“Toshkent irrigatsiya va qishloq xo’jaligini mexanizatsiyalash muhandislari instituti”
Milliy tadqiqot universiteti

Termodinamika va Issiqlik uzatish asoslari fani

Mavzu:
Issiqlik dvigatellarining ideal sikllari

texnika fanlari nomzodi , dotsenti
Nuritov Ikrom Rajabovich

Issiqlik dvigatellarining ideal sikllari

Reja:

1.Porshenli ichki yonuv dvigatellari (i.yo.d) ning ideal sikllari

1.1. O'zgarmas hajmda issiqlik beriladigan ichki yonuv dvigatelining sikli .

1.2. O'zgarmas bosimda issiqlik beriladigan ichki yonuv dvigatelining sikli.

1.3. Aralash usulda issiqlik beriladigan ichki yonuv dvigatelining sikli.

1.4. Issiqlik foydali ish koefftsientlari, oshirish usullari.

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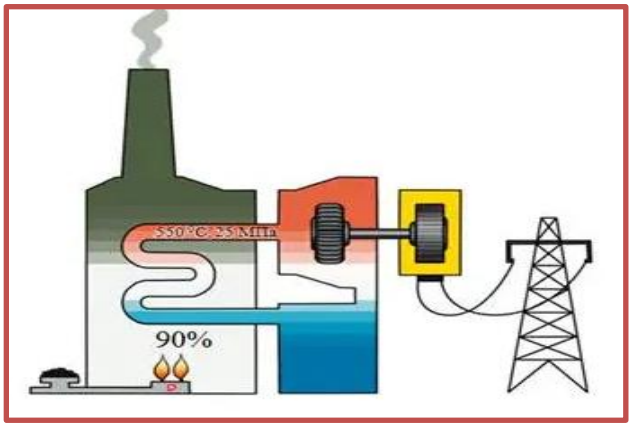
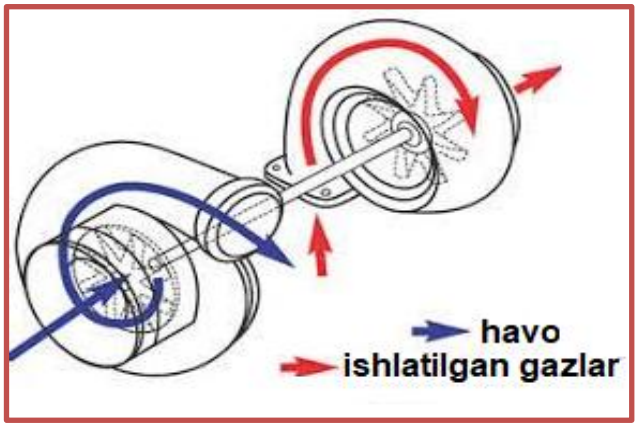
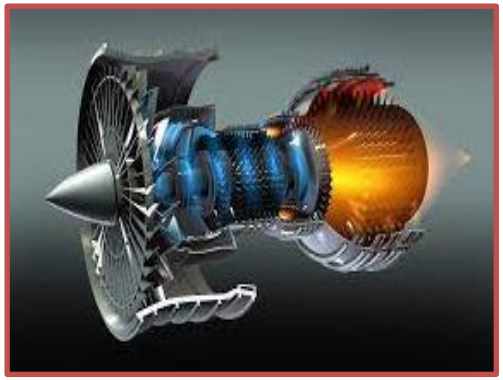
Ochiq tizimlar termodinamikasi

Texnikaning turli sohalarida uzluksiz gaz yoki bug‘ oqimlari bilan ishlashga to‘g‘ri keladi. **Masalan,** bug‘ mashinalarida, gaz turbinalarida, turbokompressorlarda, reaktiv dvigatel va hokozalar.







bunda, quvurning ko‘ndalang kesimi bo‘yicha gaz teng tarqalgan, quvur ko‘ndalang kesimi o‘zgargani bilan undan o‘tayotgan gaz miqdori vaqt davomida o'zgarmas va gaz oqimi bo‘yicha asosiy ko‘rsatkichlari o‘zgarmay qoladi, **m-**1sekundda quvurdan oqib o‘tayotgan gaz massasi, kg/s;

$$m = \frac{f_1 \cdot C_1}{v_1} = \frac{f_2 \cdot C_2}{v_2} = \frac{f_3 \cdot C_3}{v_3} = \frac{f \cdot C}{v} = const, \quad mv = f \cdot C,$$

ДВИГАТЕЛНИ_ЙИ?ИЛИШИ.mp4

1.Porshenli ichki yonuv dvigatellari (i.yo.d) ning ideal sikllari

Ideal sikllarni o’rganib chiqishda dvigatel silindrlari ichida sodir bo’ladigan jarayonlarni tadqiq va jarayonlarning f.i.k. ga ta`sir qiluvchi omillar tahlil qilinadi.

