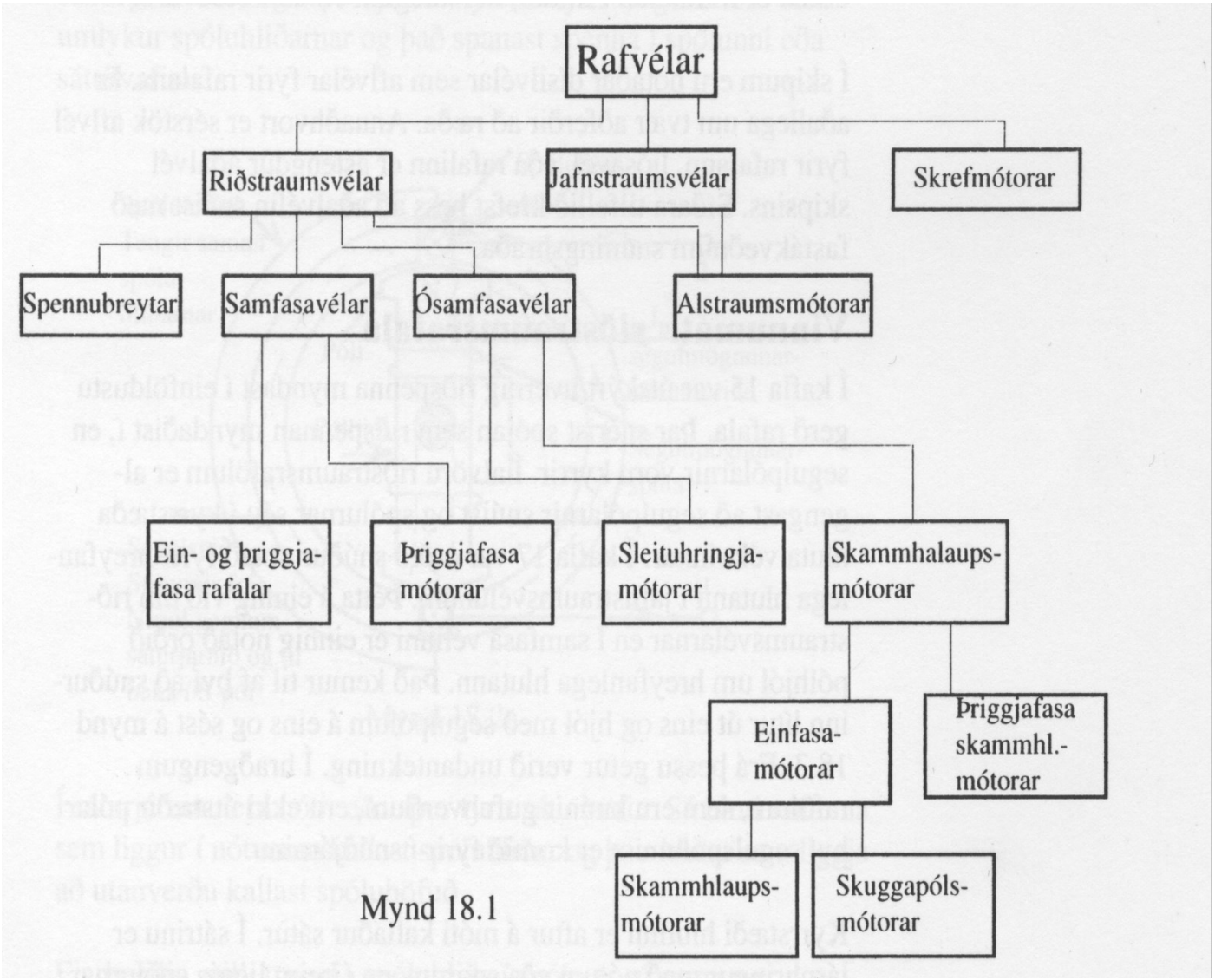
4. önn Rafmagnsfræði

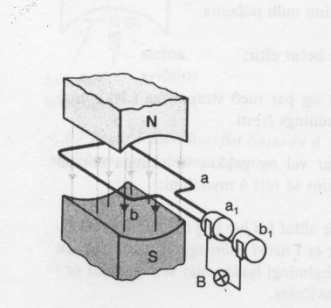
Riðstraumsrafalar

Flokkun rafvéla

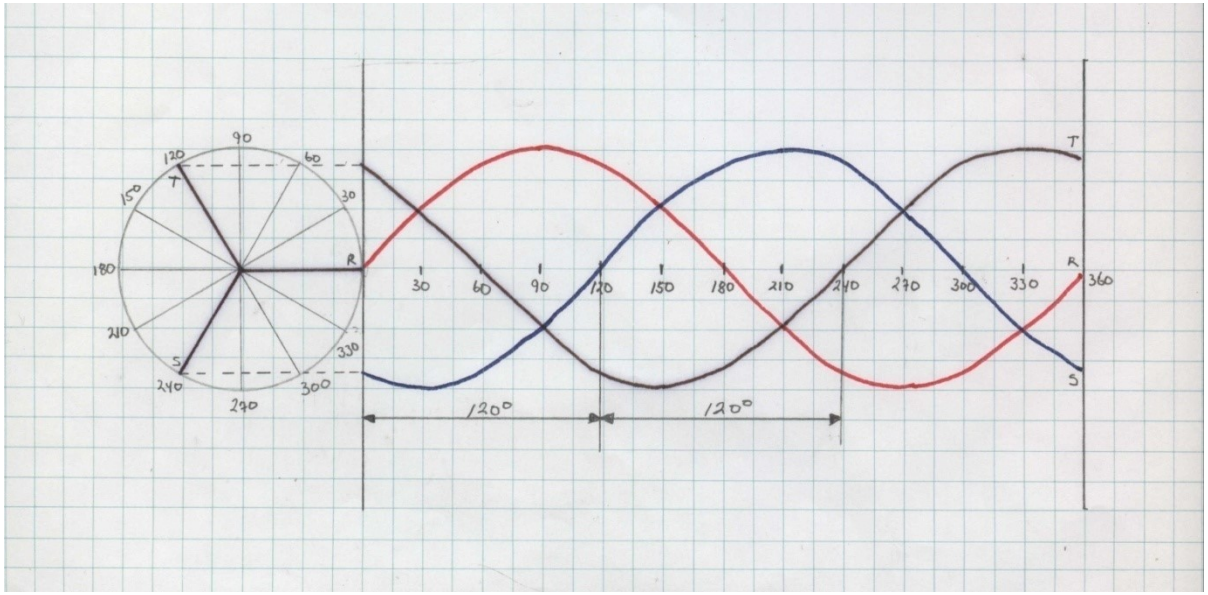


Mynd 18.1

Vinnumáti riðstraumsrafala



1.2.1 Einföld mynd af riðstraumsrafala.



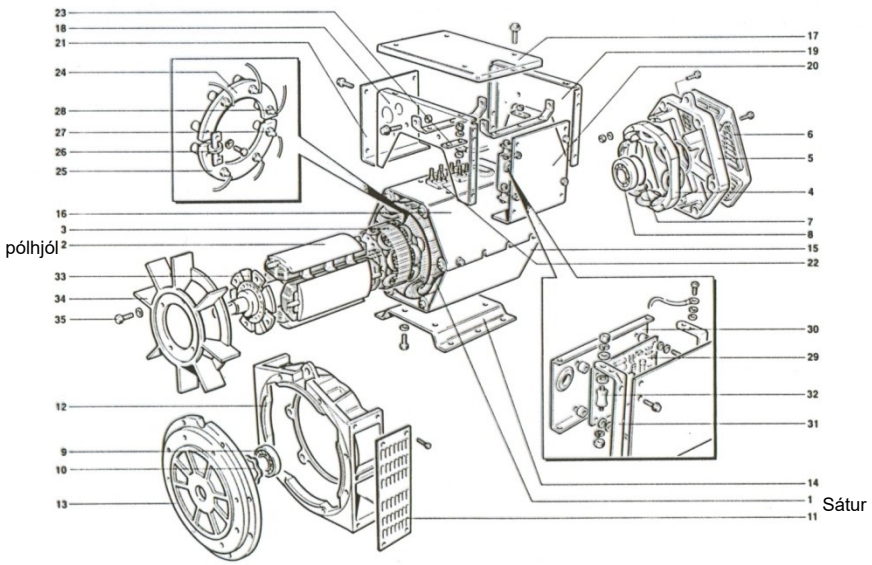
http://www.youtube.com/watch?v=HLNugJwBRow

Plate Ref.	Description	Plate Ref.	Description
1	Stator	25	Main Rectifier Assembly - Reverse
2	Rotor	26	Varistor
3	Exciter Rotor	27	Diode Reverse Polarity
4	Exciter Stator	28	Diode Forward Polarity
5	N.D.E. Endbracket	29	A.V.R.
6	Cover N.D.E.	30	A.V.R. Mounting Plate
7	Bearing 'O' Ring N.D.E.	31	A.V.R. Mounting Bracket
8	Bearing N.D.E.	32	A.V.M.
9	Bearing D.E.	33	Fan Hub
10	Bearing Wave Washer D.E.	34	Fan
11	D.E. Screen	35	Fan Securing Screw
12	D.E. Adaptor		
13	D.E. Endbracket		
14	Foot		
15	Frame Cover Bottom		
16	Frame Cover Top		
17	Terminal Box Lid		
18	Endpanel D.E.		
19	Endpanel N.D.E.		
20	Side Panel (A.V.R.)		
21	Side Panel		
22	Main Terminal Panel		
23	Terminal Link		
24	Main Rectifier Assembly - Forward		

