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The Second General Law Of Thermodynamics Teaching Method

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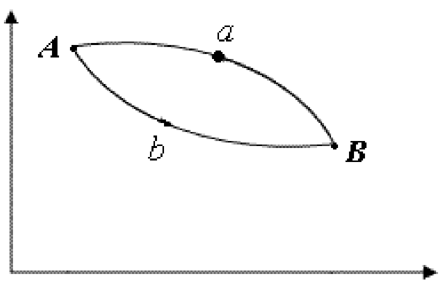
Abstract : The article covers the methods, principles of asynchronous teaching of the second law of thermodynamics. On the basis of asynchronous teaching, full coverage of the topic and technologies for the formation of science-based compensation in students were revealed.

Keywords : method, asynchronous, Knowledge, Skills, Qualification, competence, creativeness, logic.

Introduction, Literature Review And Discussion

As we know, when mechanics and energy are transformed into heat, this procedure takes place quite simply. All of the mechanical energy is converted into heat. To find out how many calories are formed in such a cycle, it is enough to multiply the number of Joules by 0,239. (Mechanics and heat equivalent of work).

We know that the coefficient of such use is equal all the time together, but the reverse prosess is much more complicated. There are real existing devices that convert heat into work (Steam Machines, internal combustion engines, etc.).k) as is known, it works cyclically, that is, in them the heat transfer (transfer) and its conversion into work are repeated davriy. To do this, after the body doing the work receives heat from the source, it must again return to its initial state in order to start the process again from this, in other words, the body must perform rotational prosesses. Such a process is called a cycle. If the state of the body is characterized by its pressure and volume, then this state is graphically represented by AB points in the P-V diagram.



Picture 1

A line in the diagram, for example, represents the change of position: A and B in Figure 1. The circular process (cycle) is represented by a closed curve,for example,A, b and B, a curved line. The work done during this cycle will be equal to the surface bounded by this closed curve. 1854-the year V.Thomson (Kelvin): heat taken from one body does not cause any change in some other body or body, it meant that cyclic prosess can not be carried out, allowing it to become a single

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mechanical operation. This principle is proved on the basis of numerous experiments on the operation of heat transfer machines.

First, the working body, and secondly the source of heat - a heater, a lower - temperature body in which heat is transferred from the tip-the cooler is the basis of this process. The principle of confirmation Karno that in order to perform work in a cyclic machine it is necessary to participate two bodies of different temperatures. According to this principle, the heat transfer machine (cyclic machine) cannot be satisfied only with the heat source and the working body. If only it were possible to be satisfied with the working body and the source of heat, then for the performance of work it was possible to use "sources" from which it was possible to obtain practically unlimited amounts of heat, such as the waters of the seas and oceans, the Earth's crust, the Earth's atmosphere, these were. A machine that runs because of the heat of such sources and does not require any combustion would be as important as an eternal engine, and such a machine was called an eternal engine of the second type. However, the law of conservation of Energy "confirms" such a machine. Work is done because of the heat. However, experience shows that such a machine cannot be made. In order for the cyclic heat transfer machine to work, it will need a body whose temperature is below the temperature of the heat source. Usually the atmosphere itself serves as a refrigerator.

2. For the cyclic process, we know that three bodies: the heat source from which it is taken (the heater), the cooler body from which the heat is given (the cooler), and the working body from which the heat is given and the mediator in the performance of its work should be.

Let's start with the fact that the circulating process, which takes place in the working body, is from the moment when this body is in contact with a heater compressed to some pressure, that is, it has a temperature equal to T_0 (A in Figure 2). Since there is no temperature difference, there will be no process of thermal conductivity. There will also be no process of giving heat before the work is done. Since the purpose of the ice is to get the maximum work, we must not allow there to be such prosesses in the cycle. Now the working bodymga when in contact with the heater, we can increase the volume and allow one body to rub, for example: piston. So it will be isometric (A V curved line in Figure 1). The work is done.

This work is done on the account of the heat from the heater, but since the heat capacity of the heater is large, it does not change its temperature[1,2,3.153-159-p].