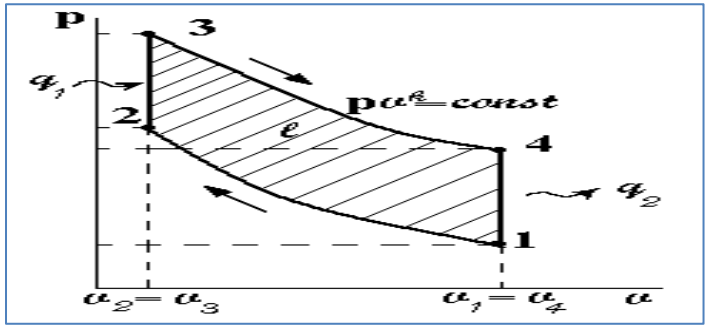
Sikllarni o’rganishda quyidagi shartlarga amal qilamiz:

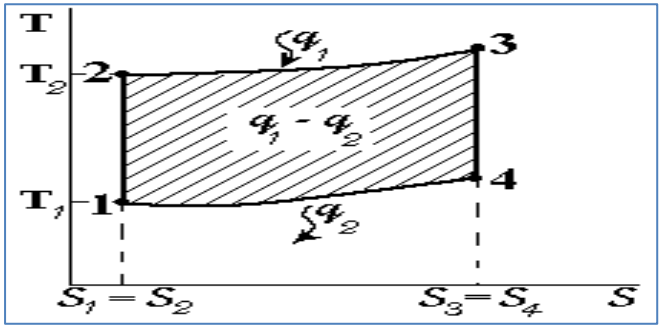
1) Ishchi jism sifatida ideal gaz olinadi;
2) Sikllar - yopiq va qaytuvchan;
3) Ishchi jism kimyoviy o’zgarmas (ya’ni yonish jarayoni sodir bo’lmaydi);
4) Yonish jarayoni o’rniga gazga teng miqdordagi issiqlik berish bilan almashtiriladi.

Shunday qilib, texnikaviy termodinamika faqat eng yuqori f.i.k. beradigan jarayonlarni va ularning eng qulay kombinatsiyalarini ko’rib chiqadi. Demak, dvigatelning ideal ishlash sharoitini o’rganadi.

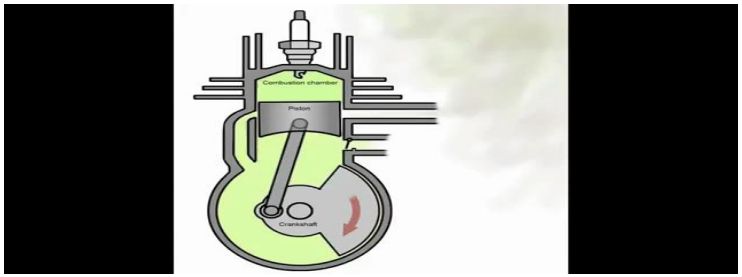
1.1. O’zgarmas hajmda issiqlik beriladigan i.yo.d .ning sikli .

O’zgarmas hajmda issiqlik beriladigan siklni **pv** va **Ts** diagrammalarida ifodalaymiz





1- rasm. O’zgarmas hajmda issiqlik beriladigan sikilning $p\vartheta$ va 2-rasm Ts diagrammalarida ifodalangan



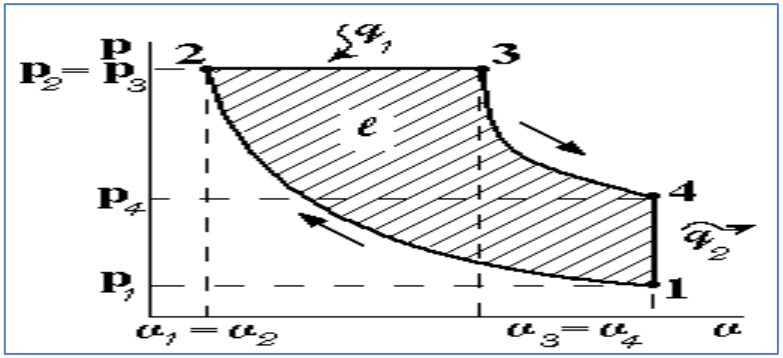
$$\eta_t = 1 - \frac{T_1}{T_2} = 1 - \frac{T_1}{T_1 \cdot \varepsilon^{k-1}} \quad \text{yoki} \quad \eta_t = 1 - \frac{1}{\varepsilon^{k-1}}$$

