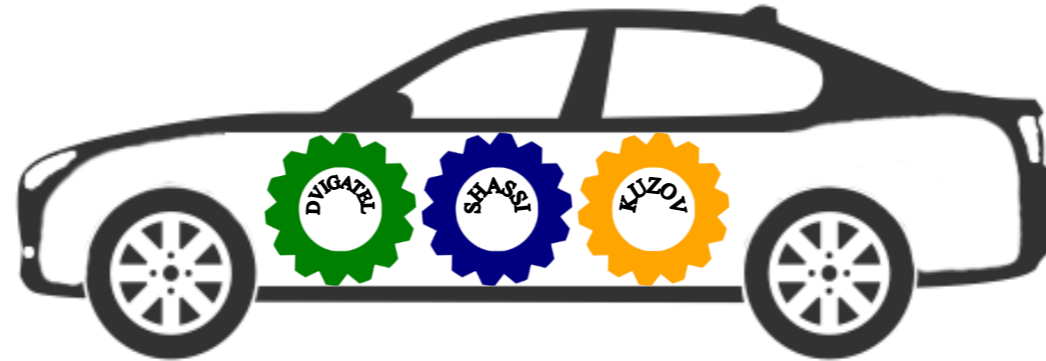


VEHICLES CONSTRUCTION

AVTOMOBILLAR KONSTRUKSIYASI



12th Topic: Differential. Wheel drives.

(12-Mavzu: Differensial. Yetakchi g'ildiraklar yuritmalari.)

Part 1

Associate Professor: Yusupov Sarvarbek

12-Mavzu: Differensial. Yetakchi g'ildiraklar yuritmalari.

(12th Topic: Differential. Wheel drives.)

O'quv rejası:

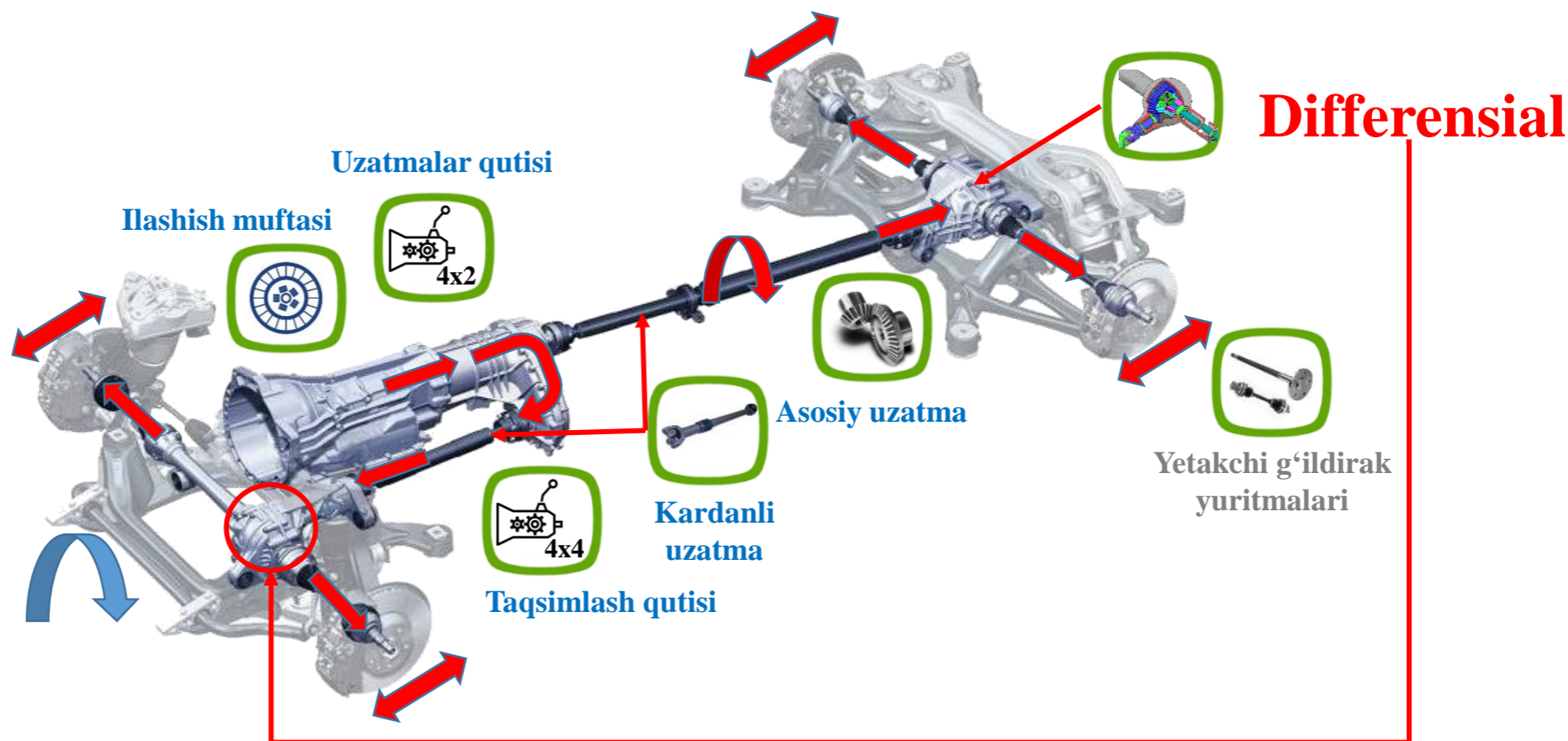
12.1. Differensialning vazifasi va turlari.

12.2. Differensialning konstruksiyalari va ularning ishlash prinsipi.

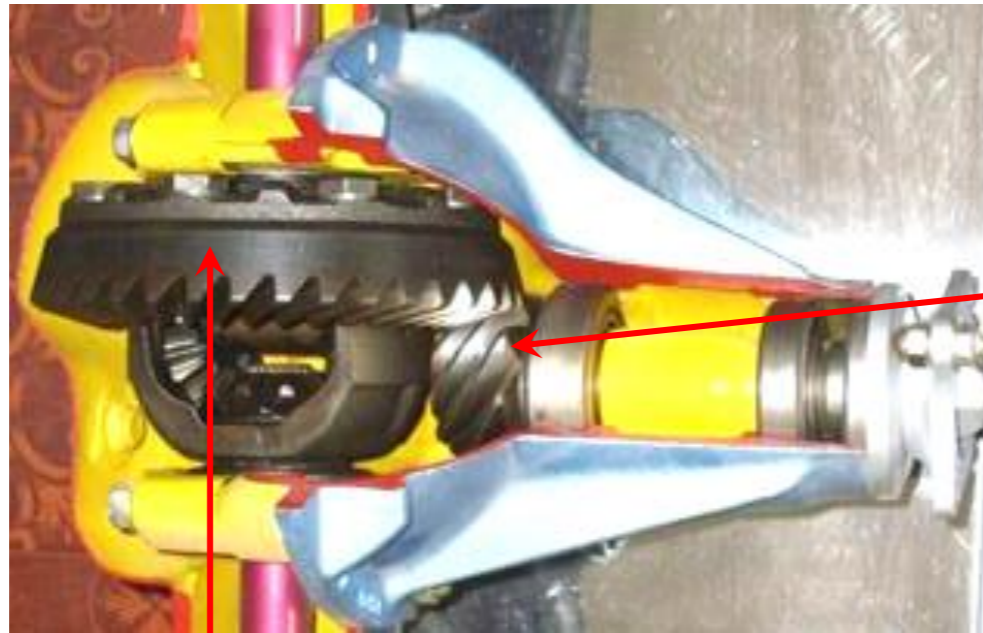
12.3. Yetakchi g'ildiraklar yuritmalarining vazifasi va turlari.

12.4. Yetakchi g'ildiraklar yuritmalarining konstruksiyalari va ularning ishlash prinsipi.

TRANSMISSIYA



[1]