The worker must give the Heat received by the body to the refrigerator. It is impossible to carry out this heat to the refrigerator by touching the working body directly with a refrigerator, since the temperature of the isothermic kengaygan working body is higher than the temperature of the refrigerator, and useful work is not done when the heat in direct contact is Uzay. Therefore, it is necessary to initially cool the working body to the temperature of the refrigerator, and then touch it. As for cooling the working body, it should be insulated from the heater, and then allow adiabatic kengayas (2-th picture CD curve) until the temperature of the refrigerator is equal.

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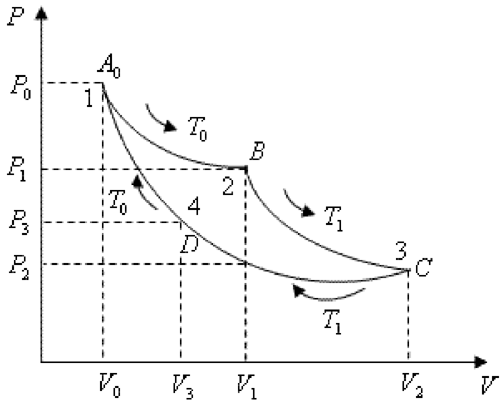

Picture 2

(Ediabatic) sovisinde bodies cool down. It performs additional mechanical work by physically silencing the piston, for example, in the second phase. In this way, after the working body is cooled, it is touched by the refrigerator. The first half of the same cycle is complete; the body performs useful work on the account of the Heat received in the heater[8. 53-59-p].

Now it is necessary to return the working body to its original position, that is, to restore the initial pressure and temperature. This means that the working body must be compressed and again in contact with the heater. Both the process of return to the initial stage is carried out in two stages. Initially, the isothermic is compressed - the CD curve is compressed, and then the adiabatic. AD-curve line and finally the cycle ends[5,6,7.13-19-p].

Hence, the rotational process consists of two isothermal and two adiabatic displacement and compression. Kengay working body in contractions performs useful work: while contractions, on the contrary dish forces are because of the work performed on the body.

In this case, the whole cycle is carried out with a slipping (that is, the prosess is very slow quasystatic bulsin) the French scientist Sadi Karno first described the work done on such a working body in 1824 - th year. Therefore, in his honor is called the cycle of Karno. As a working body, the ideal gas is obtained [10,11].

$T_0 > T_1 \;_0 = P_0 V_0 / R,$ T_1 - cooling temperature

Stage I:

A_1 work done in Av-isothermic circuit

$$A_1 = RT_0 \ln \frac{V_1}{V} = Q_0 \qquad (1)$$

will be equal, here Q_0 is the amount of heat that the gas receives from the heater.

Stage II:

BC-adiabatic $T_0=T_1$ when the procedure is gasified in the ovary

$$T_0 V_1^{\gamma-1} = T_1 V_2^{\gamma-1} \qquad (2)$$

Equality is relative. As well as

$$\left(\frac{V_2}{V_1}\right)^{\gamma-1} = \frac{T_0}{T_1} \qquad (3)$$

Equality can be found in V_2. Phase II gas - fulfilling iishi A_2

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$$A_2 = \frac{RT_0}{\gamma - 1}\left[1 - \left(\frac{V_1}{V_2}\right)^{\gamma-1}\right] = \frac{R(T_0 - T_1)}{\gamma - 1} \qquad (4)$$

Will be equal. In Stage III, after that, the volume of gas is compressed isothermically to V_2 and V_3. In this goose, the work done will be equal to A_3.

$$A_3 = RT_1 \ln\frac{V_3}{V_2} = -RT_1 \ln\frac{V_2}{V_3} = -Q_1 \qquad (5)$$

And Q_1 comes out of the heat dissociation.