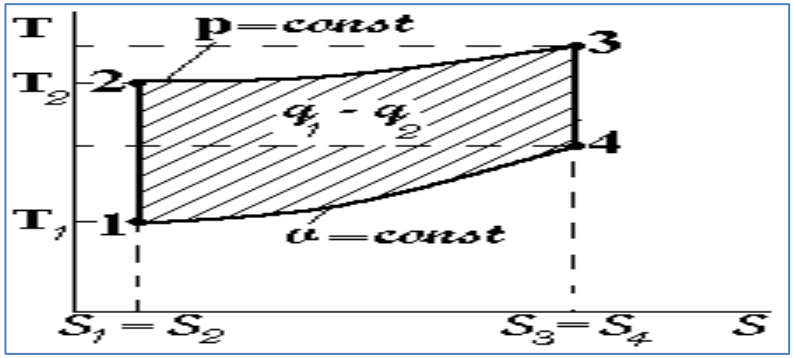
$\frac{\vartheta_1}{\vartheta_2} = \varepsilon$ dvigatelning qisish darajasi

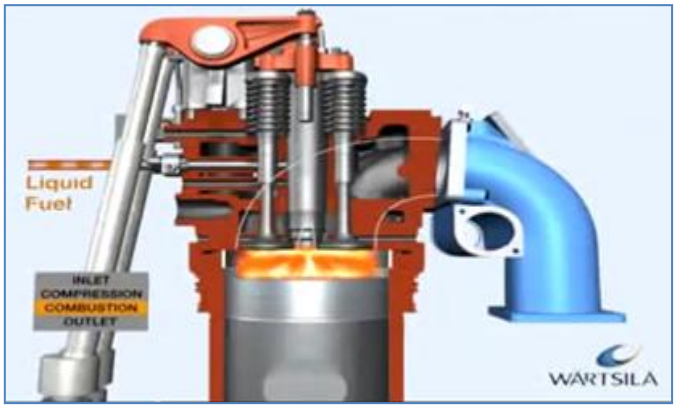
Demak, siklning termik f.i.k. dvigatelning qisish darajasiga va adiabata ko’rsatkichlariga to’g’ri proportsional bog’langan.

1.2. O’zgarmas bosimda issiqlik beriladigan i.yo.d .ning sikli .

Yuqorida ko’rib chiqilgan sikldan bu siklning asosiy farqi shuki, bu yerda gazga beriladigan issiqlik q_1 oniy bo’lmay biroz davom etadi. Bu paytda silindrda bosim o’zgarmaydi (izobara). Siklni *pv* va *Ts* diagrammalarida ifodalaymiz 3 va 4 - rasmda siklni ifodalovchi kontur ichidagi yuza ma’lum masshtabda sikldan olingan ishni ifodalaydi. Rasmdagi yuza esa siklda foydali ishga aylangan issiqlik miqdori bo’lib hisoblanadi.





