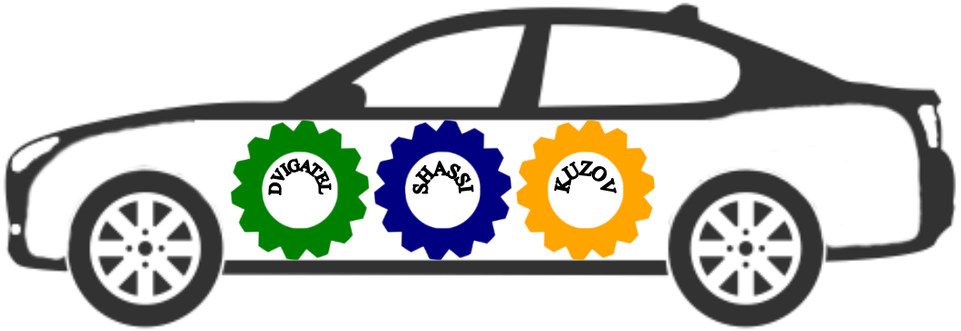
AVTOMOBILLAR KONSTRUKSIYASI



2nd Topic: Engine

(2-Mavzu: Dvigatel)

Part 1

Associate Professor: Yusupov Sarvarbek

2-Mavzu: Dvigatel

(2nd Topic: Engine)

O‘quv rejasi:

2.1. Avtomobil dvigatellarining tasnifi.

2.2. Ichki yonuv dvigatelining asosiy parametrlari.

2.3. Ikki taktli dvigatellar.

2.4. To‘rt taktli benzinli dvigatellar.

2.5. To‘rt taktli dizelli dvigatellar.

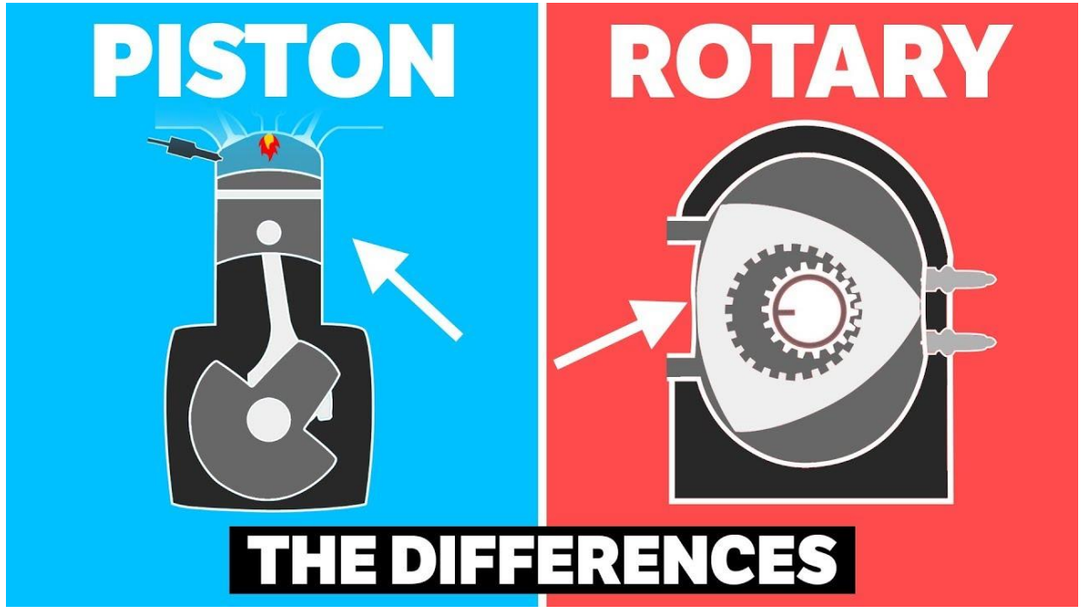
2.6. Rotor-porshenli dvigatellar.

2.7. Gazturbinali dvigatellar.

2.1. Avtomobil dvigatellarining tasnifi.

Avtomobil harakatlanishi uchun mustaqil energiya manbaiga ega bo‘lishi kerak.

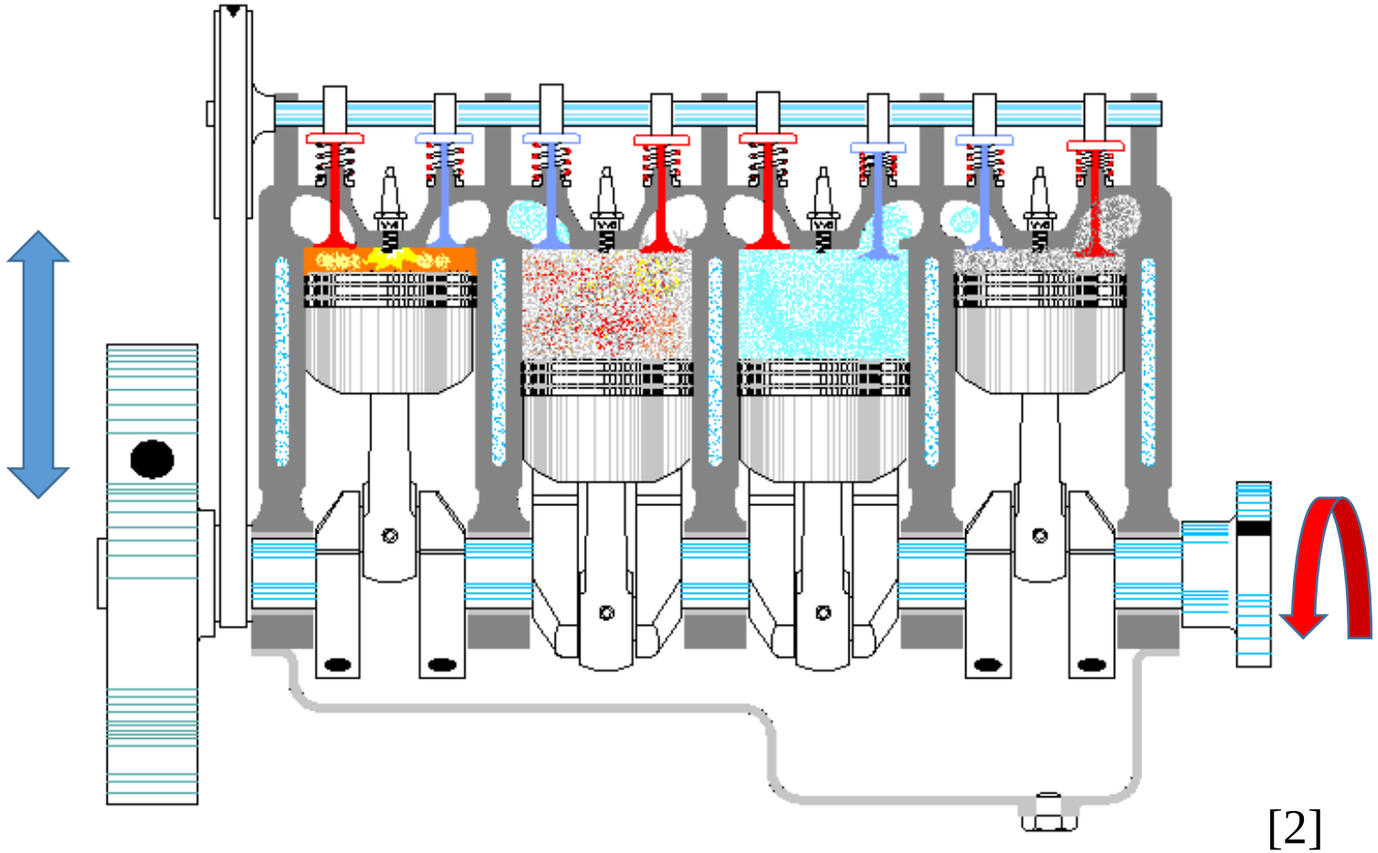
Zamonaviy avtotransport vositalarida asosan **ichki yonuv dvigatellari** keng tarqalgan.