**Yetaklovchi tishli
g'ildirak**

**Yetaklanuvchi tishli
g'ildirak**



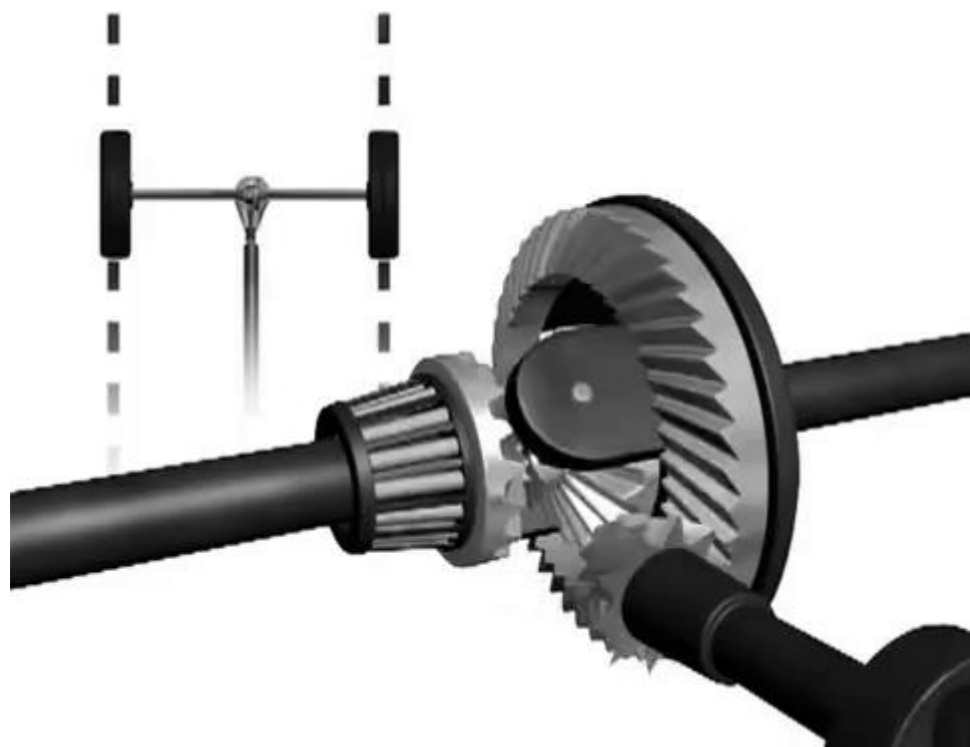
- 3,5 - 5,5

- 6,5 - 9,0

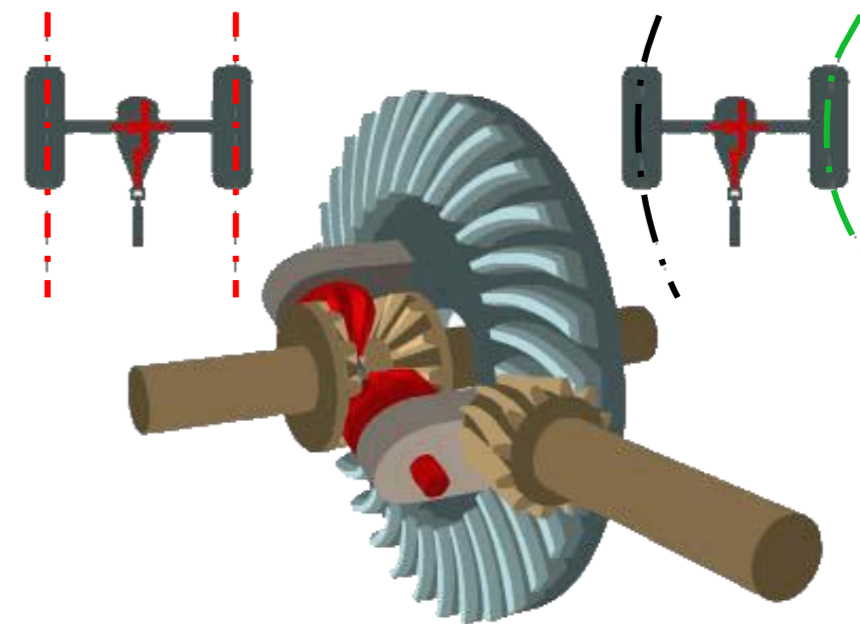
[2]

12.1. Differensialning vazifasi va turlari.

Ma'lumki, avtomobil burilayotganda uning g'ildiraklari har xil yo'l bosib turli chastotada aylanadi.



[4]

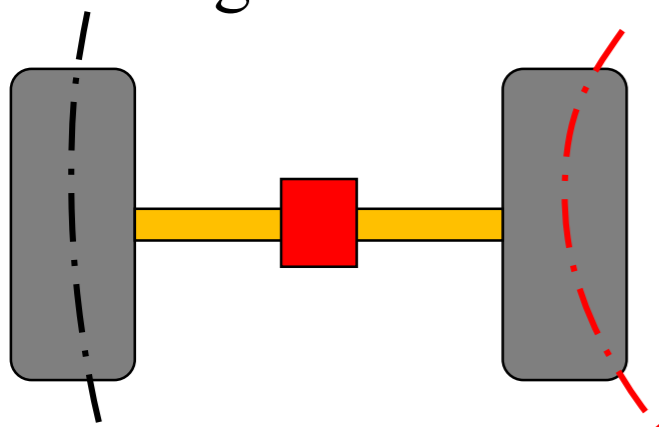


[3]

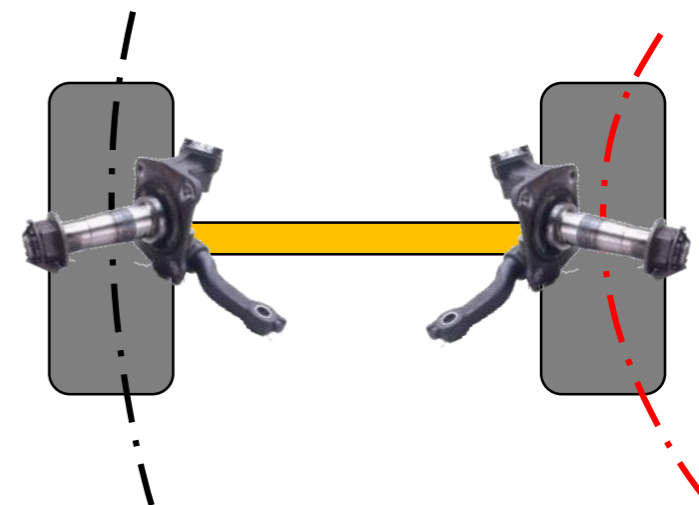
Masalan, avtomobil burilayotganda uning tashqi g'ildiraklari **ichki g'ildiraklariga** qaraganda **ko'proq yo'l** bosib tez aylanadi.

G'ildiraklarni bunday turli chastotada aylanishi avtomobilning notekisliklarda harakatlenganda,

g'ildiraklar har xil diametrga (**shinalarning yeyilishi yoki havo bosimi turlicha bo'lganda**) ega bo'lganda ham ro'y beradi.



Yetakchi bo'lmagan oldingi g'ildiraklarni bir-biriga nisbatan turli chastotada mustaqil aylana olishini ta'minlash uchun **ular o'zaro bog'liq bo'lmagan o'qlar (sapfalar)**ga o'rnatilgan bo'ladi.

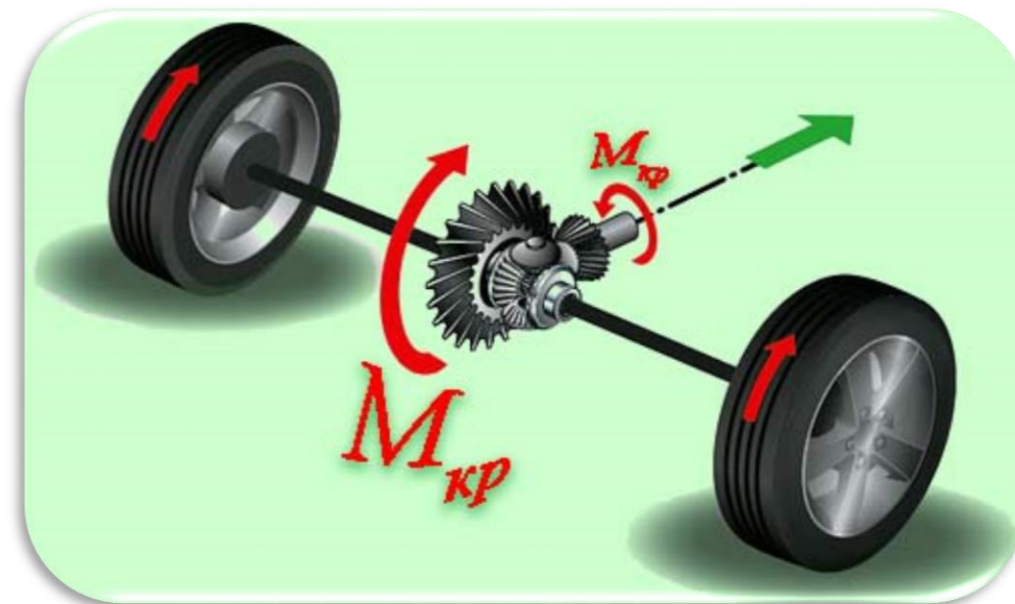


[5]

Yetakchi g'ildiraklarga esa burovchi moment asosiy uzatmadan uzatiladi.

Agar burovchi moment g'ildiraklarga **bitta umumiy val orqali uzatilgudek bo'lsa,**

avtomobil burilayotganida uning **g'ildiraklari turli chastotada aylana olmasdan yo'lga nisbatan sirpana boshlaydi.**



