ICHKI YONUV DVIGATELLARI NAZARASI

(Theory of Internal Combustion Engines)

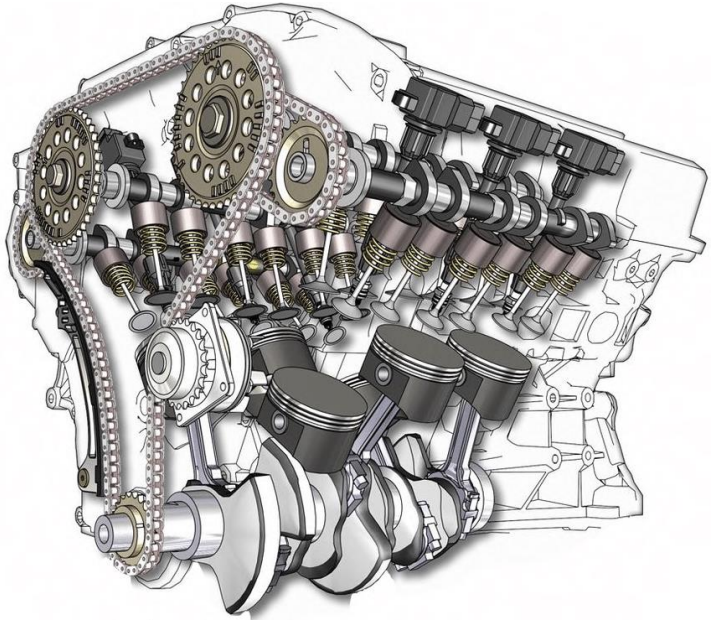

Photo source: https://www.researchgate.net/figure/Illustration-of-a-V6-internal-combustion-engine_fig1_339612888

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8-Mavzu: Kengayish jarayoni.
(Topic 8: Power event).

REJA:

1. Haqiqiy sikldagi kengayish jarayonining o`ziga xosligi.

2. Issiqlikning devorlarga uzatilishi va yonilg`ining yonib tugashi.

3. Kengayish jarayonining poltropik ko`rsatkichi

4. Kengayish oxiridagi gazning termodinamik ko`rsatkichlari

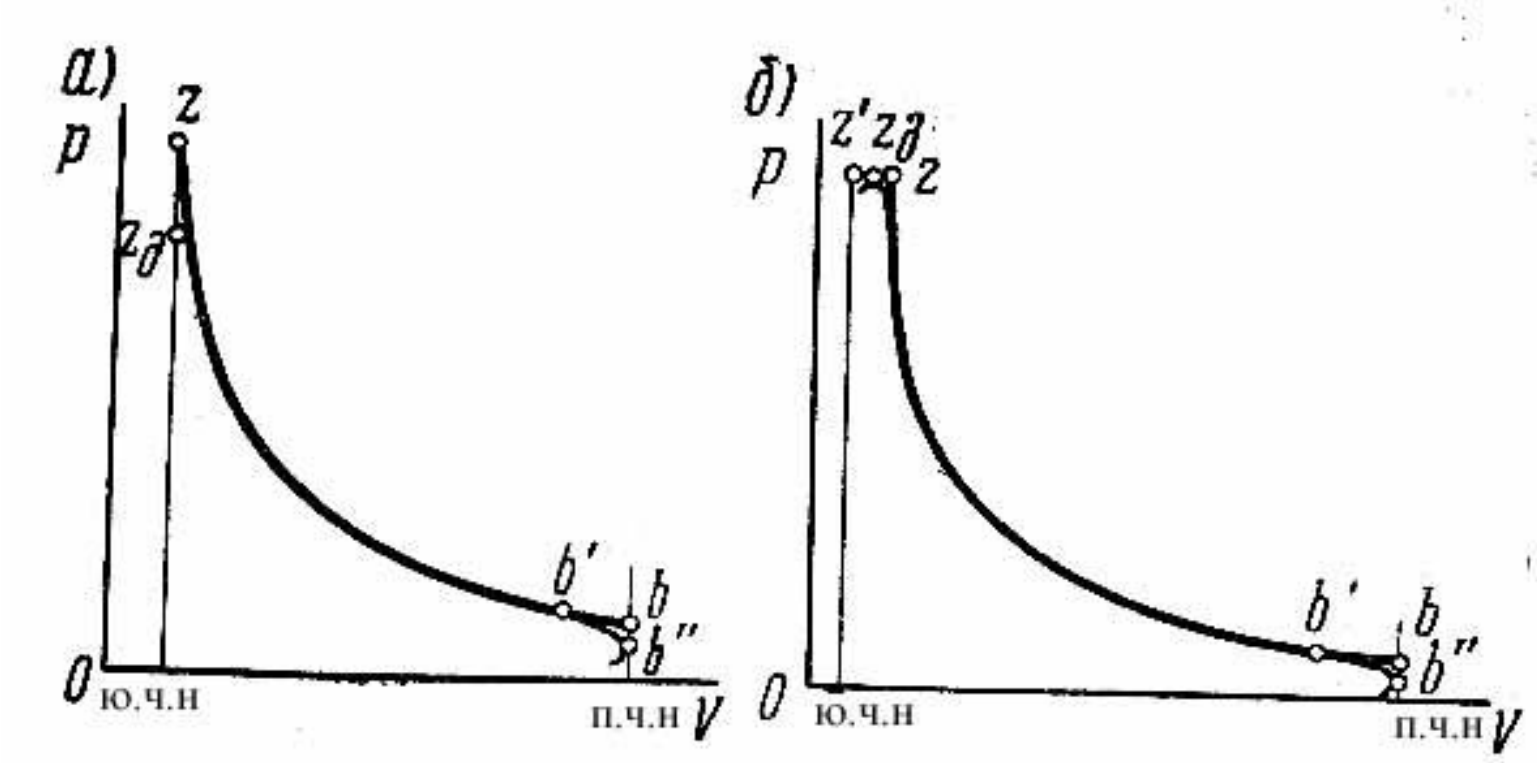
5. Kengayish jarayoni kursatkichlarining amaldagi qiymatlari