Konstruksiyasi bo‘yicha ichki yonuv dvigatellari **porshenli** va **rotorlilarga** bo‘linadi.

[1]

Porshenli dvigatellarda yonilg‘ining yonishi natijasida



[2]

gazning kengayishida hosil bo‘lgan bosimni porshen o‘ziga qabul qiladi.

tirsakli valning aylanma harakati yuzaga keladi.

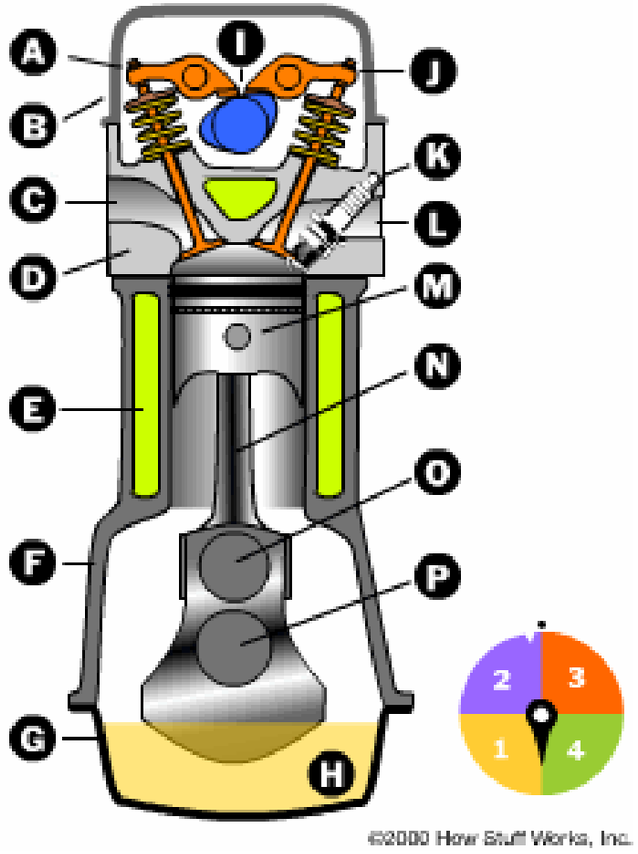
Uning to‘g‘ri chiziqli ilgarilama va qaytma yo‘nalishi orqali

Yonilg‘i yonishidan hosil bo‘ladigan issiqlik energiyani mexanik energiyaga aylantiradigan dvigatellar ikki xil bo‘ladi:

- **Ichki yonuv dvigatellar;**
- **Tashqi yonuv dvigatellar.**

Avtomobillarda ichki yonuv dvigatellar keng tarqalgan.

Ichki yonuv dvigateli (IYoD) **mexanizm** va **tizimlar** majmuasidan tashkil topgan.



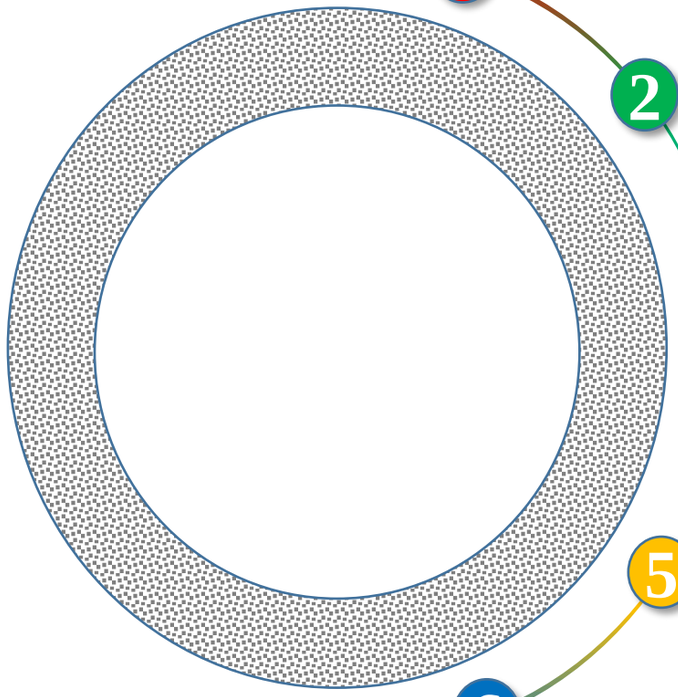
[3]

Benzinli dvigatellarda majbur ***o‘t oldirish tizimi***,

Dizel dvigatellarida esa ***yuritish tizimi*** bo‘ladi.

[4]

Avtomobillarga o‘rnatiladigan porshenli ichki yonuv dvigatellari quyidagi belgilari bo‘yicha turlarga bo‘linadi:



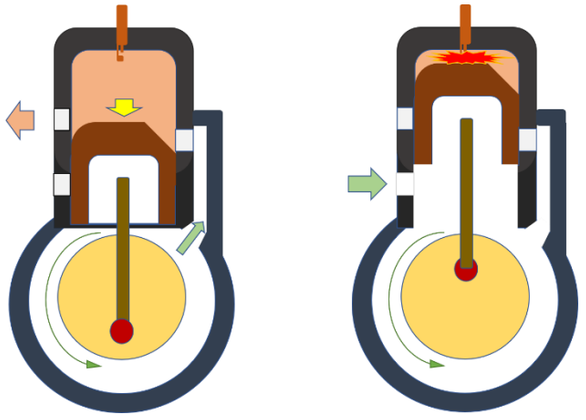
1. Ishlatiladigan yonilg‘ining turi bo‘yicha:
2. Ish siklining amalga oshishi bo‘yicha:
3. Yonuvchi aralashmaning hosil qilish usuli bo‘yicha:
4. Ish aralashmasining alangalanishi bo‘yicha:
5. Konstruktiv belgilari bo‘yicha:
6. Sovutish usuli bo‘yicha:

1 Ishlatiladigan yonilg‘ining turi bo‘yicha:

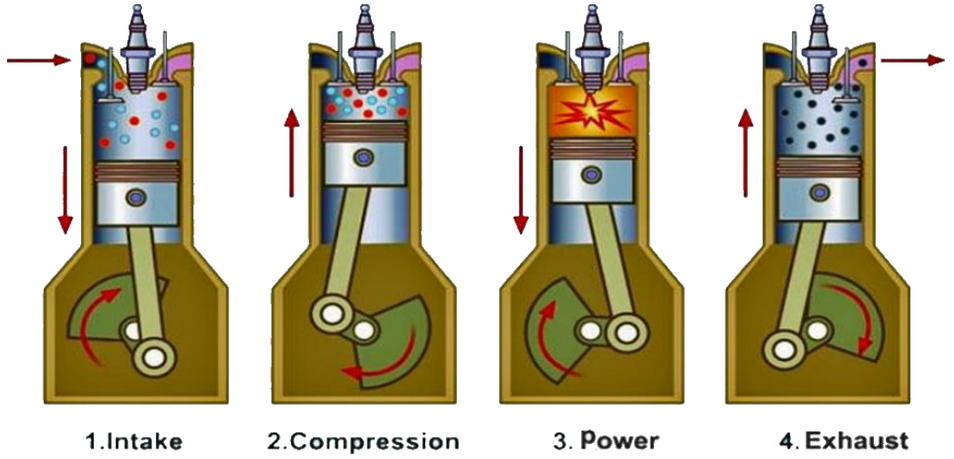
- Yengil suyuq yonilg‘i (benzin, gazokondensat) bilan ishlaydigan;
- Og‘ir suyuq yonilg‘i (dizel) bilan ishlaydigan;
- Gazsimon yonilg‘i (tabiiy, sanoat va sintetik gazlar) bilan ishlaydigan.

2 Ish siklining amalga oshishi bo‘yicha:

- Ikki taktli;
- To‘rt taktli.



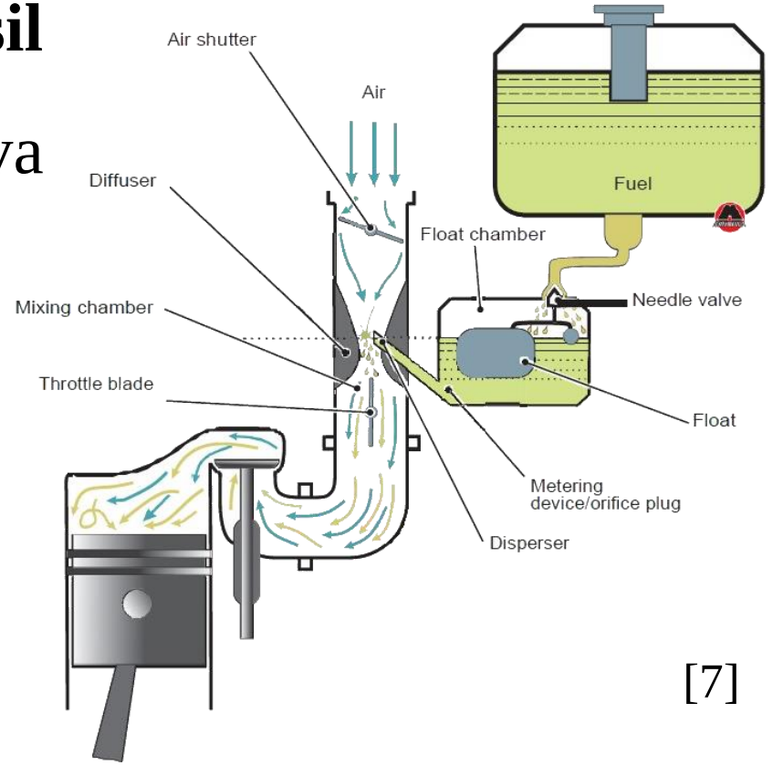
[5]



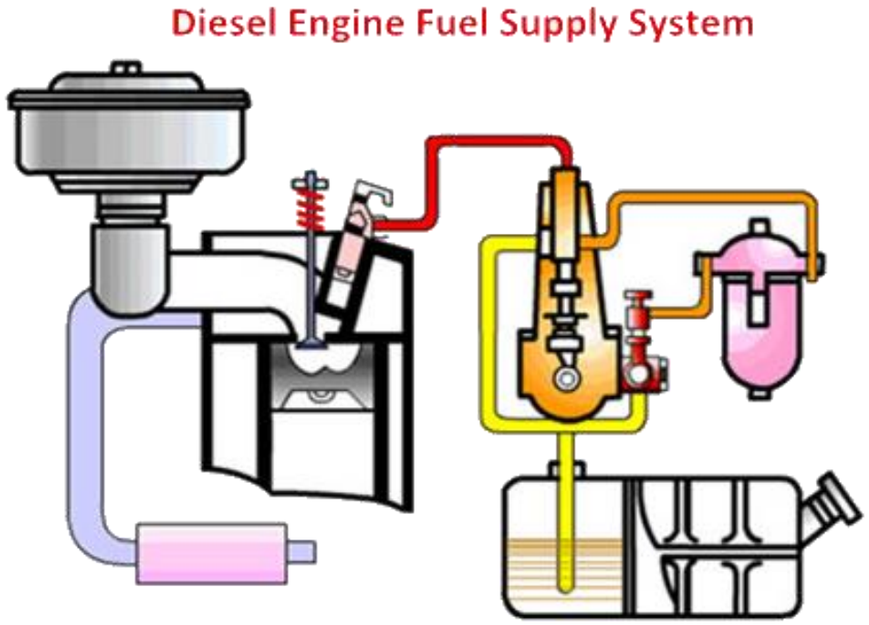
[6]

3 Yonuvchi aralashmaning hosil qilish usuli bo‘yicha:

➢ **Silindr tashqarisida yonuvchi aralashma hosil qilinadigan** (karburatorli, gazda ishlaydigan va purkash tizimli) **dvigatellar;**



[7]



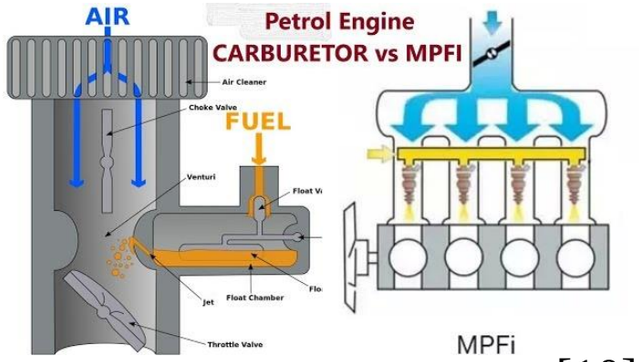
[8]

➢ **Silindr ichida yonuvchi aralashma hosil qiluvchi** (dizel, purkash tizimli) **dvigatellar.**