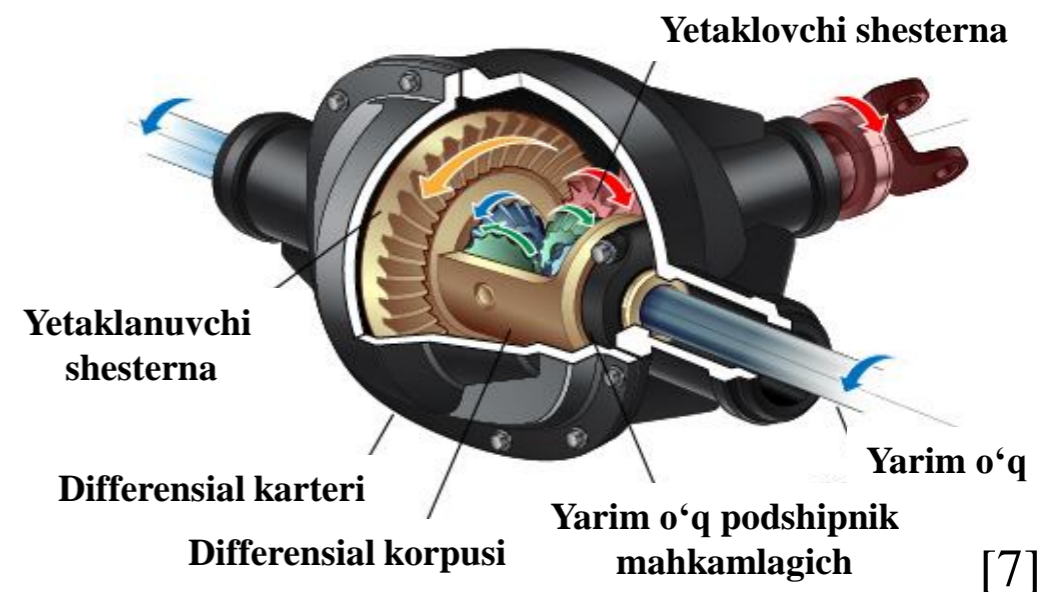
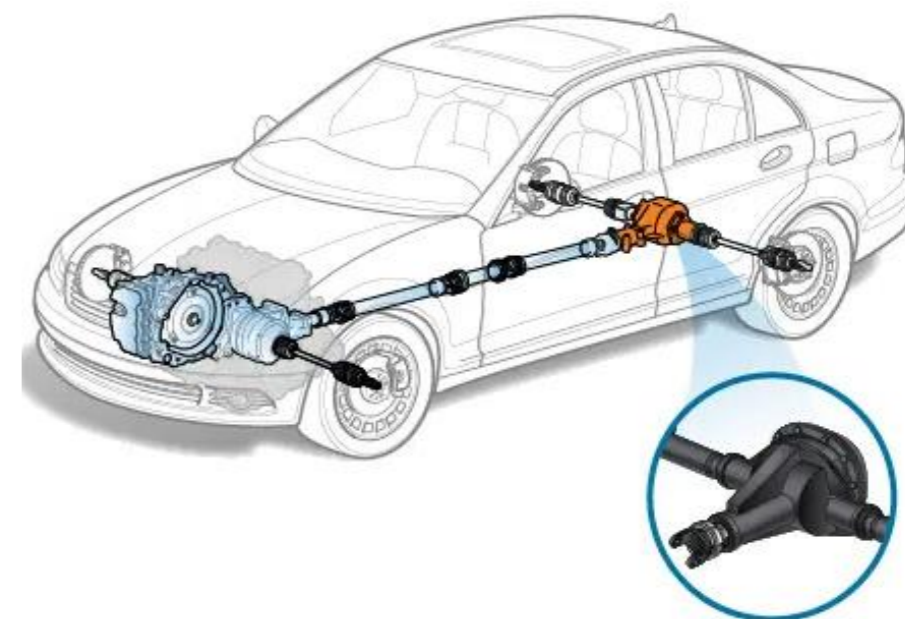
[6]

Shuning uchun **yetakchi g'ildiraklar bitta butun valga o'rnatilmasdan,**

har biri mustaqil aylana oladigan va **yarim o'q** deb nomlangan **alohida-alohida vallarga o'rnaliladi.**

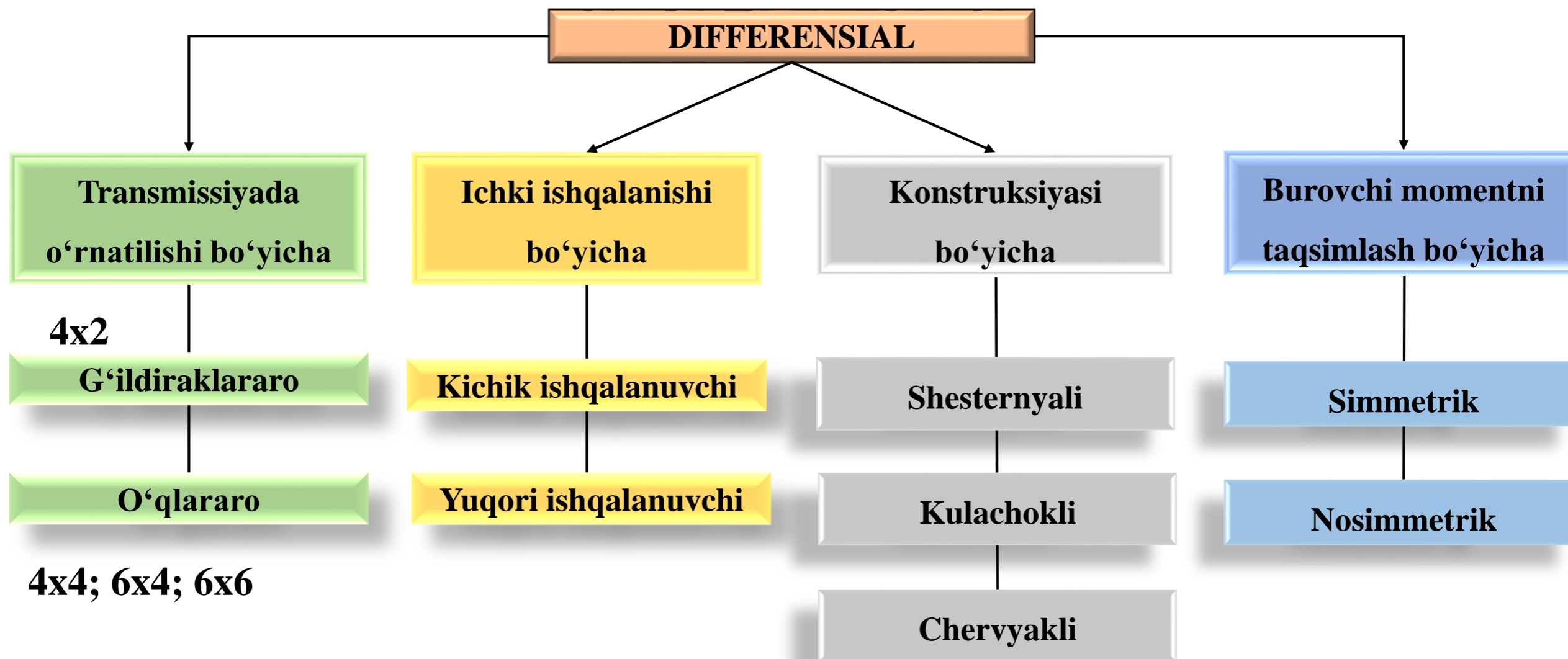
Demak, differensialning vazifasi:

avtomobilning burilishida yoki notekisliklarda harakatlanganida **burovchi momentni yetakchi g'ildiraklarga taqsimlash** bilan **ularni turli tezlikda aylana olishini ta'minlashdir.**



[7]

Differensial turlari:



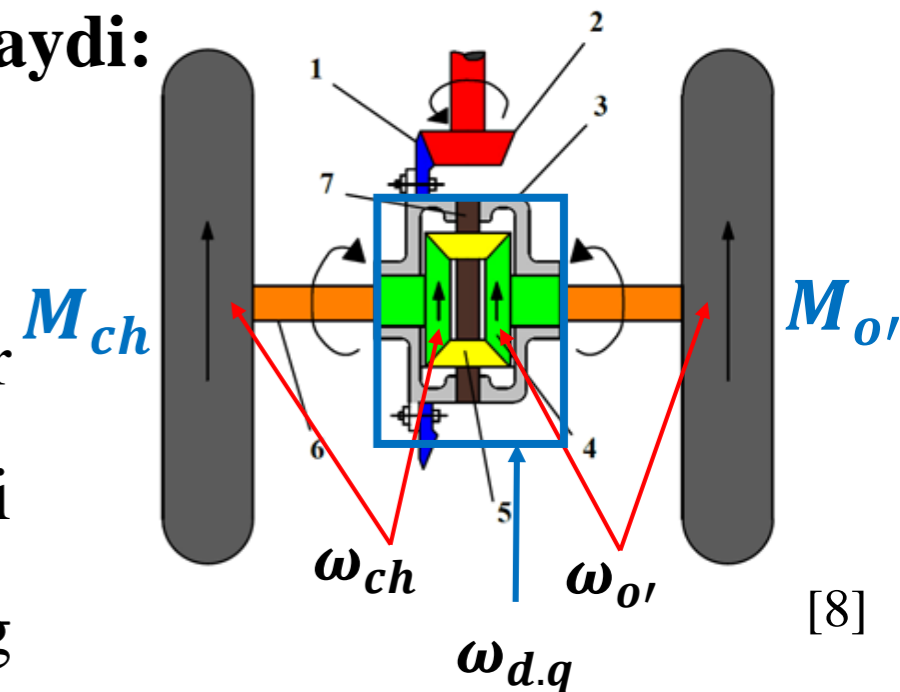
Simmetrik g'ildiraklararo differensialda



$$U = \frac{Z_{ch}}{Z_{o'}} = \frac{16}{16} = 1$$

Bunday differensialning quyidagi xususiyatlarini belgilaydi:

1. $\omega_{ch} + \omega_{o'} = 2 \cdot \omega_{d.q}$
2. Chap va o'ng yarim o'q shesternyalari turli, har qanday burchak tezliklarida aylanganida ham ulardagi burovchi moment (avtomobilning chap va o'ng g'ildiraklaridagi kabi) o'zaro teng, ya'ni $M_{ch} = M_{o'}$



[8]

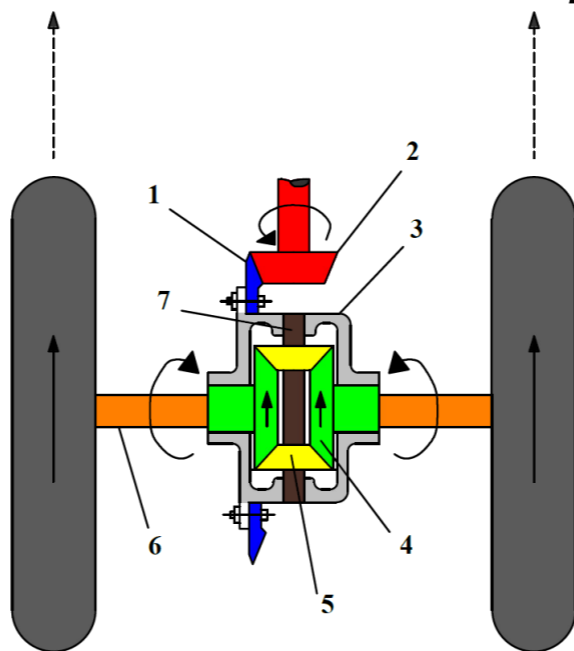
12.2. Differensialning konstruksiyalari va ularning

ishlash prinsipi.

