

## The Energy and The Work Of Engine

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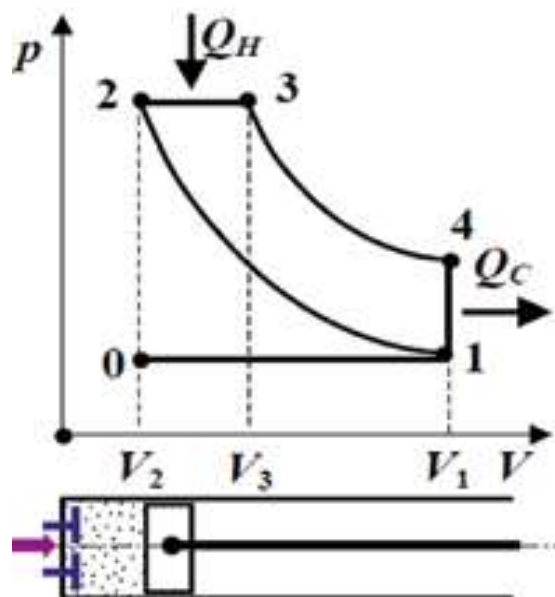
**ABSTRACT:** We live in the 21. century, we drive cars, we have the thermal and nuclear power plants and it all started with the work of Carnot, who established the principle of creating work of an engine from the supplied warmth. However, we have also problems with the pollution of our environment and the created warmth from these technical devices.

Josef Kovář

### I. INTRODUCTION

To Carnot and his followers we need to be grateful, without their activities would still pulling carts horses and cows and put the light from candles or oil lamps. Fundamentals of thermodynamics came out of the knowledge the steam engine and thermodynamics is successfully developed on this basis in the present state of affairs. All warmth engines basically considering the same mass of the gas throughout the course of the work cycle. The current thermodynamics is processed scientifically to the maximum detail, but on an imperfect base, is like a house with a great the interior and exterior space stands on the flat rocks instead on the concrete foundation. This analogy of the foundations of thermodynamics to the basics of the house, when the flat stones correspond to a permanent mass of gas and the concrete basics of variable mass of the gas, reflected in many current calculations even the conclusions of thermodynamics.

Max Planck stated: "The principle of energy is a matter of experience. Therefore, if one the day was supposed to be its universality questioned, which in atomic physics it is not excluded, it would become suddenly the current problem of perpetua mobile, whose existence would cease to be absolutely senseless." Even he failed to imagine the creation of the work of the new engine, as is further stated, while scientists have been able to this solution to grow up even in the time of Carnot, long before knowledge in atomic physics.



The figure 1: The cycle of the four-stroke the diesel engine

### A New Principle of Work Of The New Engine

Currently there is a new principle of creation of the work of the new engine consisting not only in saving work in a cycle when compression of air in the cylinder of the new engine by reducing the mass of the air its transition into the absorber, whose description is further formulated (See course cycle new engine according to the diagram p-V in the figure 3 and in the calculations watch the gradual reduction of the mass of the compressed the air in the cylinder. The graph of p-V is similar to the cycle of the four-stroke diesel engine shown in the figure 1, where the phase 2-3 is given by the warmth from the fuel during the move of the piston from the top dead center).

To the process of spontaneous transition of the compressed the air from the cylinder to the absorber it should be mentioned the following:

- The gas overflows always spontaneously from the space, where it is a higher pressure into the space, where is the pressure lower. This is so even in the spontaneous the transition of the compressed air from the cylinder to the absorber. Of course this effect is reflected positively in the small compression work.
- The total internal energy at point 3 is then given by the sum of the inner energy of the air in the cylinder at the top dead center of the piston and the inner the energy of the air in the absorber.
- The expansion in the phase of the 3-4 is the internal energy of the air decreases and creates the work engine.