Haqiqiy sikldagi kengayish jarayonining o`ziga xosligi

Kengayish jarayoni - yonilg`ining yonishidan hosil bo'lgan issiqlikni mexanik energiyaga aylantirish uchun xizmat qiladi. Dvigatel ishchi siklining qolgan kiritish, qisish va chiqarish tashkil etuvchi jarayonlari porshienning ishchi yo`lini tayyorlovchi jarayonlar hisoblanadi.

Kengayish jarayonida issiqlikning bir qismi silindrlar, blok qopqog`i, porsheng`, klapan va boshqa qismlarga uzatiladi, bir qismi mexanik energiyaga aylanadi, bir qismi mexanik isroflarga, sovitish va moylash tizimlariga uzatiladi. SHu sababli kengayish jarayoni davomida silindr ichidagi gazning bosimi va harorati porshen P.CH.N. ga yetgunga qadar kamayib boradi [1].

Kengayish jarayoni indikator diagrammasi



Kengayish jarayonida silindr ichidagi bosimning o`zgarish shakli [1]: a-karbyuratorli dvigatelda, b-dizel dvigatelda

Haqiqiy sikldagi kengayish jarayonining o`ziga xosligi

Kengayish jarayoni boshlanganda klapanlar yopiq bo`ladi. Porshen Yu.CH.N. ga yaqinlashganda chiqarish klapani (B′) nuqtada ochiladi va P.CH.N. oxiri B nuqtagacha silindr ichidagi gazning bosimi kamayib boradi. Silindr ichidagi gazning (B) nuqtadagi ($P_b$) bosimi, atmosfera ya`ni tashki havo bosimi P_o dan bir oz yuqori bo`ladi.

Gazning kengayish jarayonida yonilg'i yonganida ajralib chiqqan issiqlikning boshqa turga aylanishi natijasida ish bajariladi. Uchqundan o't oldiriladigan dvigatellar va dizellarning siklida gazning kengayishi **yonish davom etayotganda boshlanadi**, bu esa kengayish jarayonining ana shu bosqichdagi o'ziga xos xususiyatidir [7].