Shesternyali differensiallar
konstruksiyasi bo'yicha
birmuncha oddiy.

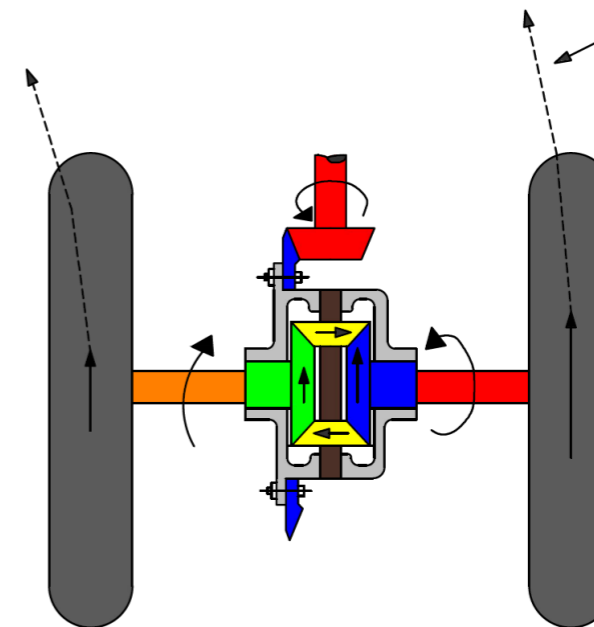
konussimon
shesternyali
differensiallar

$$\omega_{ch} = \omega_{o'} = \omega_{d.q}$$



a) Differensialning to'g'riga harakatlanishi.

$$\omega_{ch} < \omega_{o'}$$

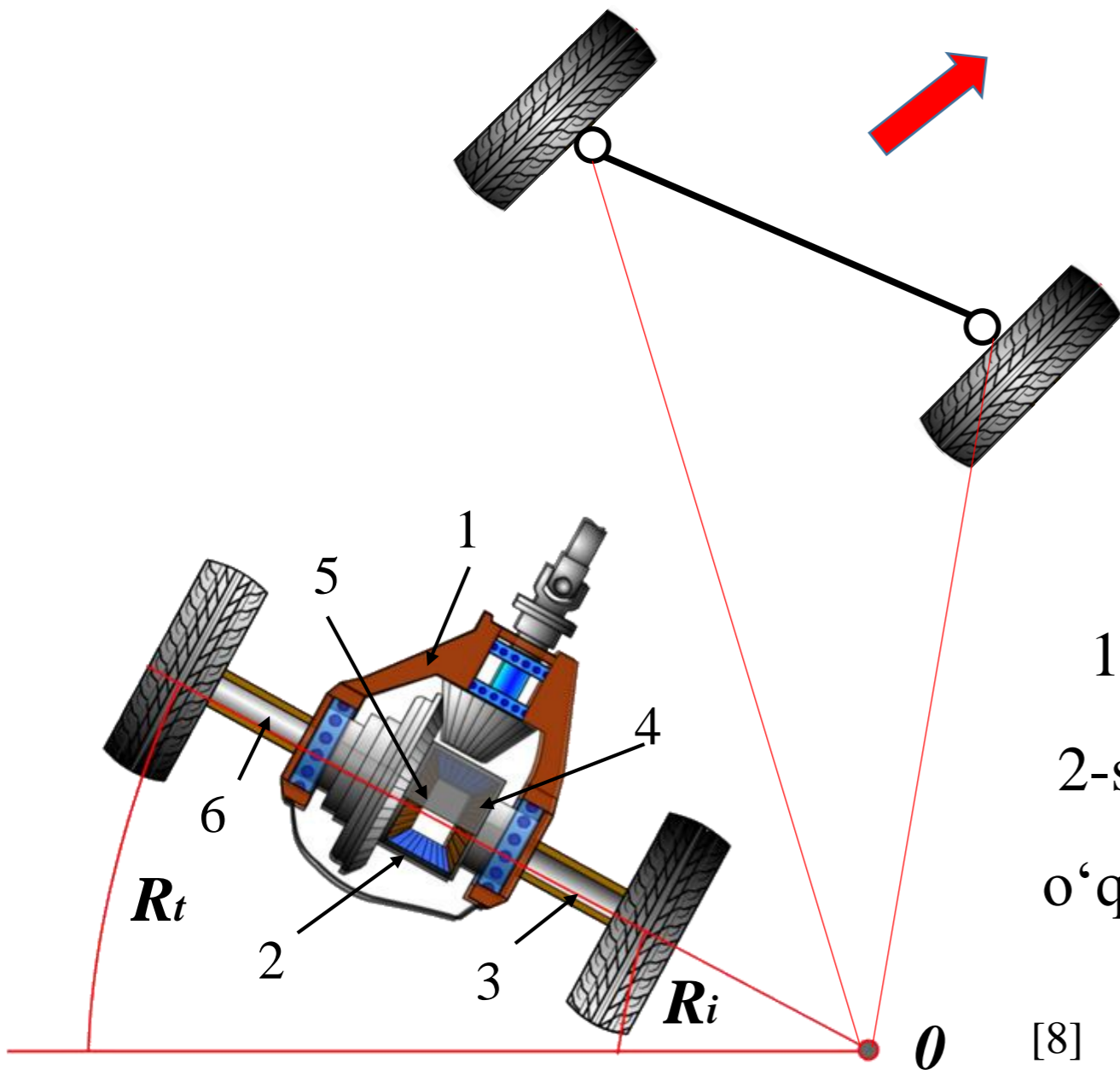


b) Differensialning burilishdagi harakatlanishi.

[8]

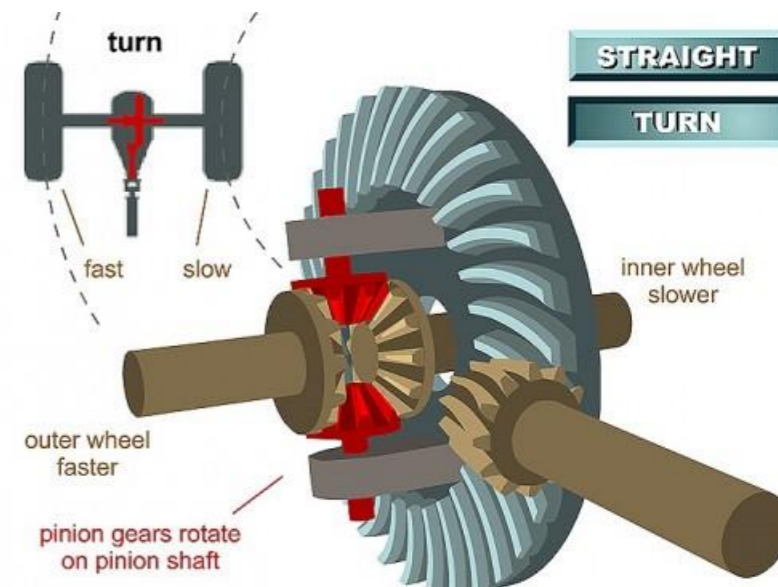
1-yetaklanuvchi g'ildirak, 2-yetaklovchi g'ildiragi, 3- korpus, 4-yarim o'q g'ildiragi,
5-satellit, 6-yarim o'q, 7- satellitlar o'qi.

G'ildirak formulasi 4x2 avtomobilining burilish sxemasi:



1-differensial qutisi;
 2-satellit; 3 va 6-yarim
 o'qlar; 4 va 5-yarim o'q
 shestemalari.

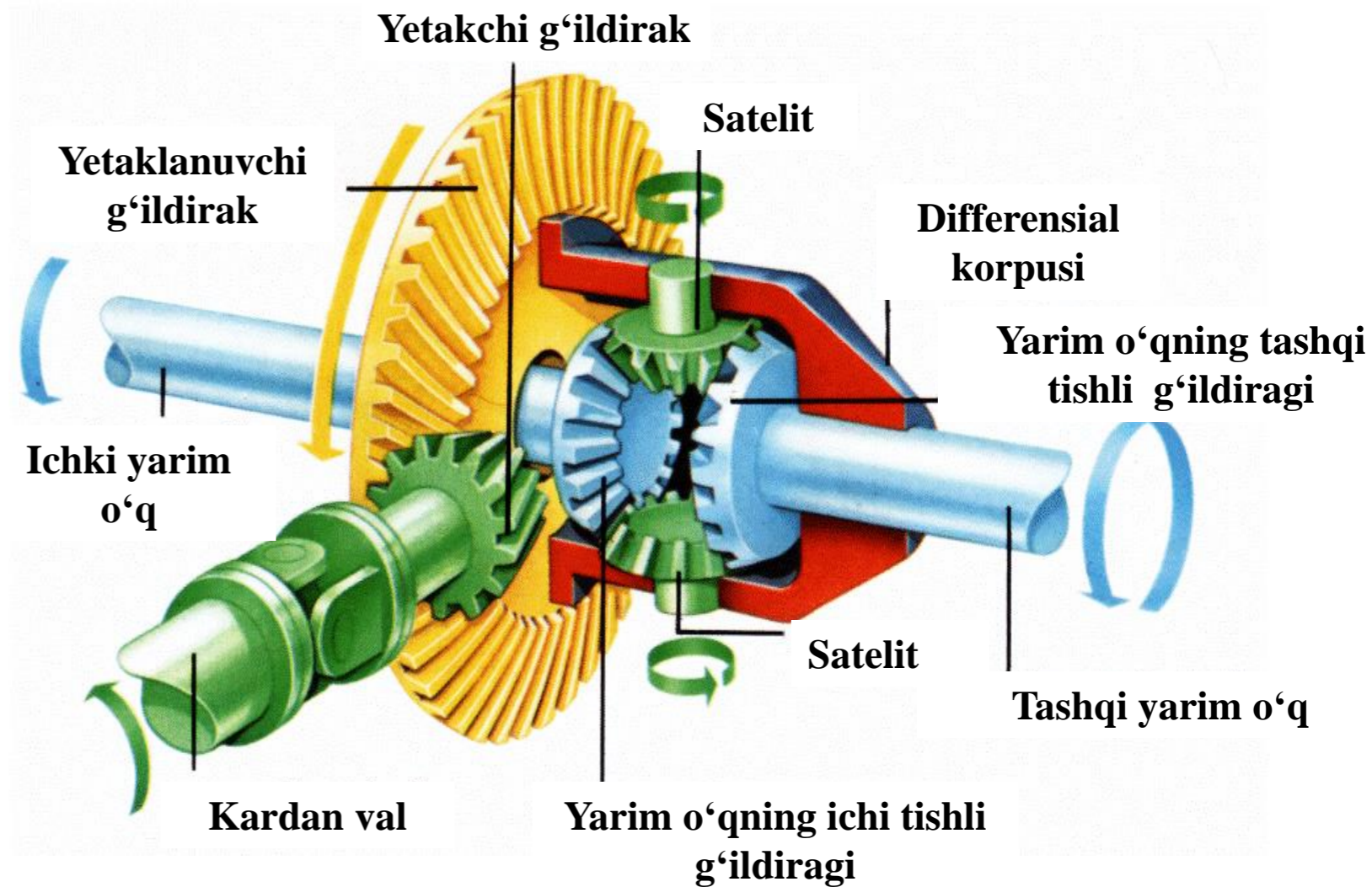
[8]