4 Ish aralashmasining alangalanishi bo‘yicha:

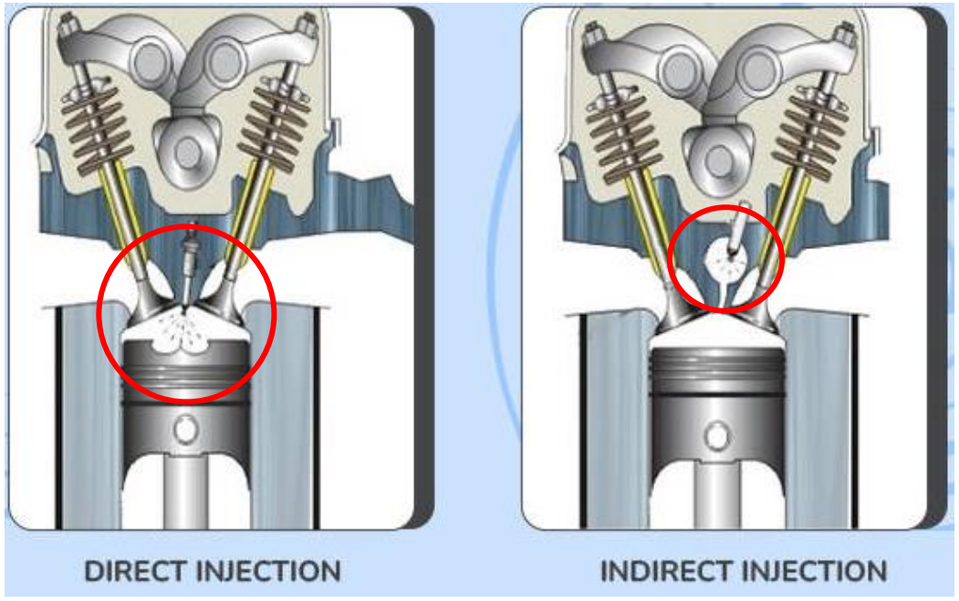
➢ Majburan alangalanuvchi (elektr uchqunidan);

[9]



[10]

➢ Siqish natijasida o‘z-o‘zidan alangalanuvchi dizel dvigatellari;



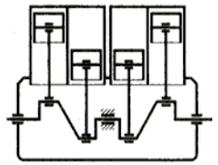
[11]

➢ Forkkamerali alanga bilan o‘t oldiriladigan dvigatellar.

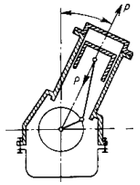
Konstruktiv belgilari bo‘yicha:

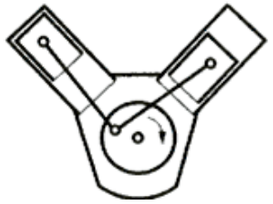
1. Silindrlar soni va ularning joylashuviga qarab:

- Vertikal qatorli;

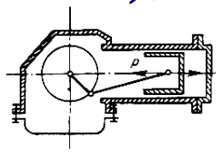


- Burchak ostida;

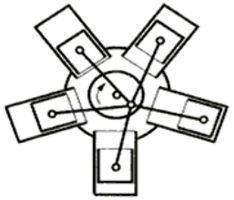




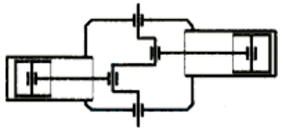
- Burchaksimon (V simon);
- Gorizontal qatorli;

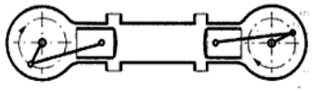


- Yulduz shaklli;



- Qarama-qarshi yotuvchi silindrlilar.

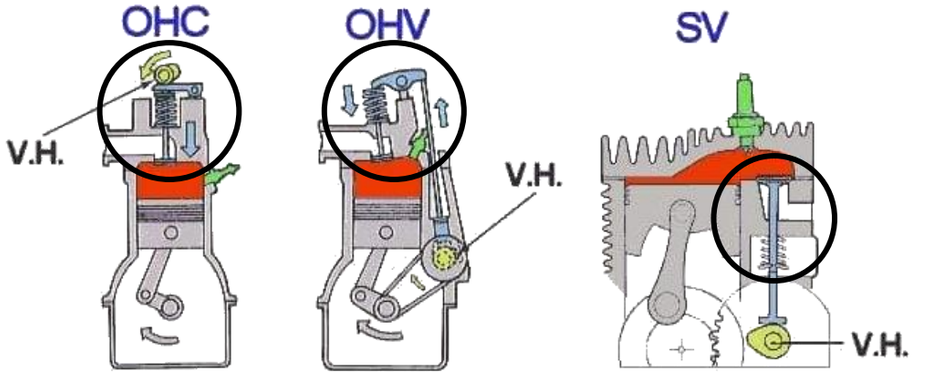




[12]

2. Gaz taqsimlash mexanizmining joylashuvi bo‘yicha:

- Klapanlar yuqorida joylashgan;

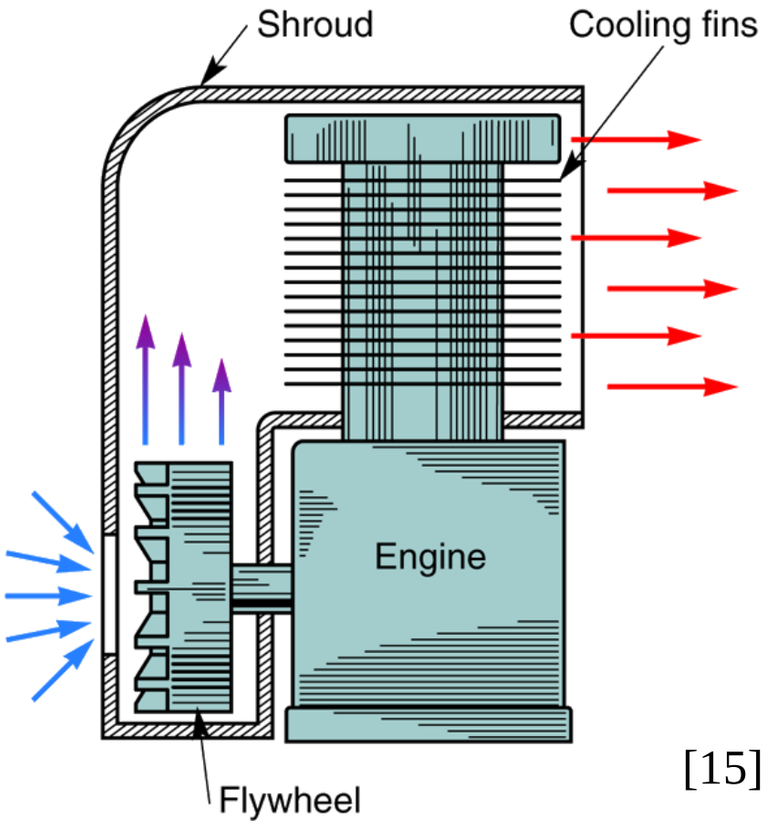


[13]

- Klapanlar pastda joylashgan.

Sovutish usuli bo‘yicha:

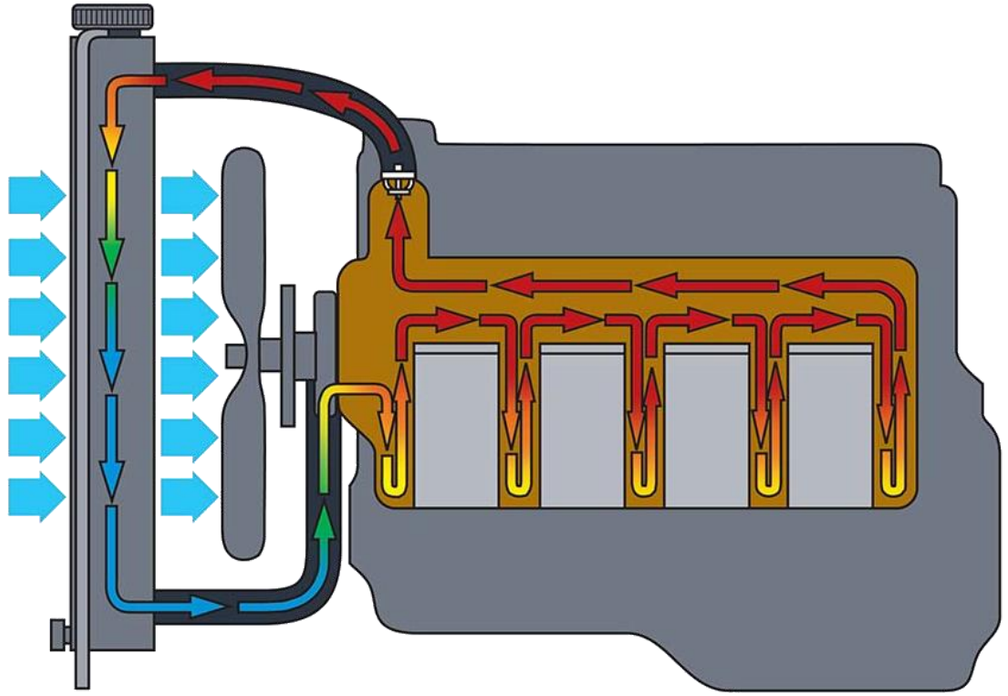
- Havo bilan sovutiladigan;



[15]

- Suyuqlik bilan sovutiladigan.

[14]

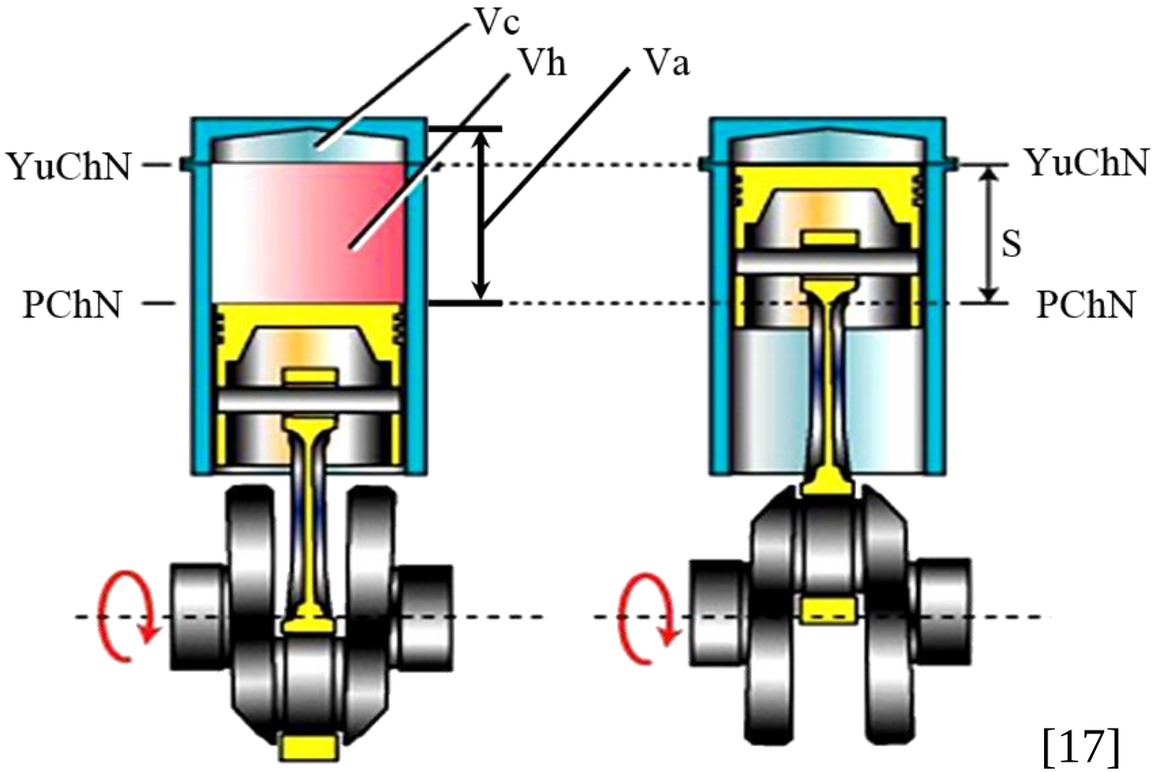


[16]

Yuqorigi chekka nuqta (yu. ch. n) porshenning tirsakli val o‘qidan eng uzoqlashgan silindr ichidagi yuqorigi turish holati.

Pastki chekka nuqta (p. ch. n) porshenning tirsakli val o‘qidan eng yaqinlashgan silindr ichidagi pastki turish holati.

Porshen yo‘li – porshen bir chekka nuqtadan ikkinchi chekka nuqtagacha harakatlanganda bosib o‘tilgan masofa.



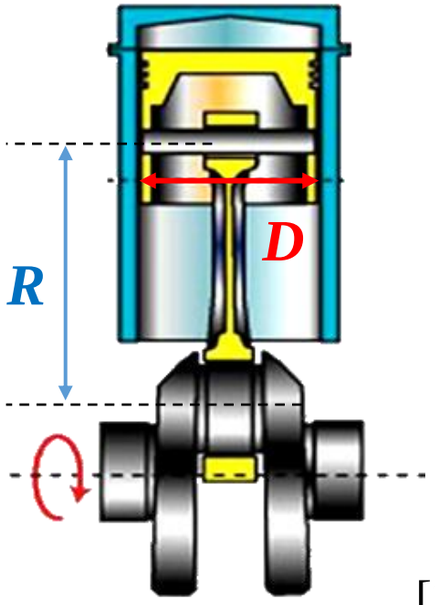
[17]

Porshen yo‘li ***S*** tirsakli valning yarim aylanishiga (180°) mos.

Tirsakli val o‘qidan shatun bo‘ynining o‘qigacha bo‘lgan masofa ***krivoship radiusi R*** deb ataladi. Demak,

$$S = 2 \cdot R$$

Porshen yo‘li ***S*** va silindrning diametric ***D*** dvigatelning asosiy ko‘rsatkichlaridan biridir.

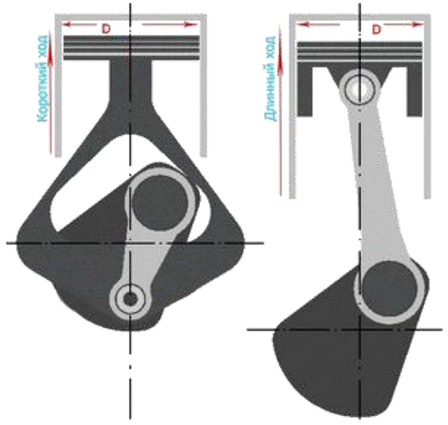


[17]

S / D = 1,0 ***- Kvadratli;***

S / D < 1,0

- Qisqa yo ‘lli;