#### 1. The state of volumes and phase 1-2:

At start the temperature of air in the working cylinder ( $V_{1cylinder}$ ) and in the absorber ( $V_{absorber}$ ) is the same as it is in the surroundings. The piston in the working cylinder is moving in this compression phase from the bottom dead center of the piston (BDC - the point 1) to the top dead center of the piston (TDC; the point 2), the pressure and the temperature of air increase in the working cylinder and the part of overpressure air **spontaneously** transmits by the open overpressure cover from the working cylinder to the absorber. The work in this compression process with the spontaneous the transition of the compressed air from the cylinder to the absorber is small, a result of decreasing the mass of the compressed air in the cylinder.

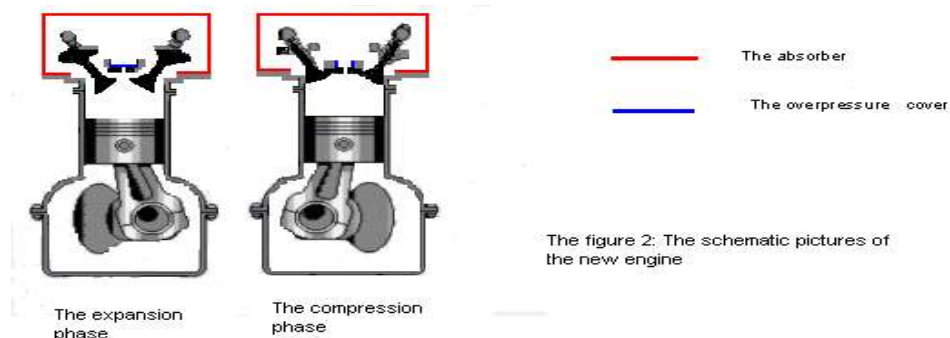
2. The state of volumes and phase 2-3: In TDC the working cylinder ( $V_{2cylinder}$ ) and the absorber ( $V_{absorber}$ ) are the same increased pressure and the temperature of the air. The working cylinder is connected with the absorber by the open valve and creates the common volume ( $V_{3common} = V_{2cylinder} + V_{absorber}$ ; the point 3).

3. The state of volumes and phase 3-4: The piston in the working cylinder is drifting from TDC to BDC and the air is expanded. In BDC ( $V_{4common} = V_{1cylinder} + V_{absorber}$ ; the point 4) the pressure and the temperature of the air in the working cylinder and in the absorber decrease the same way. The work in this the expansion phase is significantly greater than the work embedded in the compression phase.

In case of the thermodynamic cycle with polytropic expansion the temperature and pressure of air in phase 1-2 increases, in phase 3-4 the temperature and pressure of air decreases. The cylinder with the absorber after expansion at the BDC ( $V_{6common} = V_{1cylinder} + V_{absorber}$ ; the point 4) connects with the surroundings, will the exhaust in the phase 4-5 to the TDC ( $V_{1cylinder}$ ; the point 5) and subsequently sucking new air from the surrounding area in the phase 5-6, thereby reaches

the BDC of the piston the initial temperature and the air pressure in the cylinder and absorber ( $V_{6common} = V_{1cylinder} + V_{absorber}$ ; the point 6). After that in the BDC of the piston (the point 6) closes the connection between the cylinder and its surroundings and the interconnection between

the cylinder and the absorber. In the phase 6-1 the common volume of the cylinder with absorber is separated to the volume of cylinder  $V_{1cylinder}$  and to the volume of the absorber  $V_{absorber}$ . After this open the cycle repeats.



The absorber is a chamber on the cylinder head, whose the volume corresponds to the volume of the cylinder at the top dead center of the piston. The valve completely connects the cylinder with absorber when the expansion phase 3-4, when the exhaust phase 4-5 and also in sucking the air from the surroundings of the phase 5-6. The isothermal nor adiabatic expansion is not technically recoverable. The thermodynamic processes in the phase 1-2 are very dynamic and thermodynamically complicated, but the basic thermodynamic axiom  $p \cdot V = n \cdot R \cdot T$  is valid.