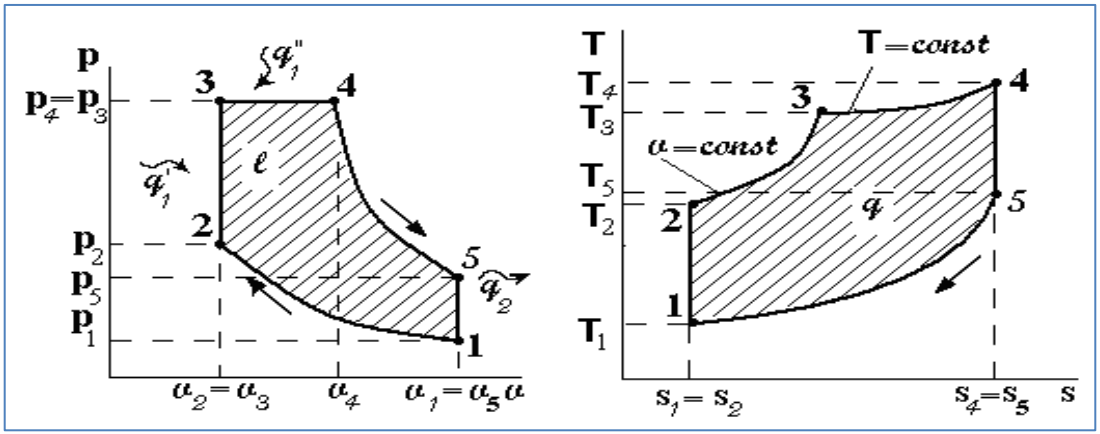


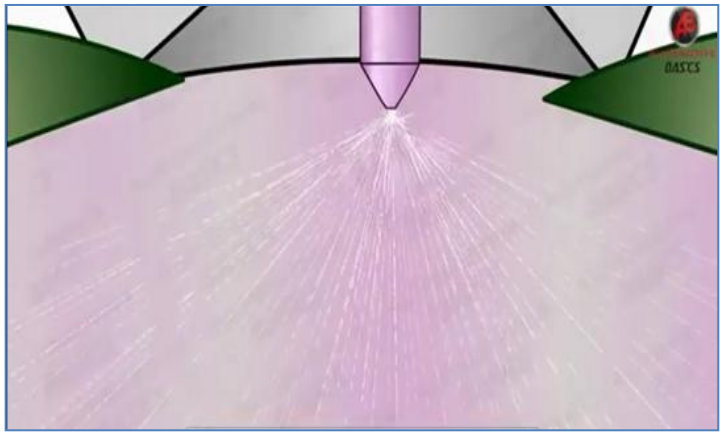
$$\eta_t = 1 - \frac{T_1}{T_2} \cdot \frac{(p^k - 1)}{K(p-1)} = 1 - \frac{1}{\varepsilon^{k-1}} \cdot \frac{p^k - 1}{K(p-1)}$$

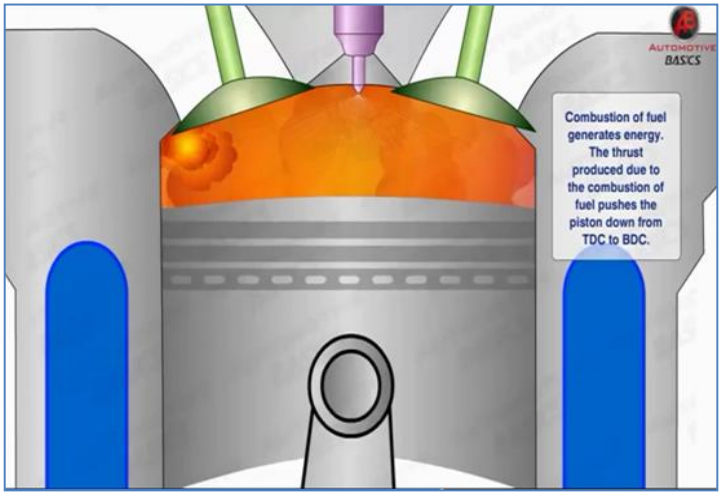
$\frac{\vartheta_3}{\vartheta_2} = p$ dastlabki kengayish darajasi

1.3. Aralash usulda issiqlik beriladigan i.yo.d .ning sikli.

Siklni ***pv*** va ***Ts*** koordinatalarida chizamiz. Sikl 5 ta jarayondan tashkil topgan: 1-2- adiabatik qisish; 2-3- izoxorik (gazga) issiqlik berish; 3-4- izobarik (gazga) issiqlik berish; 4-5- adiabatik kengayish (ish olish); 5-1- gazning izoxorik sovushi (gazdan issiqlikning sovutgichga o'tishi).







$$\eta_t = 1 - \frac{1}{\varepsilon^{k-1}} \cdot \frac{\lambda \cdot p^k - 1}{(\lambda - 1) + k\lambda(p - 1)}$$

$$\frac{p_3}{p_2} = \frac{T_3}{T_2} = \lambda$$

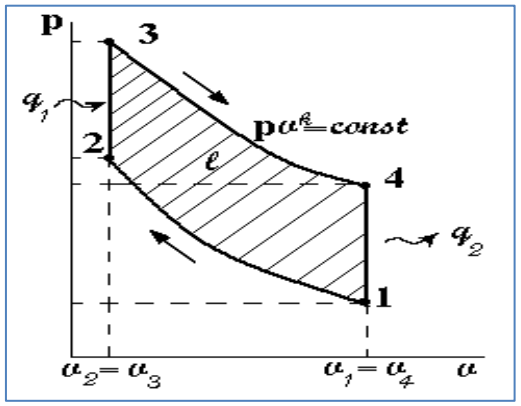
i.yo.d.larida yonishdagi bosimning ortish darajasi deyiladi.