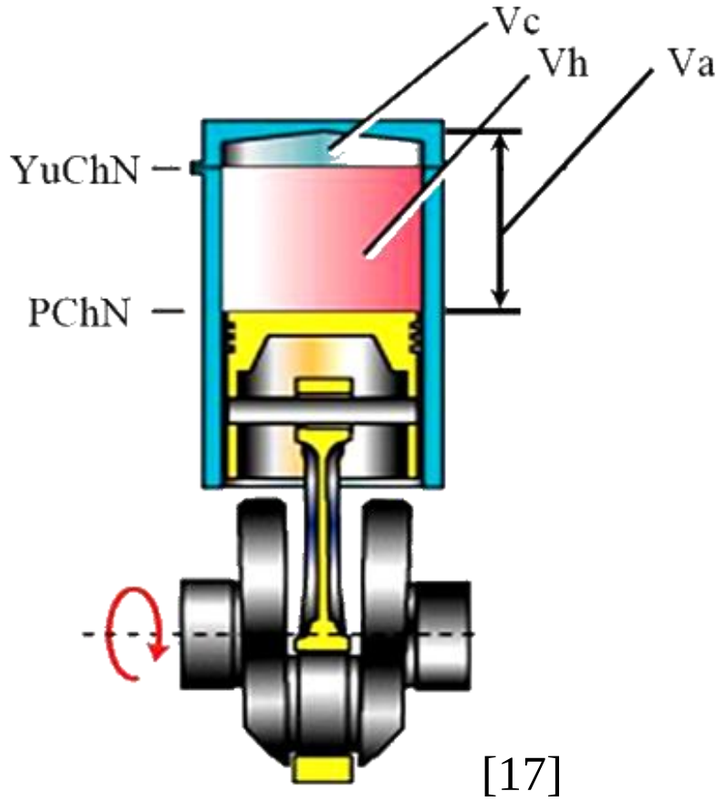


[18]

S / D > 1,0

- Uzun yo ‘lli.

Silindrning ish hajmi $\mathbf{V_h}$ porshen Yu.Ch.N dan P.Ch.N gacha harakatlanganda hosil bo‘lgan hajm tushuniladi.



[17]

$$V_h = \frac{\pi \cdot d^2}{4} \cdot S;\ (m^3)$$

bu yerda: d – silindr diametri, mm;

S – porshen yo‘li, mm.

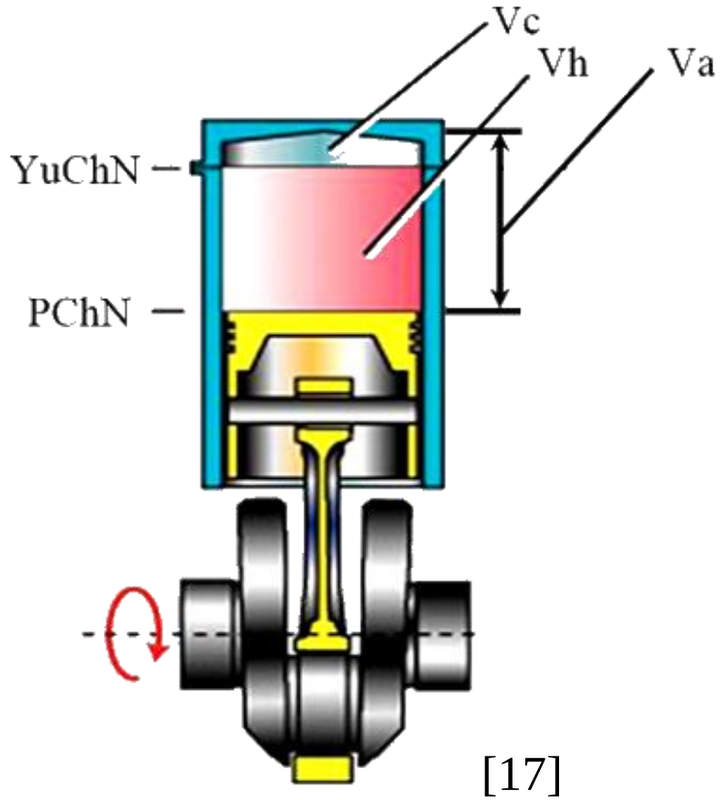
Nexia T-250:

d = 74,7 mm;

S = 84,7 mm.

$$V_h = 0,371\ (m^3)$$

Siqish bo‘linmasi (kamerasi) ning hajmi porshen Yu.Ch.N da turganda, uning yuqorisida hosil bo‘lgan hajm. - V_c



[17]

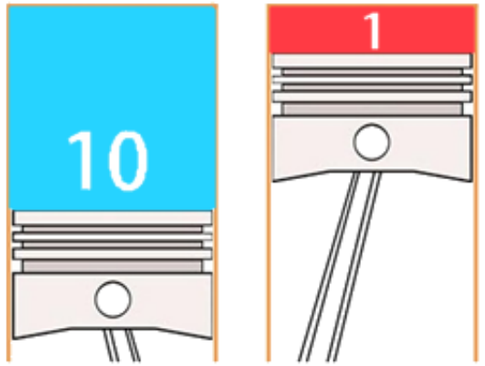
Silindrning to‘la hajmi – porshen P.Ch.N da turganda uning ustida hosil bo‘lgan silindr bo‘shlig‘idir. - V_a

$$V_a = V_h + V_c\ ;\ (m^3)$$

Silindr to‘la hajmini siqish kamerasining hajmiga nisbati ***siqish darajasi*** deb ataladi.

$$\varepsilon = \frac{V_a}{V_c} = \frac{V_h + V_c}{V_c} = \frac{V_h}{V_c} + 1$$

Siqish darajasi porshen P.Ch.N dan Yu.Ch.N ga borganda, silindr ichidagi ish aralashmasining hajmi siqilish tufayli necha marta kamayishini ko‘rsatadi.



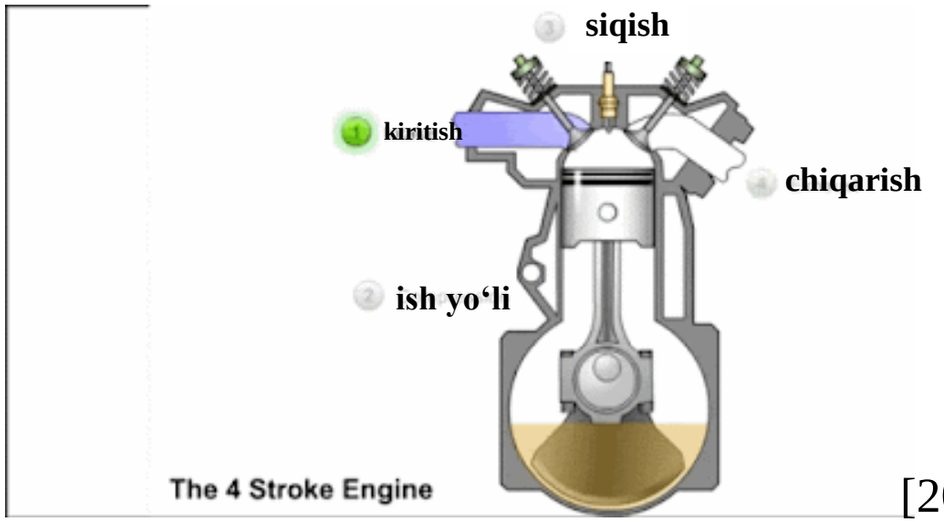
10 : 1 [19]