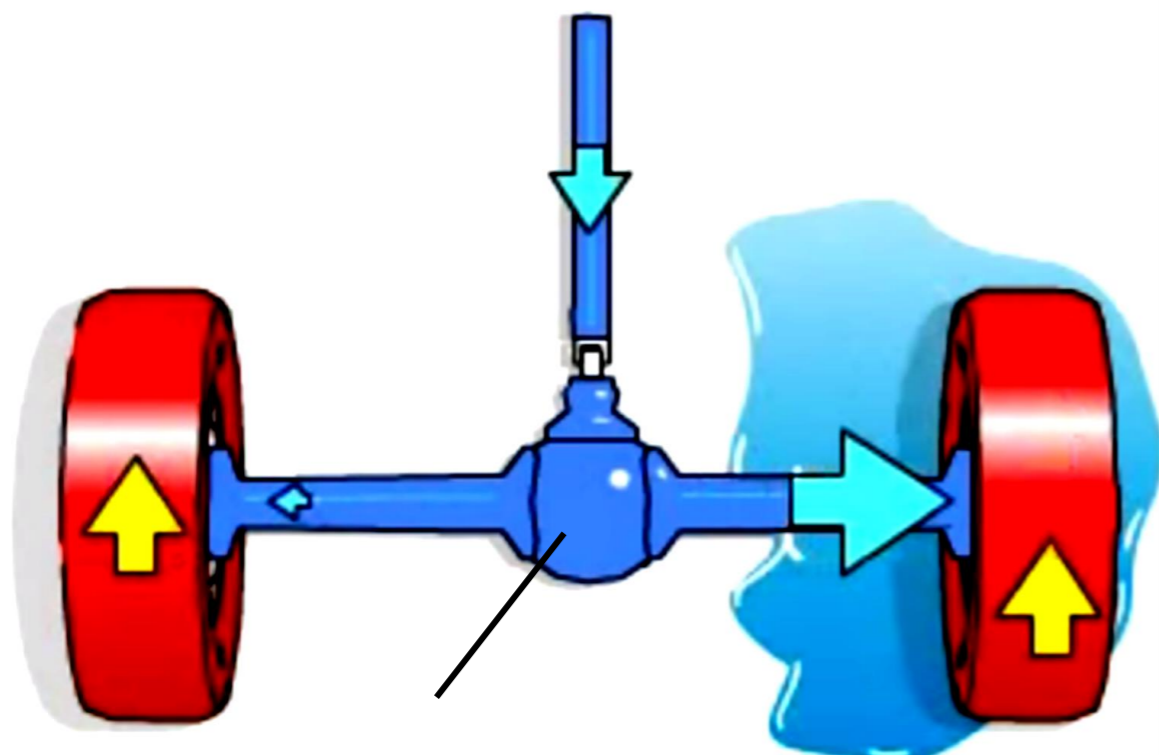
[9]

G'ildiraklararo konussimon differensialning konstruksiyasi.

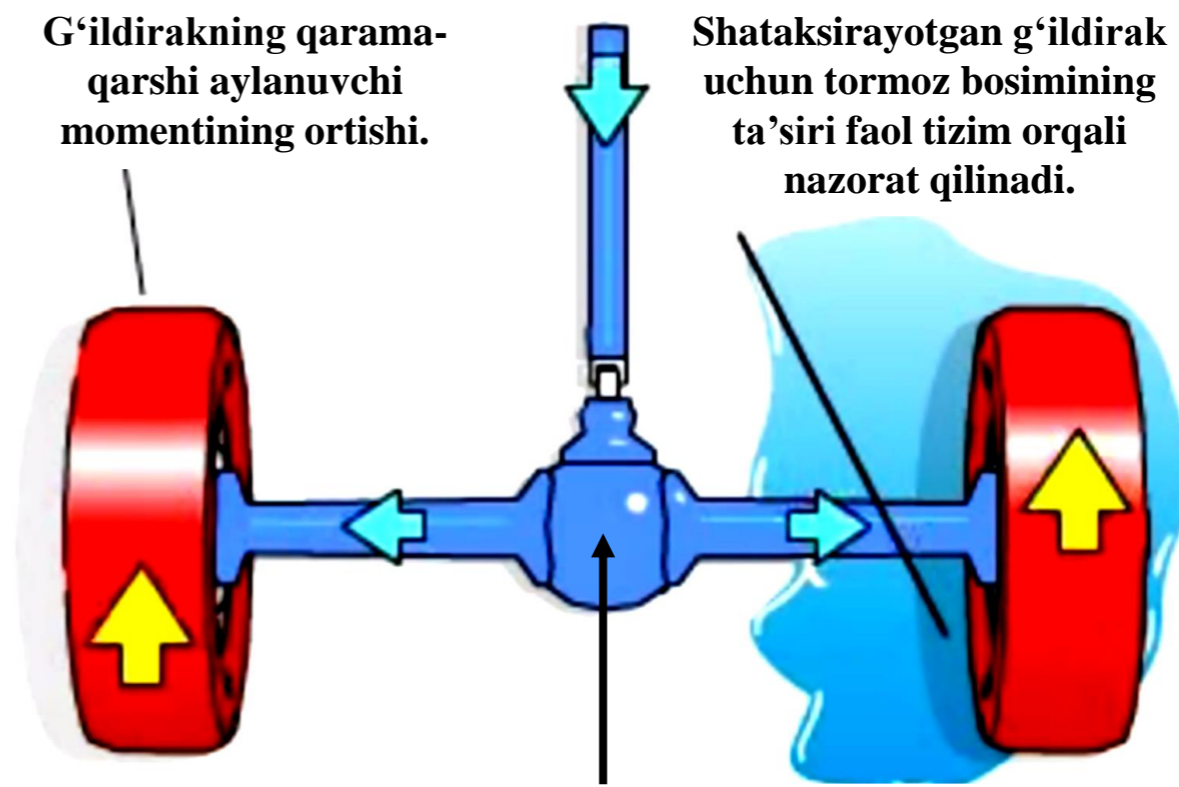
U yetakchi g'ildiraklarga burovchi momentni teng taqsimlashi avtomobilning hattoki sirpanchiq yo'llarda ham (transmissiya dvigateldan uzilmaganda) turg'unligini saqlagan holda boshqarilishini ta'minlaydi.



Lekin avtomobilning o‘rnidan qo‘zg‘alishida uning yetakchi g‘ildiraklaridan biri sirpanchiq yo‘lga duch kelsa, u **shataksiraydi**.



Ochiq differensial



G‘ildirakning qarama-qarshi aylanuvchi momentining ortishi.

Shataksirayotgan g‘ildirak uchun tormoz bosimining ta’siri faol tizim orqali nazorat qilinadi.

Differensial bloklab qo‘yiladi.