The thermodynamic cycle with the polytropic expansion and the graph p-V

$$V_{1\text{cylinder}} = 500 \text{ cm}^3; V_{2\text{cylinder}} = 25 \text{ cm}^3; V_{\text{absorber}} = 25 \text{ cm}^3; k_{\text{expansion}} = 1,25;$$

$$p_1 = 100 \text{ kPa}; T_1 = 293 \text{ K}; p_{(\text{in } 0,525)} = 101,31 \text{ kPa}; T_{(\text{in } 0,525)} = 296,84 \text{ K};$$

$$n_{1\text{cylinder}} = 100 \cdot 0,5 \cdot 1/(8,314 \cdot 293) = \mathbf{0,02052543} \text{ mol}; n_{1\text{absorber}} = \mathbf{0,00102627} \text{ mol};$$

$$n_{\text{common}} = n_{1\text{cylinder}} + n_{1\text{absorber}} = \mathbf{0,0215517} \text{ mol};$$

$$\{p_2 = p_3 = 1914,92 \text{ kPa}; T_2 = T_3 = 534,35 \text{ K}\}$$

The informative example of the calculation compression work (a increased pressure air in the compression is divided in the ratio of the respective volume of the cylinder to a common volume of the cylinder with the absorber, is given by the set pressure between the cylinder and the absorber; it is likewise the case with the calculation of the work, since it takes in the account always default to the air mass in the cylinder at the beginning of the respective compression changes):

A.  $p_{\text{cal}} = (0,5/0,4)^{1,25} \cdot 100 = 1,28684 \cdot 100 = 128,684$ ;  
 $128,684 - 100 = 28,684 \cdot 0,4/0,425 = 27$ ;  $p_{(0,5-0,4)} = 27 + 100 = 127 \text{ kPa}$ ;  
 $T_{(0,5-0,4)} = 127 \cdot 0,425 \cdot 8,314^{-1} \cdot 0,0215517^{-1} = 301,232 \text{ K}$ ;  
 $n_{\text{cyl } 127} = 127 \cdot 0,4 / 8,314 \cdot 301,232 = \mathbf{0,02028395} \text{ mol}$ ;  
 $W_{0,5-0,4} = \mathbf{0,02052543} \cdot 0,4/0,425 \cdot 127 = 2,453 \text{ J}$   
 $p_{(\text{in } 0,425)} = 131,94 \text{ kPa}; T_{(\text{in } 0,425)} = 312,95 \text{ K}$ ;

B.  $p_{(0,4-0,3)} = 177,733 \text{ kPa}$  ;  $T_{(0,4-0,3)} = 322,373 \text{ K}$ ;  
 $n_{\text{cyl } 177,33} = 177,733 \cdot 0,3 / 8,314 \cdot 322,373 = \mathbf{0,0198939} \text{ mol}$ ;;  
 $W_{0,4-0,3} = \mathbf{0,02028395} \cdot 0,3/0,325 \cdot 177,733 = 3,328 \text{ J}$   
 $p_{(\text{in } 0,325)} = 184,5 \text{ kPa}; T_{(\text{in } 0,325)} = 334,66 \text{ K}$ ;  

C.  $p_{(0,3-0,2)} = 282 \text{ kPa}$  ;  $T_{(0,3-0,2)} = 354,12 \text{ K}$ ;  
 $n_{\text{cyl } 282} = 282 \cdot 0,2 / 8,314 \cdot 354,12 = \mathbf{0,01915664} \text{ mol}$ ;  
 $W_{0,3-0,2} = \mathbf{0,0198939} \cdot 0,2/0,225 \cdot 282 = 4,987 \text{ J}$   
 $p_{(\text{in } 0,225)} = 292,17 \text{ kPa}; T_{(\text{in } 0,225)} = 366,88 \text{ K}$ ;