Benzinli dvigatellar uchun: **8 : 1 – 12 :1**

Dizelli dvigatellar uchun: **14 : 1 – 24 :1**

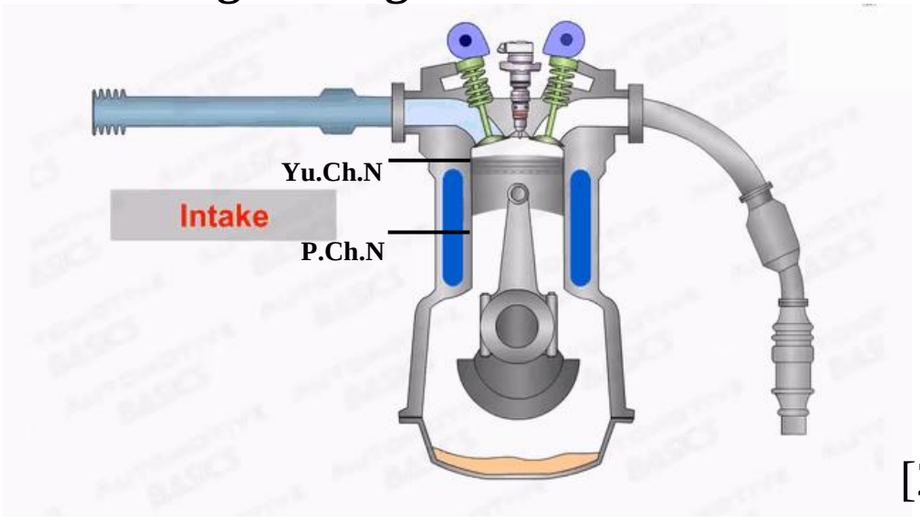
Ish sikli, foydali ish bajarish uchun zarur bo‘lgan ketma – ket sodir bo‘luvchi kiritish, siqish, ish bajarish (ish yo‘li) va chiqarish jarayonlarining yig‘indisidan ibotar.

Benzinli dvigatelning ish sikli



[20]

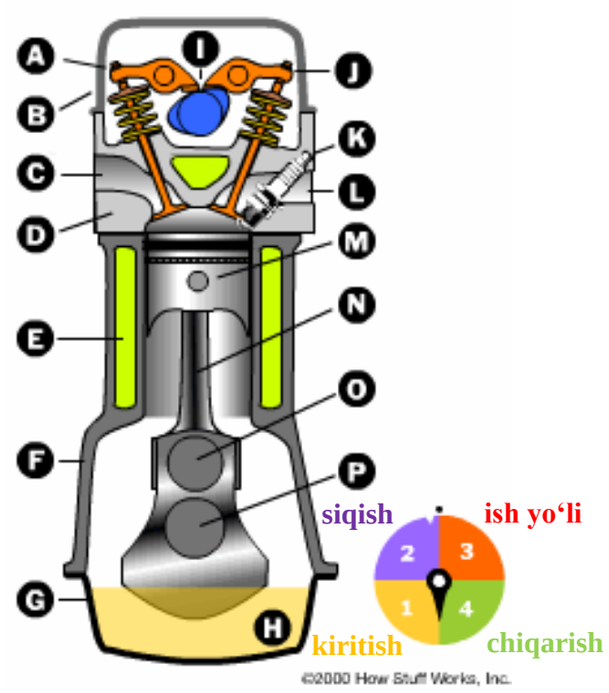
Dizelli dvigatelning ish sikli



[21]

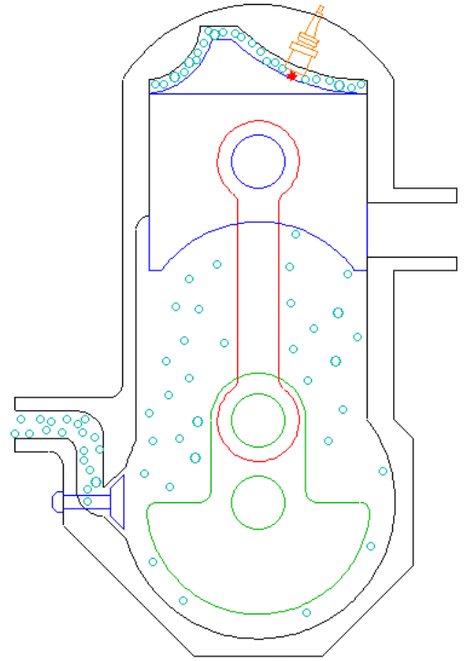
Takt dvigatel ish siklining bir qismi bo‘lib, porshen bir chekka nuqtadan boshqa chekka nuqtaga harakatlanganda bajarilgan jarayondir.

Dvigatel har bir silindrning to‘la ish sikli porshenning to‘rt yurishida yoki tirsakli valning ikki marta to‘liq aylanganda sodir bo‘lsa, bunday dvigatel ***to‘rt taktli*** dvigatel deyiladi.



[3]

Har bir silindrning to‘la ish sikli porshenning ikki yurishida yoki tirsakli valning bir marta to‘liq aylanishida sodir bo‘lsa, bunday dvigatel ***ikki taktli*** dvigatel deb ataladi.



[22]

Dvigatel litraji ko‘p silindrli dvigatellarda barcha silindrlarning litrlarda ifodalangan ish hajmlari yig‘indisidan ibotar.

$$V_l = 10^{-3} * V_h * i$$

bu yerda:

V_l – dvigarelning litraji, *l*;

V_h – bitta silindrning ish hajmi;

i – silindrlar soni;

10^{-3} – litrga aylantiruvchi koeffitsient.

Nexia T-250:

$$V_h = 0,371\ (m^3)$$

$$i = 4$$

$$V_l = 1,485 \approx 1,5\ l$$

Dvigatelning ishini xarakterlovchi asosiy ko‘rsatkichlar:

- **Burovchi moment;**
- **Quvvat;**
- **Tejamkorlik;**
- **Foydali ish koeffitsient.**

BUROVCHI MOMENT:

Porshenga ta’sir etuvchi gazlarning bosim kuchi shatun orqali krivoshipga uzatilishi dvigatelning tirsakli valida **BUROVCHI MOMENTNI** hosil qiladi.

Burovchi moment nyutonmetrlar (N*m)da ifodalanadi. Dvigatel muayyan burovchi moment hosil qilib ish bajaradi.

QUVVAT:

Dvigatelning quvvati indikatorli (N_i), effektiv (N_e) va litr quvvat (N_l) larga farqlanadi.

Indikator quvvat (N_i) - dvigatel silindrida gazlarning kengayishidan hosil bo‘ladigan quvvat.

$$V_l + i + n + P_i$$

$$N_i = P_i \cdot V_h \cdot n \cdot i /(30 \cdot \tau),$$

bu yerda:

P_i – o‘rtacha indikator bosim, *MPa*;

V_h - bir silindrning ishchi hajmi, *l*;

n - tirsakli valning aylanish chastotasi, min^{-1};

i - silindrlar soni;

τ - dvigatelning taktliligi,

(to’rt taktli dvigatellar uchun τ=2;

ikki taktlilar uchun τ=1).

Dvigatelning effektiv quvvati (N_e) - bu dvigatelning tirsakli validan olinib, kuch uzatish qismiga beriladigan quvvat hisoblanadi.

$$N_e = M_k \cdot n / 9550$$

Dvigatelning litr quvvati (N_l) - bu dvigatel effektiv quvvatining silindrlari ish hajmiga nisbatidir.

$$N_1 = \frac{N_e}{V_h \cdot i}, \quad \text{kVt/}l$$

To’rt taktli dizellarda: **7÷13 kVt/*l*;** Benzinli dvigatellarda: **18÷38 kVt/*l*.**

Dvigatellarning tejamli ishlashi yonilg‘ining effektiv solishtirma sarfi va F.I.K bilan xarakterlanadi.