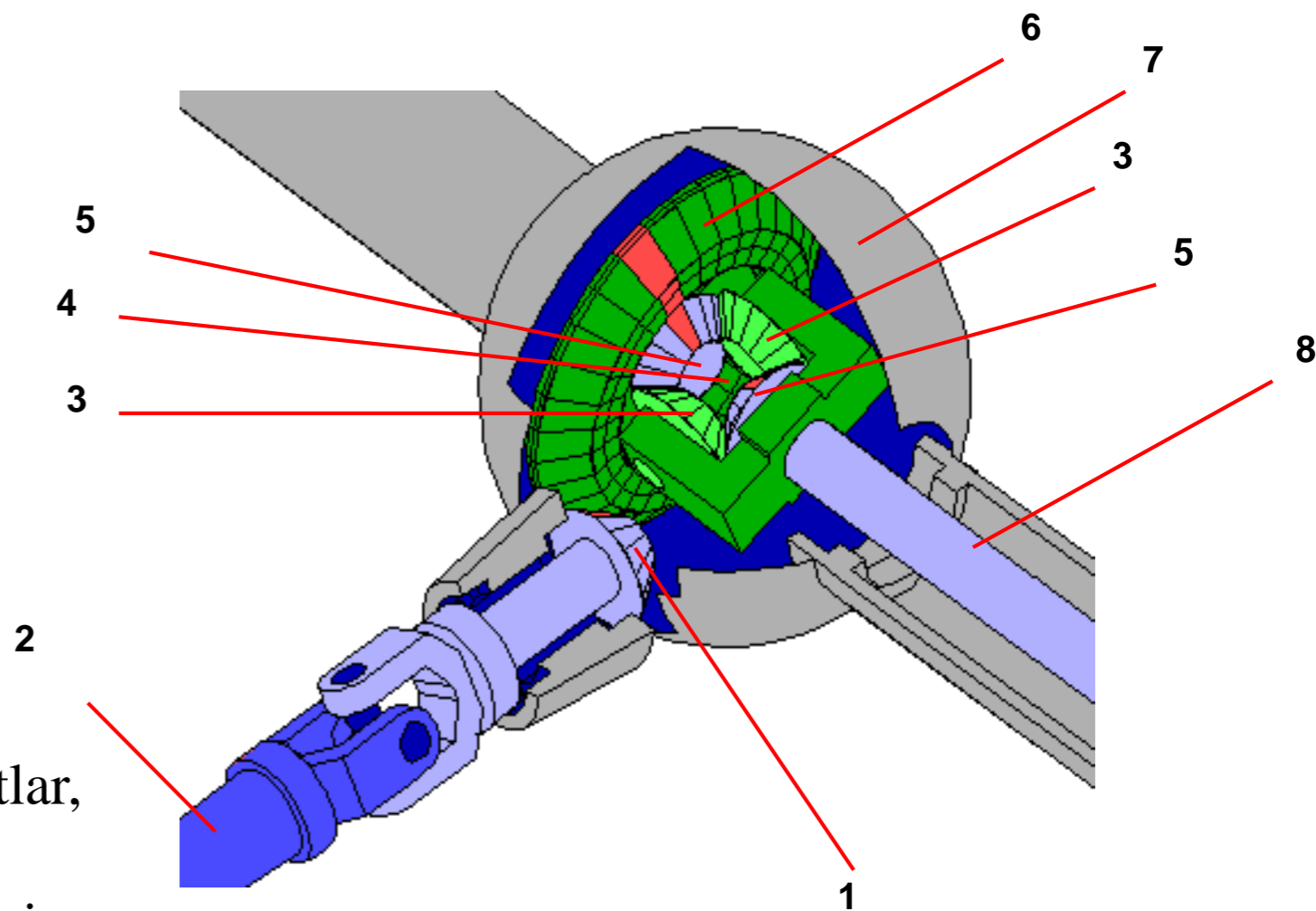
[11]

Differensialning ishlash uslubi.



[13]

1-yetaklovchi g'ildirak, 2-kardan val, 3-satellitlar,
 4-satellitlar o'qi, 5-yarim o'q shesternyasi,
 6-yetaklanuvchi g'ildirak, 7-differensial qutisi,
 8-yarim o'q.



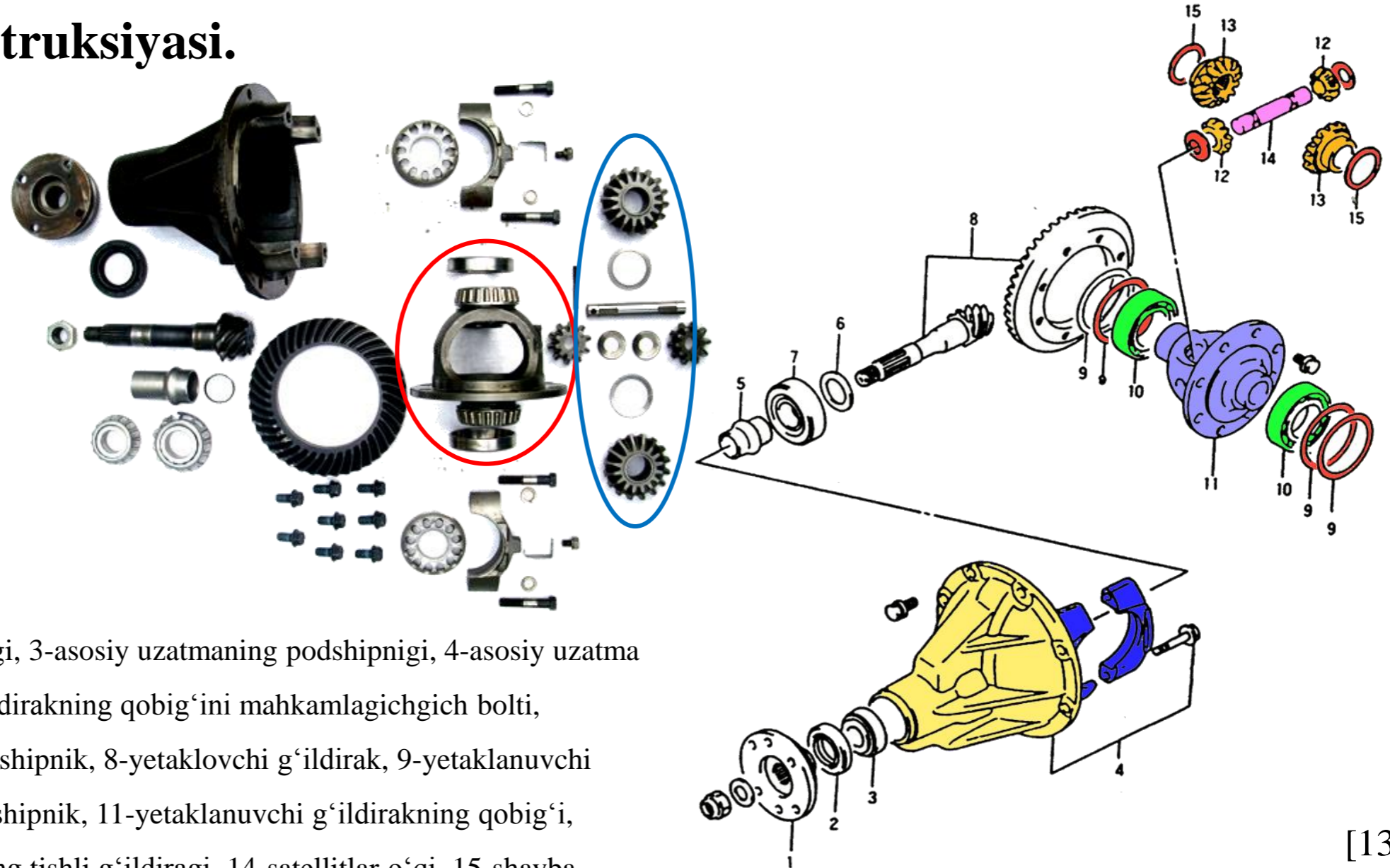
[12]

G'ildiraklararo konussimon shesternyali simmetrik differensial

detallarining konstruksiyasi.

Differensial planetar mexanizm bo'lib, uning **yetakchi zvenosiga differensial qutisi,**

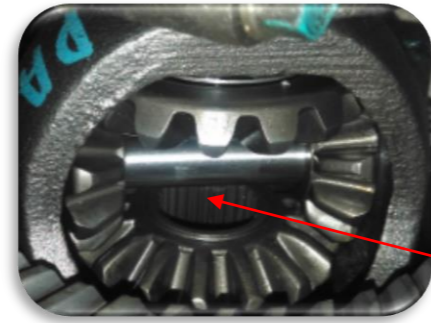
yetaklanuvchi zvenosiga esa o'lchamlari bir xil bo'lgan **yarim o'q shesternyalar** kiradi.



- 1-flanets, 2-asosiy uzatmaning salnigi, 3-asosiy uzatmaning podshipnigi, 4-asosiy uzatma qobig'iga yetaklanuvchi g'ildirakning qobig'ini mahkamlagichgich bolti, 5-ajratuvchi, 6-zichlagich, 7-podshipnik, 8-yetaklovchi g'ildirak, 9-yetaklanuvchi g'ildirakning shaybasi, 10-podshipnik, 11-yetaklanuvchi g'ildirakning qobig'i, 12-satellitlar, 13-yarim o'qlarning tishli g'ildiragi, 14-satellitlar o'qi, 15-shayba.

[13]

Satellitlar o'ng va chap yarim o'qlarning shesternyalari bilan ilashib turadi.



Differensialning barcha shesternyalari to'g'ri tishli bo'ladi.

Shesternyalar yarim o'qlarga shlitslar yordamida o'rnatiladi.

ishqalanishni kamaytiruvchi tayanch shaybalar **sfera** shaklida tayyorlanadi.

Bunday shaklda bo'lishi ularning markazlashib yarim o'q shesternyalari bilan to'g'ri ilashgan holda bo'lishini ta'minlaydi.



Damas avtomobilining differensiali.