D.  $p_{(0,2-0,15)} = 386,6 \text{ kPa}$  ;  $T_{(0,2-0,15)} = 377,58 \text{ K}$ ;  
 $n_{\text{cyl } 386,6} = 386,6 \cdot 0,15 / 8,314 \cdot 377,58 = \mathbf{0,01847288} \text{ mol}$ ;  
 $W_{0,2-0,15} = \mathbf{0,01915664} \cdot 0,15/0,175 \cdot 386,6 = 6,348 \text{ J}$   
 $p_{(\text{in } 0,175)} = 400 \text{ kPa}; T_{(\text{in } 0,175)} = 390,66 \text{ K}$ ;  

E.  $p_{(0,15-0,10)} = 590,59 \text{ kPa}$  ;  $T_{(0,15-0,1)} = 412 \text{ K}$ ;  
 $n_{\text{cyl } 590,59} = 590,59 \cdot 0,10 / 8,314 \cdot 412 = \mathbf{0,01724133} \text{ mol}$ ;  
 $W_{0,15-0,1} = \mathbf{0,01847288} \cdot 0,1/0,125 \cdot 590,59 = 8,728 \text{ J}$   
 $p_{(\text{in } 0,125)} = 609,15 \text{ kPa}; T_{(\text{in } 0,125)} = 504,36 \text{ K}$ ;

F.  $p_{(0,1-0,05)} = 1133,62 \text{ kPa}$  ;  $T_{(0,1-0,05)} = 474,5 \text{ K}$ ;  
 $n_{\text{cyl } 1133,62} = 1133,62 \cdot 0,05 / 8,314 \cdot 474,5 = \mathbf{0,01436783} \text{ mol}$ ;  
 $W_{0,1-0,05} = \mathbf{0,01724133} \cdot 0,05/0,075 \cdot 1133,62 = 13,03 \text{ J}$   
 $p_{(\text{in } 0,075)} = 1153,55 \text{ kPa}; T_{(\text{in } 0,075)} = 482,84 \text{ K}$

G.  $p_{(0,05-0,025)} = 1914,92 \text{ kPa}$  ;  $T_{(0,05-0,025)} = 534,35 \text{ K}$ ;  
 $n_{\text{cyl } 1914,92} = 1914,92 \cdot 0,025 / 8,314 \cdot 534,35 = 0,01077585 \text{ mol}$ ;  
 $W_{0,05-0,025} = \mathbf{0,01436783} \cdot 0,025/0,05 \cdot 1914,92 = 13,757 \text{ J}$   
 $p_{(\text{in } 0,05)} = 1914,92 \text{ kPa}; T_{(\text{in } 0,05)} = 534,35 \text{ K}$

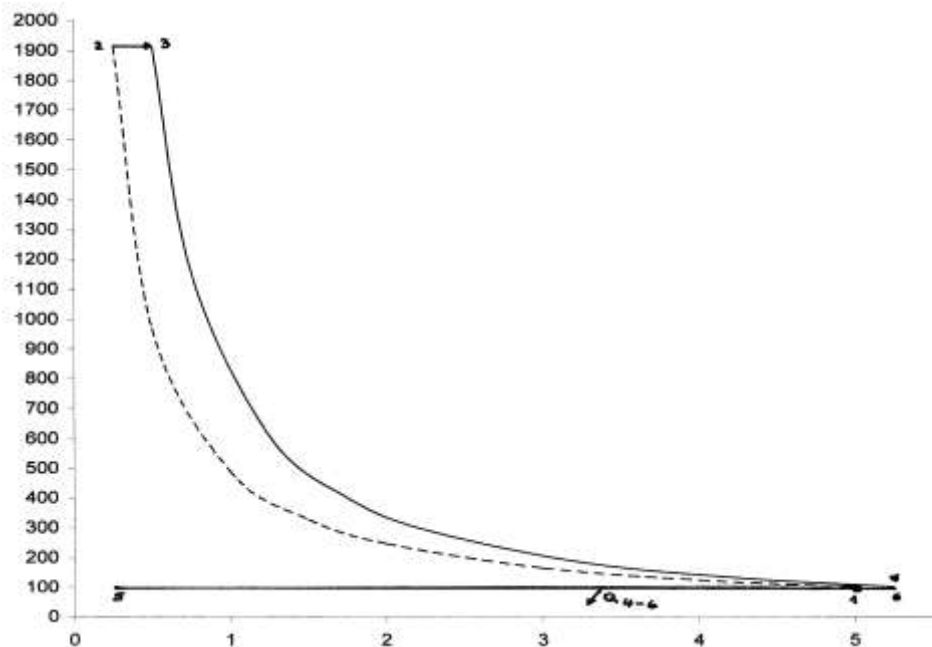
$$W_{\text{compression } 1-2} < 52,63 \text{ J} ;$$

