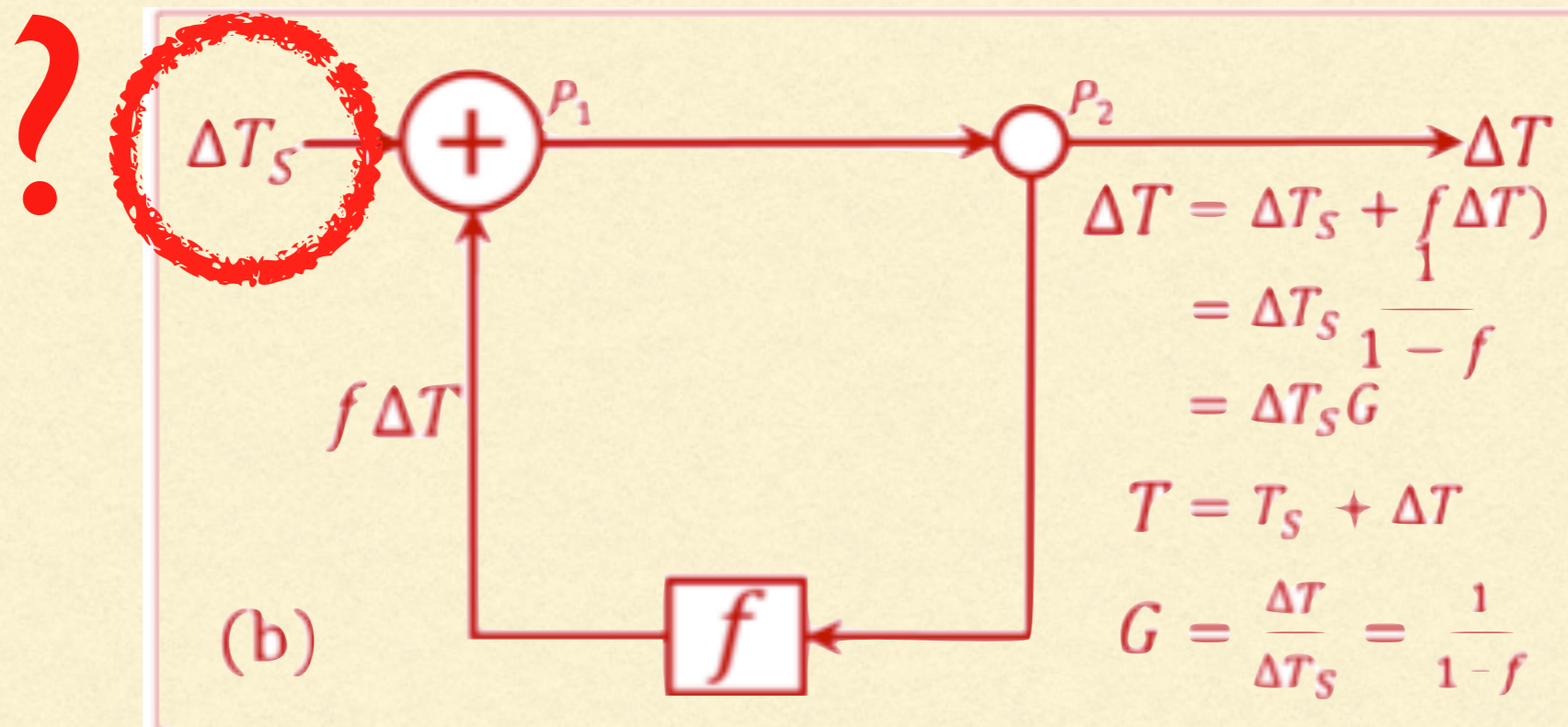
korrektes  
Blockschaltbild







korrektes  
Blockschaltbild



Blockschaltbild  
Klimaforscher





3SAT "SCOBEL" am 29.11.2009





3SAT "**SCOBEL**" am 29.11.2009



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# Klartext SchellInhuber

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# Klartext Schellnhuber

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- I. Die Körpertemperatur ( $T_k$ ) ist Bezugsgröße