Chap g'ildirak
yarim o'qining
birikish joyi



O'ng g'ildirak
yarim o'qining
birikish joyi

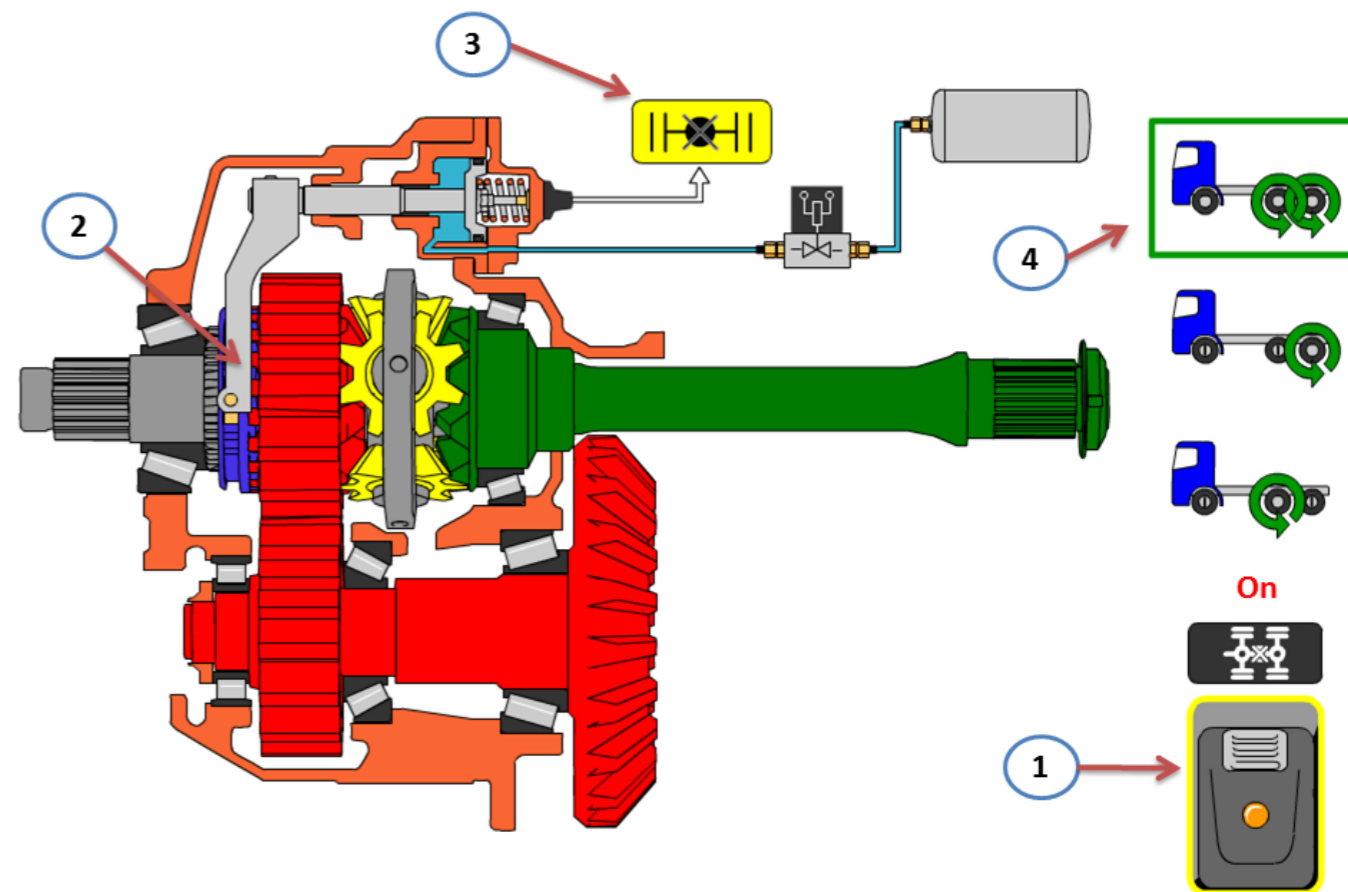
Turli avtomobillarda qoʻlaniladigan gʻildiraklararo konussimon simmetrik differensiallarning konstruksiyasi asosan **qutining tuzilishi** va **satellitlar** soni bilan farqlanadi.

Yengil avtomobillarda qoʻlaniladigan differensiallarning **qutisi ajralmaydigan yaxlit boʻlib**, ulardan katta boʻlmagan burovchi moment uzatilganligi uchun **ikkita satellit qoʻlaniladi**.

Yuk avtomobillarida satellitlar soni **uchta yoki toʻrtta boʻladi**.

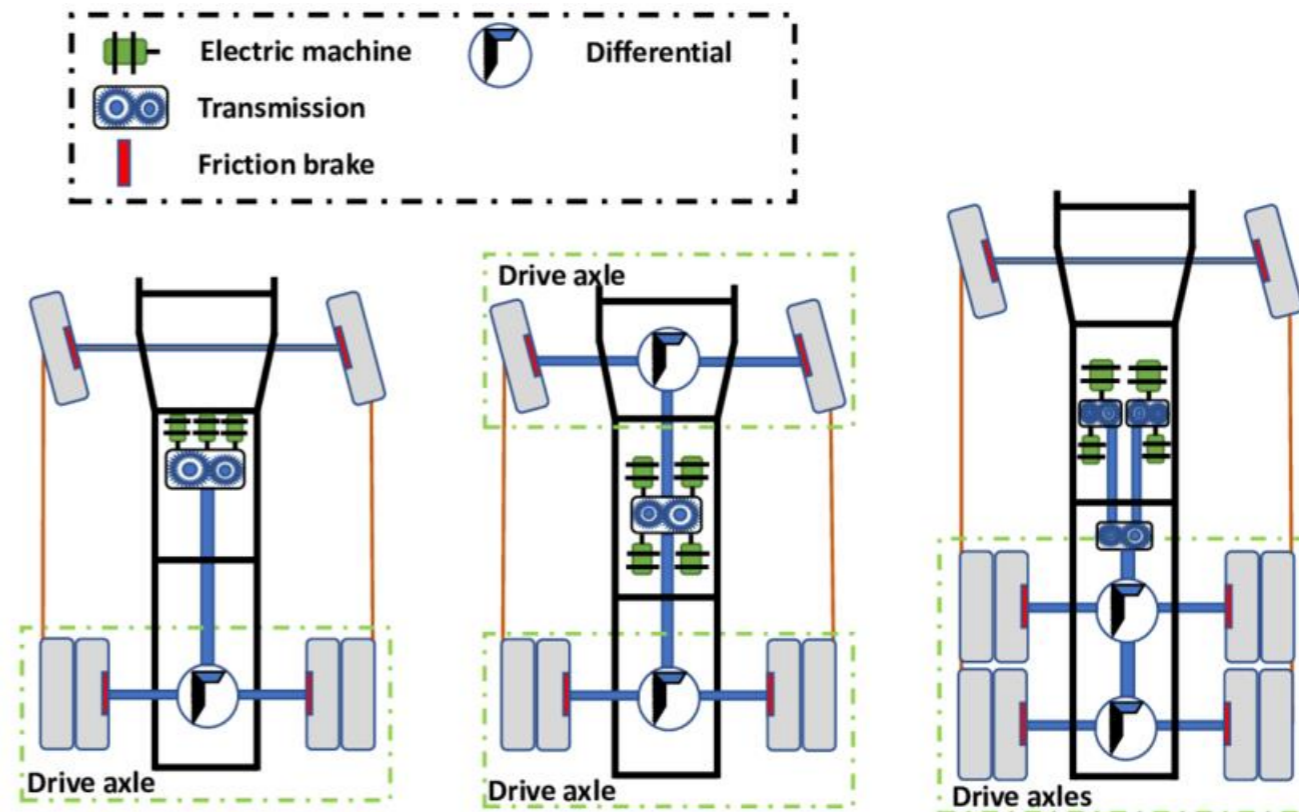
O'qlararo differensial.

Bunday differensialdan o'tuvchanligi yuqori bo'lgan 4x4, 6x4, 6x6 rusumli avtomobillar transmissiyasida yetakchi ko'priklarga burovchi momentni kerakli nisbatda taqsimlash maqsadida foydalaniladi.



[15]

Avtomobil burilayotganda, uning oldingi boshqariluvchi g'ildiraklarining bosib o'tgan yo'li orqa ko'prik g'ildiraklarining bosib o'tgan yo'ldan katta bo'ladi.



[16]

Shunday ekan, taqsimlash qutisidan oldingi va orqa yetakchi ko'priklarga burovchi moment uzatayotgan kardanli uzatmaning aylanishlar chastotasi turlicha bo'lishi kerak.

Agar yetakchi ko'priklarga bir xil aylanishlar chastotasi bilan harakat uzatilgudek bo'lsa,

oldingi boshqariluvchi yetakchi g'ildiraklar sudralib aylanadi,

orqa yetakchi g'ildiraklar esa shataksirab aylanadi,

ya'ni ularda sof g'ildirash bo'lmaydi.

Natijada shinalar yeyiladi,

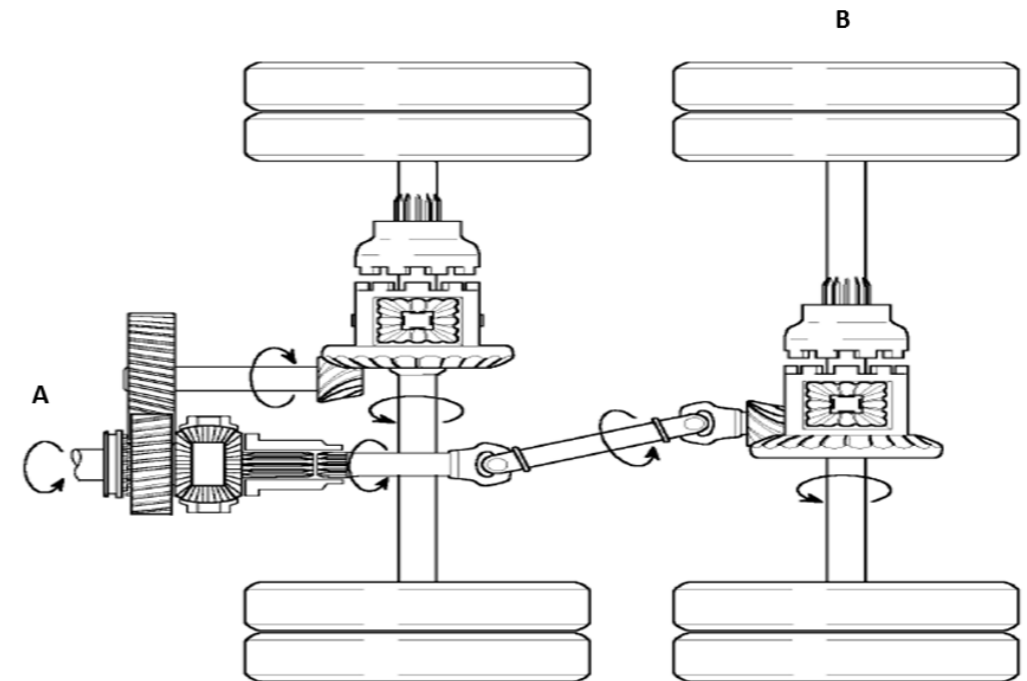
transmissiya agregatlari ortiqcha yuklanadi,

yonilg'i sarfi ortadi.