$$W_{\text{expansion } 3-4} = 1914,92 \cdot 0,05 \cdot 0,25^{-1} \cdot (1 - (0,05/0,525)^{0,25}) = 170,23 \text{ J}$$

The warmth transmits from the cylinder to the surroundings after the expansion:  
 $Q_{4-6} = (5/2) \cdot 0,0215517 \cdot 8,314 \cdot (296,8 - 293) = 1,702 \text{ J}$   
 $W_{\text{usefull}} = 170,23 - 52,63 - 1,7 > 116 \text{ J}$

The output of the four cylinders – four stroke-new engine with the turning  $f = 6000 \text{ min}^{-1}$ :  
 $P = 4 \cdot 0,5f \cdot W_{\text{usefull}} = 2 \cdot 100 \text{ s}^{-1} \cdot 116 = 23 \text{ kW}$

x (V; 10 <sup>1</sup> . dm <sup>3</sup> )	y (p; kPa)	x (V; 10 <sup>1</sup> . dm <sup>3</sup> )	y (p; kPa)
0,25	1914,92	0,5	1914,92
0,5	1133,6	0,75	1153,55
1	590,6	1,25	609,15
1,5	386,6	1,75	400
2	282	2,25	292,17
3	177,7	3,25	184,5
4	127	4,25	131,94
5	100	5,25	101,31



The figure 3: The graph p-V of the new cycle

It may be possible considerate for the **spontaneous** transmission of the compressed air from the working cylinder to the absorber the fine setting of the very small tightless of the valve instead the using of the overpressure cover.

In the actual implementation of the new engine is used construction of the existing four-stroke engine and the engine will be supplemented by the absorber with the valve (between the absorber and the working cylinder) and the new engine including the absorber is thermally isolated from the surrounding area. The better the new engine will be thermally isolated from the surroundings, the more it will approach to adiabatic expansion and the higher will be his performance (at equal volumes and processes as when polytropic cycle will be the performance of the new engine 31 kW). The new engine will be compared to existing warmth engines easier, as it passes out of the cooling and the fuel accessories and for the new engine work won't need a drop of fuel. To achieve the same performance as the present engine will be required the larger the total volume of the new engine.

### CONCLUSION

The new principle can be applied in the piston engine and the rotary engine of the Wankel, which will be using the spontaneous transition of the compressed the air from the cylinder to the absorber and the subsequent expansion of the air from the common volume of the cylinder with absorber to create the work engine. A very important benefit is that the new engines of the applying this cycle, they will not pollute our environment and falls off the existing unnecessary waste of fuel resources, that can be more effectively use in chemistry. Use of new engines for vehicles, especially for drive generators for production of electrical current and other, the life on our world could be better than today.

**About The Author**

JOSEF KOVÁŘ is devoted to the creation work engine of 30 years. Fixed knowing the previous knowledge of thermodynamics on the creation of work of the engine only of the warmth he used a warmth from surroundings for work of the engine. How it follows from the previous, everything is completely different. The author of the invention is looking for the manufacturer of the prototype new engine for the joint obtaining of the international patent. After obtaining the international patent on the new engine, you can expect high profits from licences for the next 20 years. Please, express your interest to the autor of this invention.  
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