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# Klartext Schellnhuber

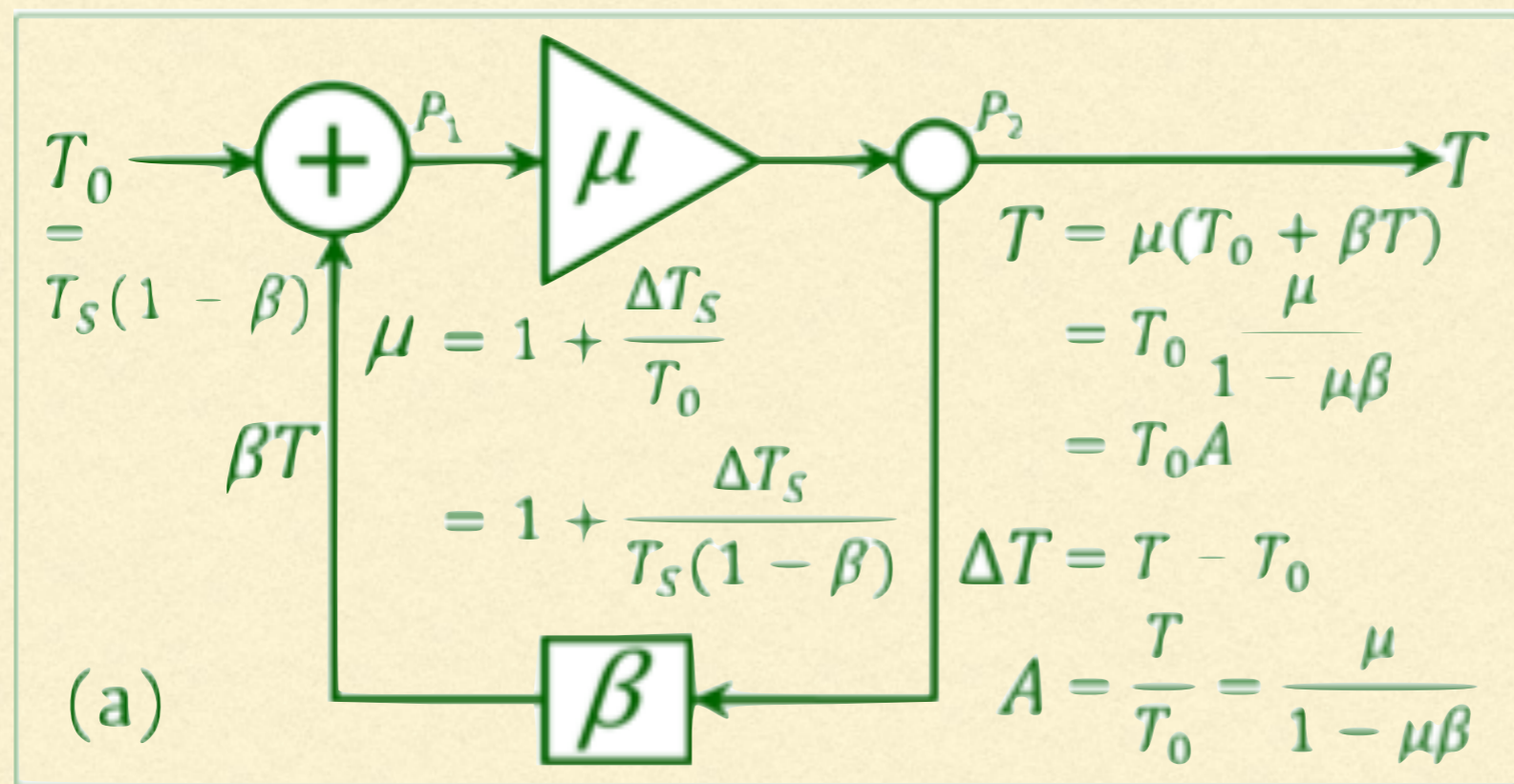
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1. Die Körpertemperatur ( $T_k$ ) ist Bezugsgröße
2. Die „Temperatur der Erde“ ( $T$ ) ist Bezugsgröße