Kengayish jarayonining politropik ko`rsatkichi

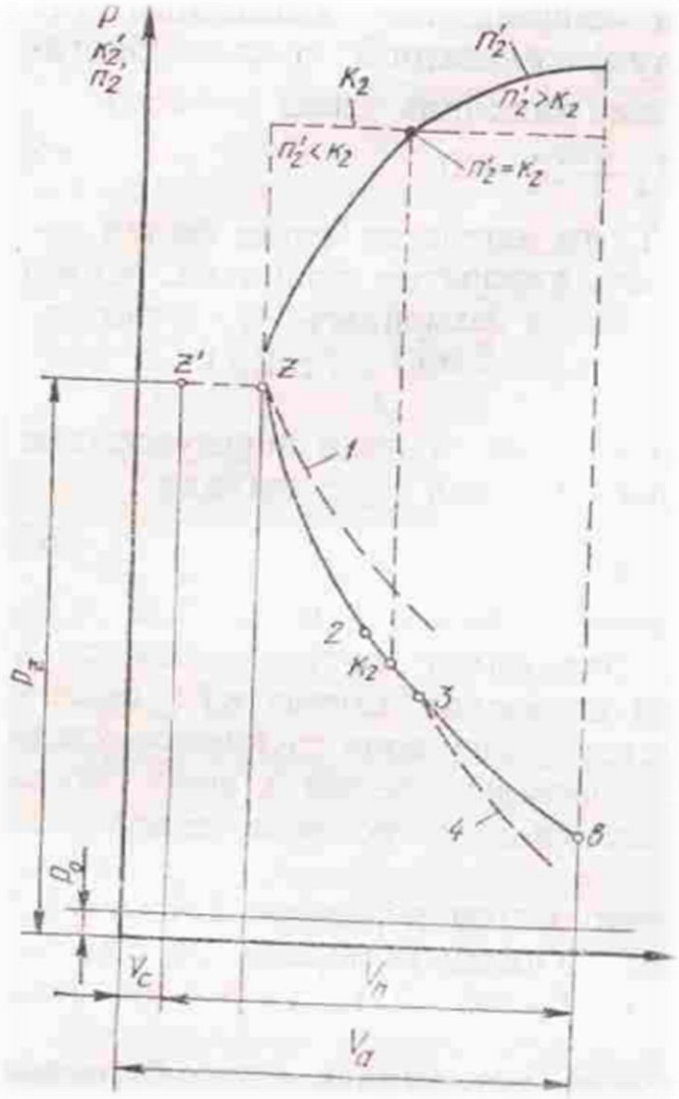
Kengayish jarayoni chizig'i (ZB) politropik chiziq bo`lib, uning qiymati dvigatel turlari bo`yicha quyidagicha aniqlanadi [2]:

Karbyuratorli dvigatel uchun: $n_2 = 1{,}22 + 130 / n$; (1.23 ……1.30)

Dizel dvigatel uchun : $$n_2 = \lg \frac{P_1'}{P_2'} \Big| \lg \frac{v_2'}{v_1'}$$ (1.18…….1.28)

bu yerda, n-dvigatel tirsakli valining aylanish chastotasi, P_1, P_2 va V_1, V_2 – ko'rinib yonishning oxiri, va chiqarish klapani ochilish paytiga mos tushadigan bosimlar va hajimlar.

Kengayish jarayonining politropik ko`rsatkichi



Kengayish jarayonining indicator diagrammasi [2].

Kengayish jarayoni oxiridagi gaz **bosimi** gaz holatining **politrop tenglamasidan** foydalanib aniqlanadi [2]:

$$P \cdot V^{n_2} = const$$

Bu yerda: P – bosim, V- hajm, n_2 – kengayish jarayonining politropik ko'rsatkichi;

Yuqorida keltirilgan tenglamani kengayish boshlanishi (Z) va kengayish oxiri (B) nuqtalar uchun yozamiz;

$$P_z \cdot V_z^{n_2} = const \qquad P_b \cdot V_b^{n_2} = const$$

Tenglamalarning o`ng tomonlarini tengligidan quyidagi ifodani yozamiz [1]:

$$P_z \cdot V_z^{n_2} = P_b \cdot V_b^{n_2}$$

Yuqorida keltirilgan tenglamadan kengayish jarayoni oxiridagi bosimni aniqlaymiz:

$$P_b = \frac{P_z \cdot V_z^{n_2}}{V_b^{n_2}} = P_z \left(\frac{V_z}{V_b} \right)^{n_2} .$$

a) karbyuratorli dvigatel uchun $V_Z=V_C$ va $V_v = V_a$ ekanligini ehtiborga olsak, ifodani o`rniga qo`yib quyidagini hosil qilamiz:

$$P_b = P_z\left(\frac{V_z}{V_b}\right)^{n_2} = P_z\left(\frac{V_c}{V_a}\right)^{n_2} = P_z\left(\frac{1}{\frac{V_a}{V_c}}\right)^{n_2} = P_z\left(\frac{1}{\varepsilon}\right)^{n_2} = \frac{P_z}{\varepsilon^{n_2}},$$

b) demak, $P_b = P_z / \varepsilon^{n2}$ MPa

Xulosa:

Kengayish oxiridagi gazning bosimi (P_b) yonish jarayoni oxiridagi bosim (P_Z) ga to`g`ri, siqish darajasi (ε) va politrop ko`rsatkichi ($n_2$) ga teskari bog`langan ekan [3].