YONILG‘INING EFFEKTIV SOLISHTIRMA SARFI - bu yonilg‘ining bir soatdagi sarfining dvigatelning effektiv quvvatiga nisbatidir.

$$q_e = \zeta_m \cdot 10^3 / N_e,$$

bu yerda: ζ_m – soatlik yonilg‘i sarfi, kg/soat.

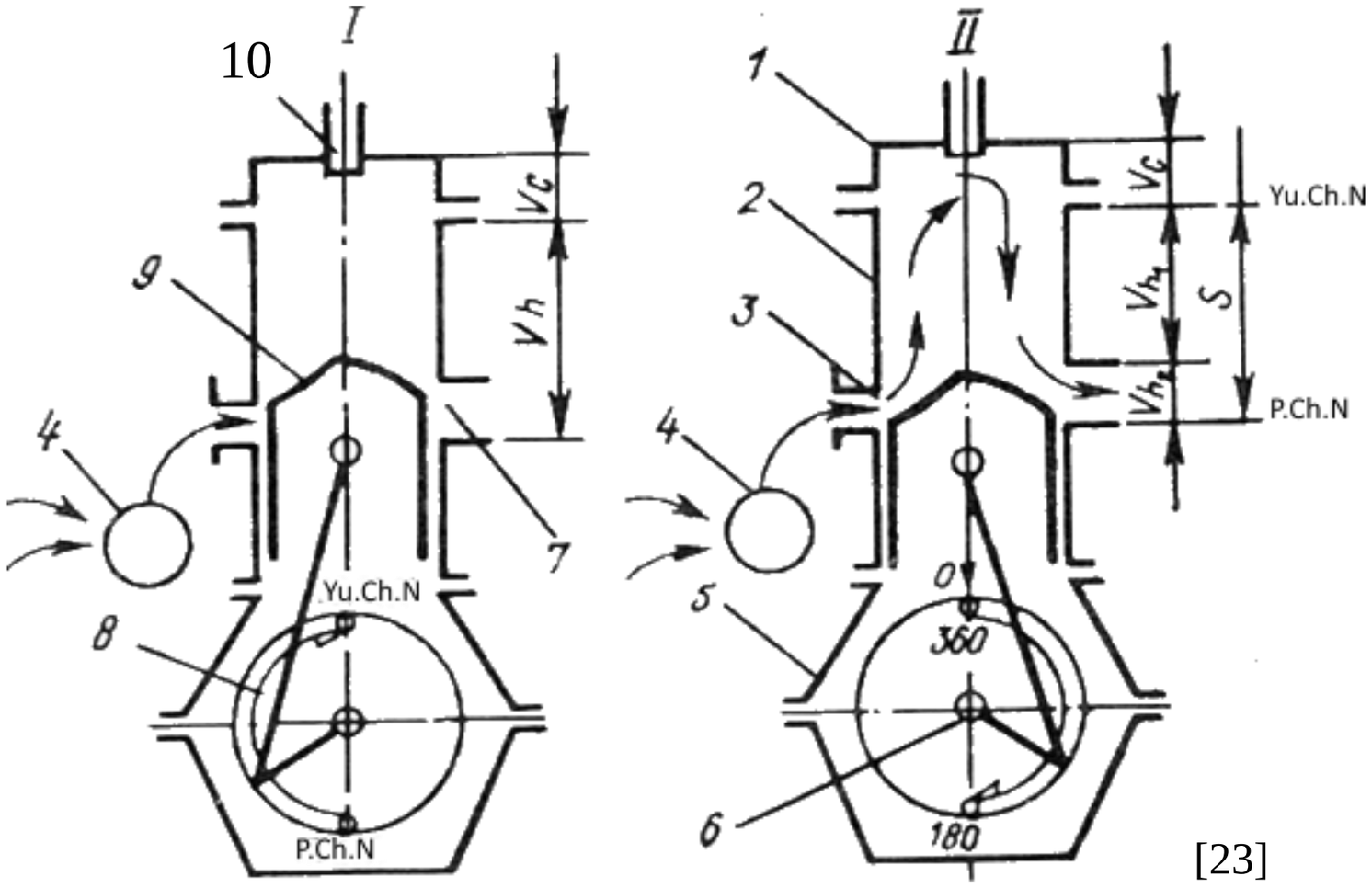
Mexanik foydali ish koeffitsient - bu dvigatel effektiv quvvatining indikator quvvatiga nisbatidir.

$$\eta_м = \frac{N_e}{N_i}.$$

2.3. Ikki taktli dvigatellar.

Kiritish takti

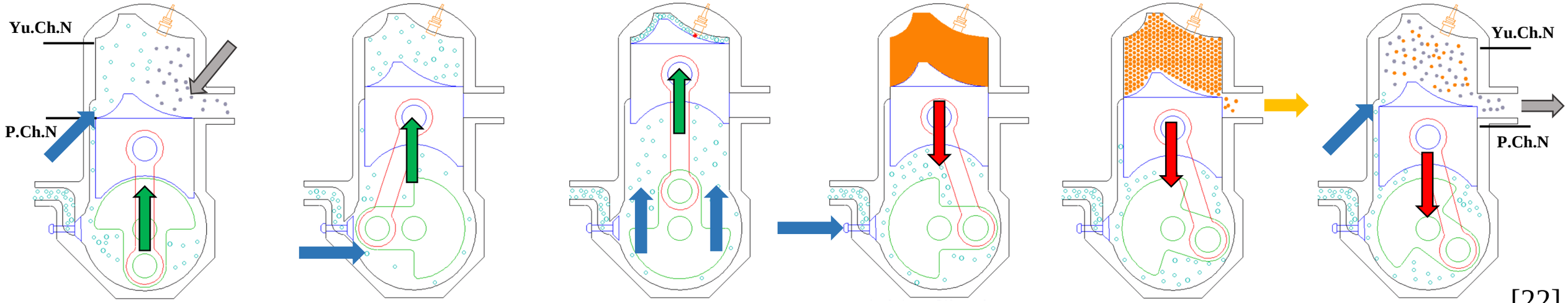
Chiqarish takti



[23]

Ikki taktli dvigatelning ish sikli tasviri.

1-silindr blokining kallagi;
2-silindrlar bloki;
3-kiritish darchasi;
4-nasos (benzinda ishchi aralashma, dizelda havo);
5-silindrlar blokining quyi qismi;
6-tirsakli val;
7-chiqarish darchasi;
8-tirsakli valning jag‘i;
9-porshen;
10-o‘t oldirish shami (benzinli dvigatelda) yoki forsunka (dizelli dvigatelda).



[22]

Kiritish takti (Kiritish jarayonining boshlanishi

Siqish jarayoni

Yonish jarayoni

Kengayish jarayoni

Chiqarish takti (Chiqarish jarayonining boshlanishi

Bunday dvigatellarni moylash uchun yonilg‘iga moy ma’lum proporsiyada (1:20) qo‘shiladi.

Yonilg‘i + Moy + Havo

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