Bunday kamchilikni yo‘qotish uchun yetakchi ko‘priklarga burovchi momentni uzatayotgan kardanli uzatmalarning turli aylanishlar chastotasida aylana olishini ta’minlaydigan o‘qlararo differensialdan foydalaniladi.



[17]



[18]

Avtomobil massasining yetakchi ko‘priklarga qanday nisbatda taqsimlanganligiga qarab burovchi momentni ham shunday nisbatda taqsimlash zarur bo‘ladi.

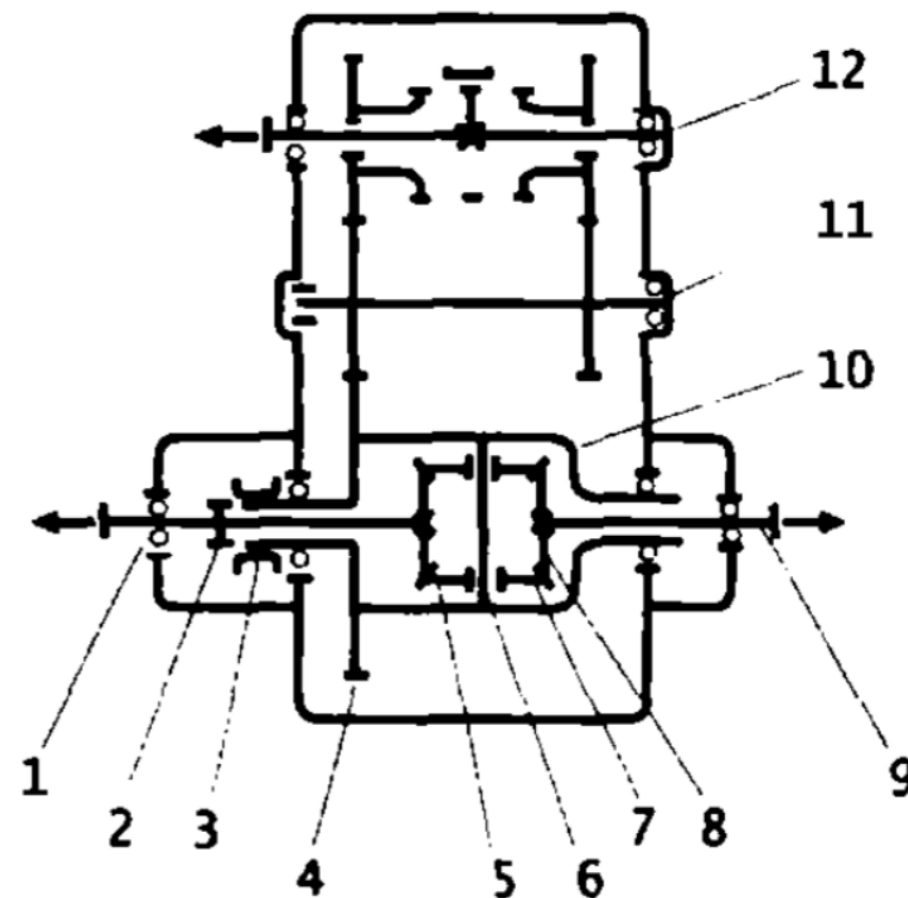
Shuning uchun qo‘laniladigan o‘qlararo differensiallar simmetrik yoki nosimmetrik bo‘lishi mumkin.

Massasi ko‘priklarga **teng bo‘lingan** burovchi momentni ularga teng taqsimlaydigan **simmetrik differensialdan** foydalanilsa,

Massasi **teng bo‘linmagan** avtomobillarda (40% i oldingi ko‘prikka, 60% i esa orqa qo‘sh ko‘priklarga to‘g‘ri keladi) **nosimmetrik o‘qlararo differensialdan** foydalanilgan.

Simmetrik bo‘lganda burovchi momentni yetakchi ko‘priklarga teng taqsimlash uchun differensialdagi yuritma vallari shesternyalarining o‘lchamlari bir xil ishlanadi.

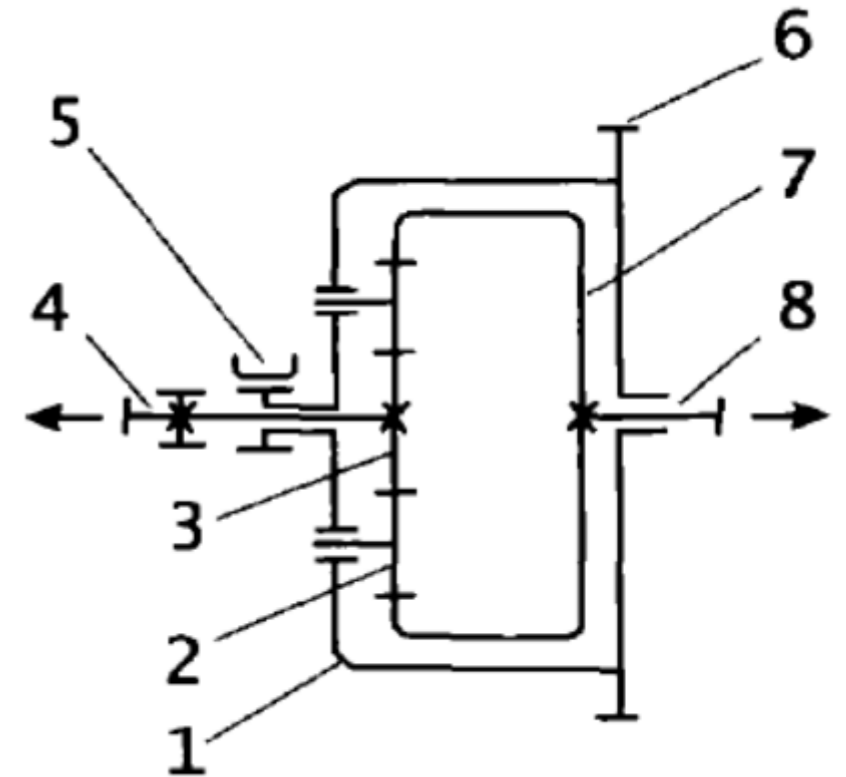
1-oldingi ko‘prik yuritmasining vali; 2-oldingi ko‘prik yuritmasi valining tishli gardishi; 3-differensialni ponalash muftasi; 4-yetaklanuvchi tishli g‘ildirak; 5-oldingi ko‘prik yuritmasining shesternasi; 6-satellit o‘qi; 7-satellit; 8-orqa ko‘prik yuritmasining shesternasi; 9-orqa ko‘prik yuritmasining vali; 10-differensial qutisi; 11-oraliq vali; 12-yetakchi val.



[19]

Nosimmetrik bo‘lganda esa, avtomobil massasining ko‘priklarga qanday nisbatda taqsimlanganligiga qarab yuritma vallari shesternyalarining o‘lchamlari ham o‘sha nisbatda ishlanadi.

1-differensial qutisi; 2-satellit; 3-oldingi ko‘p rik yuritmasining shesternasi; 4-oldingi ko‘prik yuritmasining vali; 5-differensialning ponalash muftasi; 6-yetaklanuvchi tishli g‘ildirak; 7-orqa qo‘sh ko‘prik yuritmasining tishli g‘ildiragi; 8-orqa qo‘sh ko‘prik yuritmasining vali.



[19]

1. Трансмиссия автомобиля. [Online image] [Accessed in 2014]. <https://www.razbor-vektor.ru/images/four-wheel-drive-2014.jpg>
2. Asosiy uzatmaning stendi. Photo taken by S.Yusupov. Andijon. -2012 y.
3. Типы и виды блокировок дифференциала. [Online image] [Accessed in 2017]. <https://blokirovka.ru/img/a/sovintel/opensdiff1.gif>
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6. Главная передача. [Online image] [Accessed in 2017]. http://k-a-t.ru/mdk.01.01_transmjssia/mosty_2/glavnaya_peredacha.jpg
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12. Дифференциал. [Online gif] [Accessed in 2015]. <https://avtopolka.by/media/files/file/3.gif>
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14. Damas avtomobilining differensial. Photo taken by S.Yusupov. Andijon. –AndMI. -2017 y.
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16. Examples of single e-axle group topologies on different vehicle. By Sachin Janardhanan. [Online image] [Accessed on February 2023]. <https://www.researchgate.net/publication/369030004/figure/fig1/AS:11431281124805119@1678109302848/Examples-of-single-e-axle-group-topologies-on-different-vehicle-configurations-left.png>
17. Dana tandem axle transforms to 6×2 configuration at highway speeds. By James Menzies. [Online image] [Accessed on 26 March 2015]. <https://www.trucknews.com/wp-content/uploads/2015/03/Spicer-AdvanTEK-Dual-Range-Disconnect-600x400.jpg>
18. Inter Axle And Differential Modern Mack Truck General. [Online image] [Accessed on March 2015]. <https://ubiaod.files.wordpress.com/2015/03/interaxle.png>
19. E.Fayzullayev. Transport vositalarining konstruksiyasi. Darslik. I-qism. -T.: “Yangi asr avlodi”, -2006 yil, 253-254 bet.

*E'TIBORINGIZ
UCHUN
RAHMAT!!!*