b) dizel dvigatel uchun $V_Z = \rho V_C$, $V_v = V_a$ va $\delta = \varepsilon/\rho$, ekanligini ehtiborga olsak, ifodani o`rniga qo`yib quyidagini hosil kilamiz:

$$P_b = P_z\left(\frac{V_z}{V_b}\right)^{n_2} = P_z\left(\frac{\rho V_C}{V_a}\right)^{n_2} = P_z\left(\frac{\rho}{\frac{V_a}{V_c}}\right)^{n_2} = P_z\left(\frac{\rho}{\varepsilon}\right)^{n_2} = \frac{P_z}{\delta^{n_2}},$$

demak,

$$P_в = \frac{P_z}{\delta^{n_2}}, \quad \text{MPa}$$

Xulosa:

Dizel dvigatelda kengayish oxiridagi gazning bosimi (P_b) gazning dastlabki kengayish darajasiga (b) va politrop ko`rsatkichga ($n_2$) teskari hamda yonish oxiridagi ($P_z$) bosim bilan to`g`ri bog`langan ekan.

Kengayish jarayoni oxiridagi gazning **haroratini (T_b)** aniqlash uchun gaz holatining xarakteristik tenglamasidan foydalaniladi. Gaz holatining xarakteristik tenglamasi quyidagicha bo`ladi:

$$PV = 8314\ T\ M$$

Yuqorida keltirilgan tenglamani (Z) va (V) nuqtalar uchun quyidagicha yozamiz:

$$P_z V_z = 8314 \cdot T_z M_z \qquad P_b V_b = 8314 \cdot T_b M_b$$

$M_z \approx M_b$ bo`lgani uchun, $\frac{P_z V_z}{T_z} = \frac{P_b V_b}{T_b}$ ni hosil qilamiz,

bu tenglikdan (T_b) ni qiymatini aniqlaymiz:

$$T_B = T_z \frac{P_b V_b}{P_z V_z}.$$

Benzinli dvigatel uchun: $V_z=V_c$; $V_b=V_a$ ekanligini ehtiborga olib quyidagini hosil kilamiz:

$$T_b = T_z \frac{P_b V_b}{P_z V_z} = T_z \cdot \left(\frac{P_z V_a}{\varepsilon^{n_2} \cdot P_z V_z} \right) = T_z \cdot \left(\frac{\frac{V_a}{V_c}}{\varepsilon^{n_2}} \right) = T_z \cdot \left(\frac{\varepsilon}{\varepsilon^{n_2}} \right) = \frac{T_z}{\varepsilon^{n_2-1}},$$

demak, $$T_b = \frac{T_z}{\varepsilon^{n_2-1}}, \text{ K}$$

Xulosa: Kengayish oxiridagi gazning harorati (T_b) yonish oxiridagi haroratga (T_z) to`g`ri va siqish darajasi (ε) va politrop ko`rsatkichi (n) ga teskari bog`langan ekan;

Dizel dvigateli uchun $V_z=\rho V_c$ va $V_b=V_a$ ekanligini ehtiborga olib, uni o`rniga quyib quyidagini hosil kilamiz:

$$T = T_z \cdot \frac{P_b V_b}{P_z V_z} = T_z \cdot \frac{P_z V_a}{\delta^{n_2} \cdot P_z \cdot \rho \cdot V_c} = T_z \cdot \frac{V_a / V_c}{\delta^{n_2} \cdot \rho} = T \cdot \frac{\varepsilon}{\delta^{n_2} \cdot \rho} = T_z \cdot \frac{\delta}{\delta^{n_2}} = \frac{T_z}{\delta^{n_2-1}},$$

demak, $$T_b = \frac{T_z}{\delta^{n_2-1}}$$, K

Xulosa: Kengayish oxiridagi haroratni (T_b) yonish oxiridagi haroratga (T_z) to`g`ri, kengayish darajasiga (b) va politrop ko`rsatkichiga ($n_2$) teskari bog`langan ekan [1].

Kengayish oxiridagi gazning termodinamik ko`rsatkichlari

Kengayish jarayoni kursatkichlarining **amaldagi qiymatlari** quyidagi oraliqlarda bo’ladi [1]:

Dvigatel turi	n_2	$P_{b,}$ MPa	$T_{b,}$ K
Karbyuratorli	1,23-1,3	0,35-0,60	1400-1700
Dizel	1,18-1,28	0,20- 0,50	1000-1400

Foydalanilgan adabiyotlar

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