At Stage IV, the gas is compressed adiabatic returns to the initial P_0, V_0 state:

$$\left(\frac{V_3}{V_0}\right)^{\gamma-1} = \frac{T_0}{T_1} \qquad (6)$$

Equality $T_1 V_3^{\gamma-1} = T_0 V_0^{\gamma-1}$

At the end of the cycle, it is performed in adiabatic compression in Stage IV

$$A_4 = \frac{R(T_1 - T_0)}{\gamma - 1} = -\frac{R(T_0 - T_1)}{\gamma - 1} \qquad (7)$$

will be equal.

What will be the result of the cycle?

To what extent is its purpose of converting heat into mechanical work performed?

A case in general on the gasworks and Gasworks

$$A = A_1 + A_2 + A_3 + A_4 \qquad (8)$$

equal dividing net

(18.1), (18.4), (18.5) and (18.7) from the equations, we get the following:

$$A = RT_0 \ln\frac{V_1}{V_0} + \frac{R(T_0 - T_1)}{\gamma - 1} - RT_1 \ln\frac{V_2}{V_3} - \frac{R(T_0 - T_1)}{\gamma - 1} = RT_0 \ln\frac{V_1}{V_0} - RT_1 \ln\frac{V_2}{V_3} \qquad (9)$$

(18.3) and (18.6) the right side of equality is therefore equal:

$\frac{V_2}{V_1} = \frac{V_3}{V_0}$, or $\frac{V_1}{V_0} = \frac{V_2}{V_3}$ it turns out that it is.

We define this relationship by means of r. There

$$\ln\frac{V_1}{V_0} = \ln\frac{V_2}{V_3} = \ln r \qquad (10)$$

$V_1 > V_0$ and $V_2 > V_3$ because it is. Hence the general case

$$A = R(T_0 - T_1)\ln r \qquad (11)$$

since it is equal, $T_0 > T_1$ because it is $A > 0$ this means that Q_0, which the working body receives from the heater, is not equal to the amount of heat.

Gave the heater

$$Q_0 = RT_0 \ln\frac{V_1}{V_0} \qquad (12)$$

from the amount of heat

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$$Q_1 = -RT_1 \ln r \quad (13)$$

a part equal to the volume of the gas from V_2 to V_3 was given to the cooler in the isothermic compression. Thus, the resulting heat

$$Q_0 - Q_1 = R(T_0 - T_1)\ln r = A \quad (14)$$

part of the equivalent can be achieved by turning it into a profitable business.

All in all $\frac{Q_0}{T_0} = R\ln\frac{V_1}{V_0}$,

from equality $\frac{Q_0}{T_0} - \frac{Q_1}{T_1} = 0$ $\quad \frac{Q_0}{T_0} = \frac{Q_1}{T_1} \quad (15)$

equality is appropriate.

Furthermore $\frac{Q_0}{Q_1} = \frac{T_0}{T_1}$ based on equality

$$\eta = \frac{A}{Q_0} = \frac{Q_0 - Q_1}{Q_0} \quad (16)$$

We achieve the determination of the useful working coefficient of the heating machine.

η=1 in which the heat engine would be extremely beneficial. Because such an engine requires the presence of two bodies of a hotter body (heater) and a colder body (cooler).

Such an engine would have been called the second kind of perpetuum mobele. However, from the heat calculation of Q_0, which we took only once from the heater periodic $A=Q_0$ all attempts to make a heat transfer machine that performs work are always unsuccessful.

French physicist Sadi Karno came to the conclusion that in his work "reasoning about the driving force of The Flame" in 1824, the ideal was performed on gas, and the calculation, consisting of adiabatic and isothermal changes in the volume of gas, can not be transferred from the heater to the cooler (if the temperature of the cooler is above absolute zero) [13,12].

V with Klauzius. Thomson then summarizes Trump's conclusions as follows. To the principle of a heat transfer machine that periodic cannot work on the account of the Heat received from one source to another (the Heat received from one source to another cannot be generated by the periodic process, which consists in the formation of work on the account of the Heat received from one source to another. This principle was called the II general law of thermodynamics. It is a mistake to generalize the general law of thermodynamics II to the whole universe and to the infinitely large time interval.

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