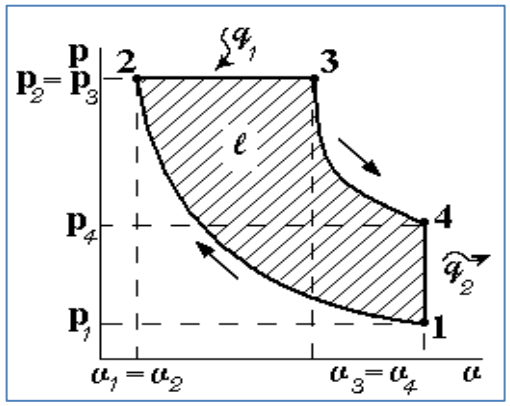
Aralash usulda issiqlik beriladigan sikl hozir ishlatilayotgan tezyurar (tirsakli valning aylanish tezligi 1000 ayl/min dan ancha yuqori) avtotraktor dizellarida keng qo’llanilmoqda.

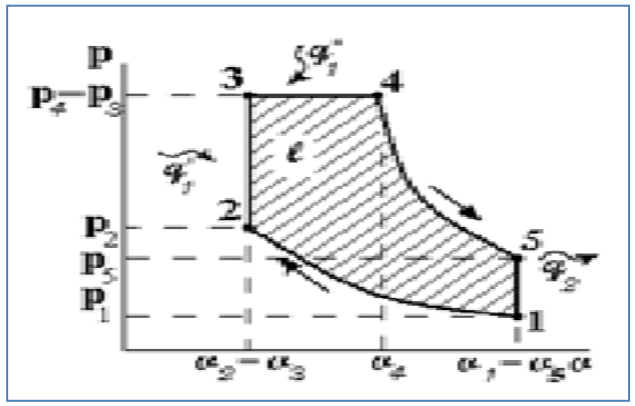
Buning sababi qisish darajasi ***(ε)*** ning yuqoriligi va ***k*** ning amaliy qiymatlarida siklning termik f.i.k. ancha yuqori (karbyuratorli dvigatellarga qaraganda) bo’lmoqda.

Ana shu xulosaga ko’ra, dunyo dvigatel sozligida shu kunga kelib traktor dvigatellari deyarli ***100 %*** dizellashdi, yengil avtomobil dvigatellari hozircha faqat ***30…35%*** dizellashdi, bu jarayon ilg’or firmalarda davom etmoqda.