# Klartext Schellnhuber

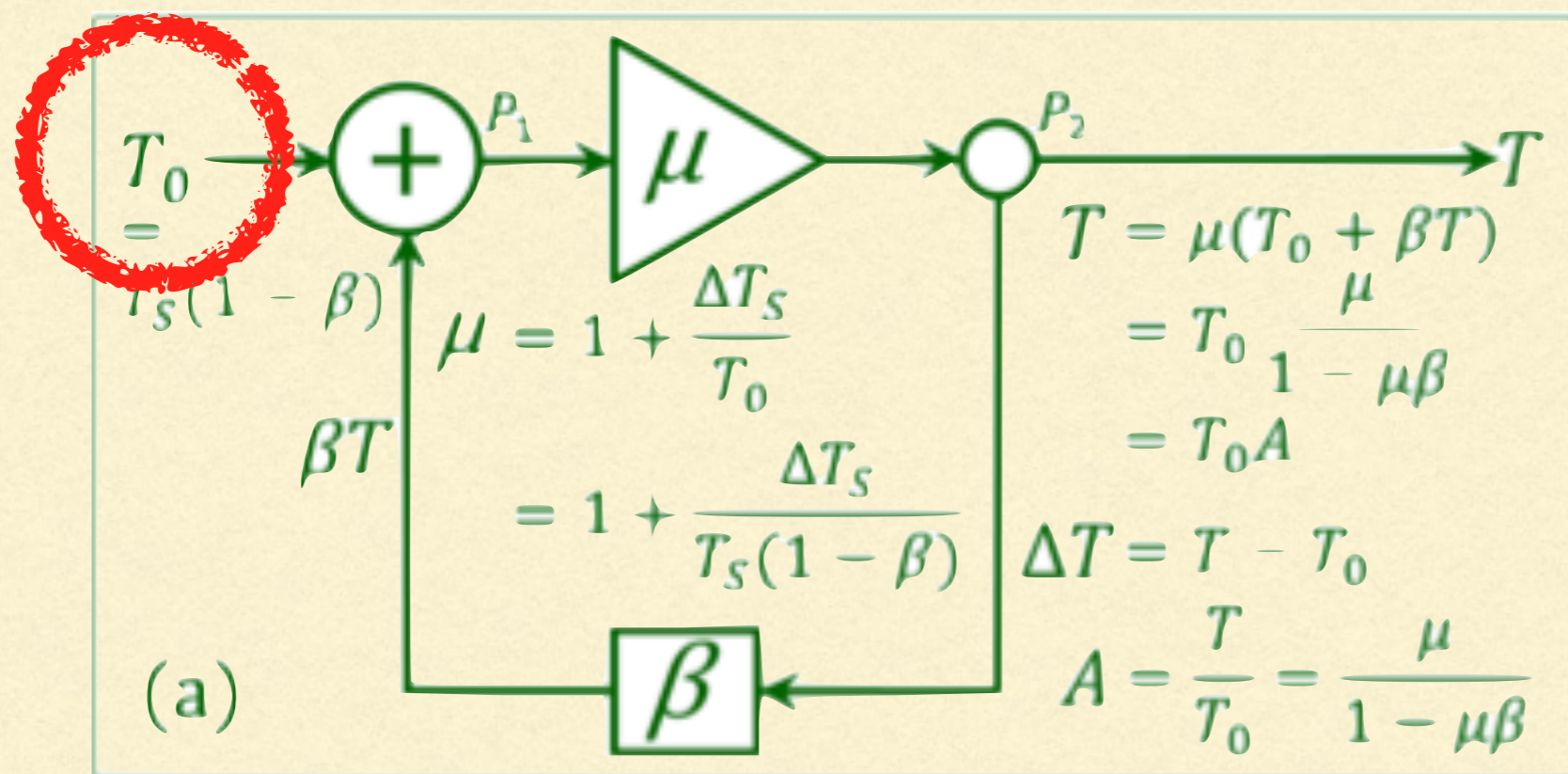
1. Die Körpertemperatur ( $T_k$ ) ist Bezugsgröße
2. Die „Temperatur der Erde“ ( $T$ ) ist Bezugsgröße





# Klartext Schellnhuber

1. Die Körpertemperatur ( $T_k$ ) ist Bezugsgröße
2. Die „Temperatur der Erde“ ( $T$ ) ist Bezugsgröße









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Was bedeutet das alle für die Klimatologie?



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Was bedeutet das alle für die Klimatologie?

Lord Christopher Monckton Viscount of Benchley..  
it's your turn now!