« Baliq skeleti» sxemasi - Ichki Yonuv dvigatellarining ideal sikllari







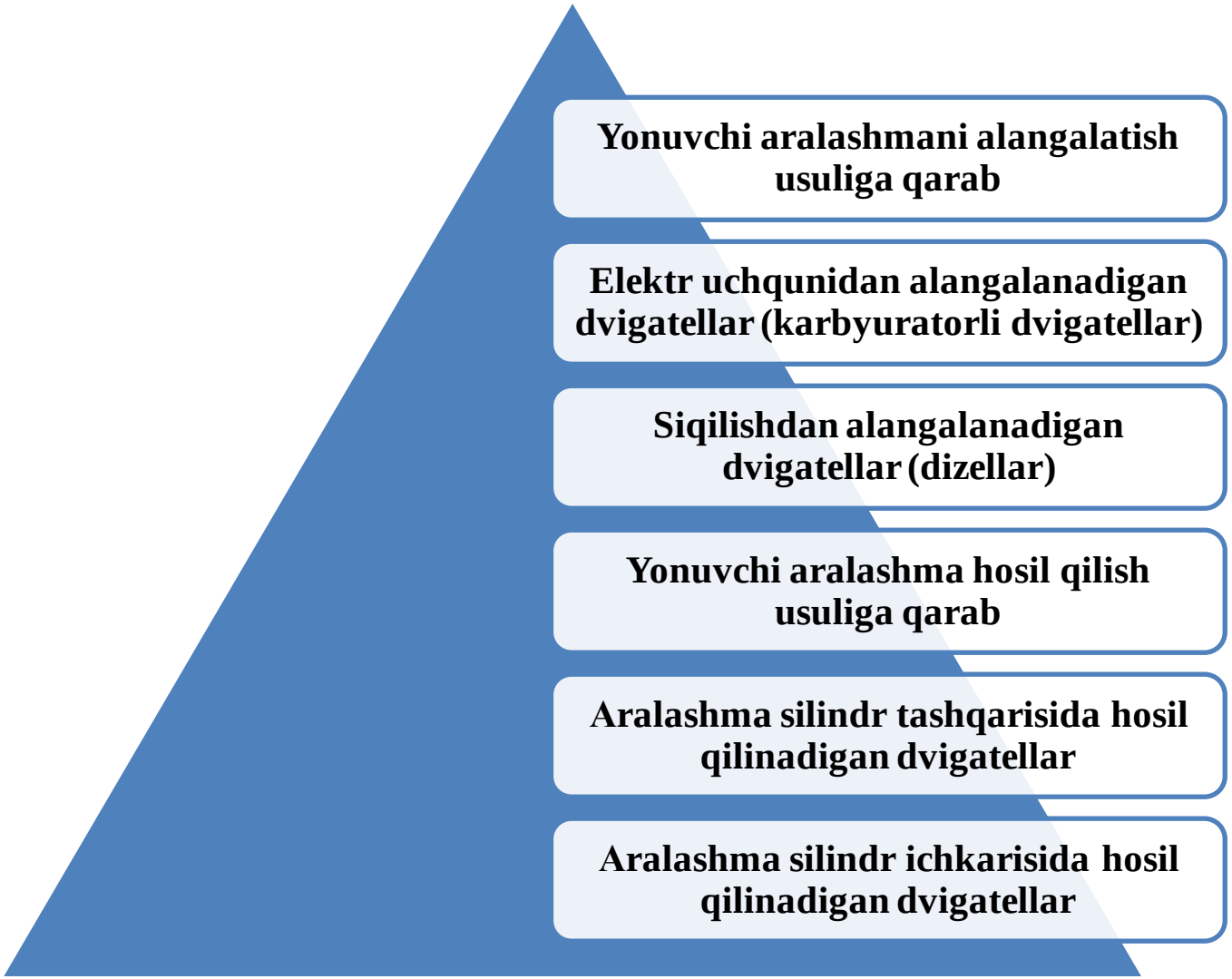
Ichki Yonuv dvigatellarining ideal sikllari

- O'zgarmas hajmda issiqlik beriladigan sikl.
- O'zgarmas bosimda issiqlik beriladigan sikl
- Aralash usulda issiqlik beriladigan sikli
- 2 ta izoxora va 2 ta adiabata jarayonlaridan tashkil topadi
- 2 ta izobara va 1 ta izoxora va 2 ta adiabat jarayonlaridan tashkil topadi
- 1 ta izobara va 1 ta izoxora va 2 ta adiabat jarayonlaridan tashkil topadi

TOIFALASH JADVALI

ICHKI YONUV DVIGATELLARINING TUZILISHI VA ISHLASHINI O’RGANISH BO’YICHA	
Mexanizmlari	Sistemalari
1. Krivoship shatun mexanizmi	1. Ta’minlash sistemasi
2. Gaz taqsimlash mexanizmi	2. Moylash sistemasi
	3. Sovutish sistemasi
	4. Yurgizib yuborish sistemasi
	5. O’t oldirish sistemasi

Porshenli IYOD quyidagi belgilariga qarab klassifikatsiyalanadi



1.4. Issiqlik foydali ish koefftsientlari, oshirish usullari.

Yuqorida ko’rib chiqilgan sikllar hozirgi zamon tez yurar karbyuratorli va dizelli dvigatellarida keng qo’llaniladi. Dvigatelning f.i.k. ni orttirish uchun uning ε va K ko’rsatkichlarini kattaroq qilish kerak. $"\varepsilon"$ ni kattalashtirish uchun dvigatelga oktan soni yuqoriroq benzin kerak bo’ladi. $"K"$ ni orttirish uchun esa dvigatel silindriga havo emas, balki biror bir atomli gaz kiritish kerak, bu esa mushkul masala.

Demak, karbyuratorli dvigatellarida benzinni oktan sonini orttirish osonroq yo’l hisoblanadi.