N.D.E.	Non Drive End
D.E.	Drive End
A.V.R.	Automatic Voltage Regulator
A.V.M.	Anti-Vibration Mount

https://www.youtube.com/watch?v=tiKH48EMgKE

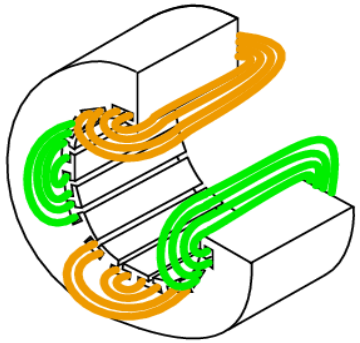
Fig. 9.
TYPICAL TWO BEARING GENERATOR

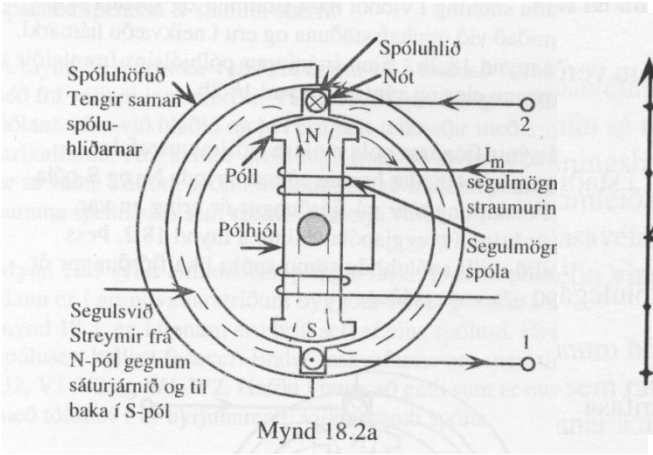


pólhjól

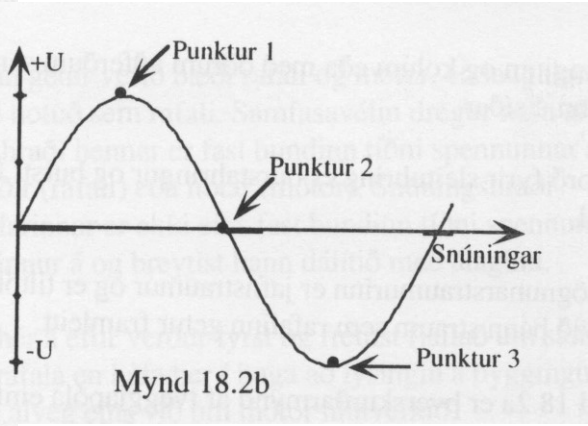
Sátur

Uppbygging riðstraumsrafala.

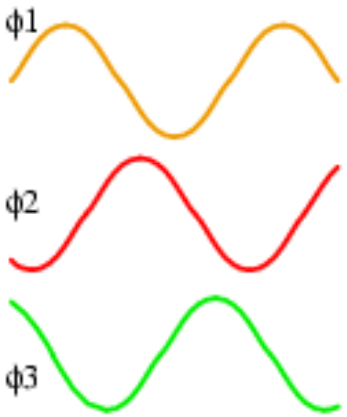


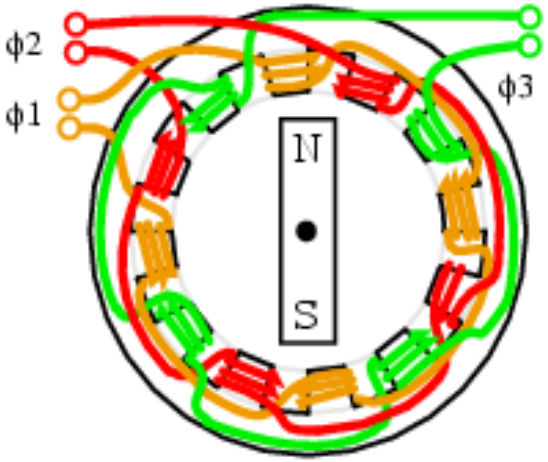


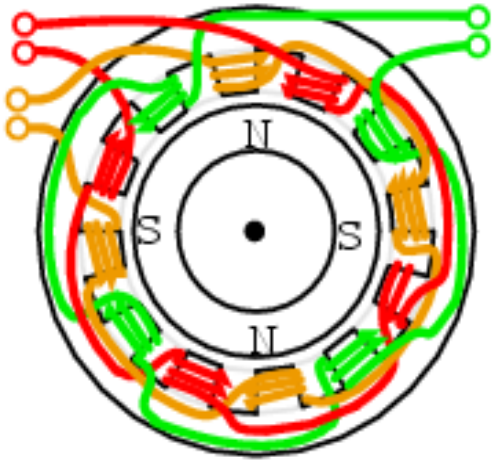
Mynd 18.2a



Mynd 18.2b

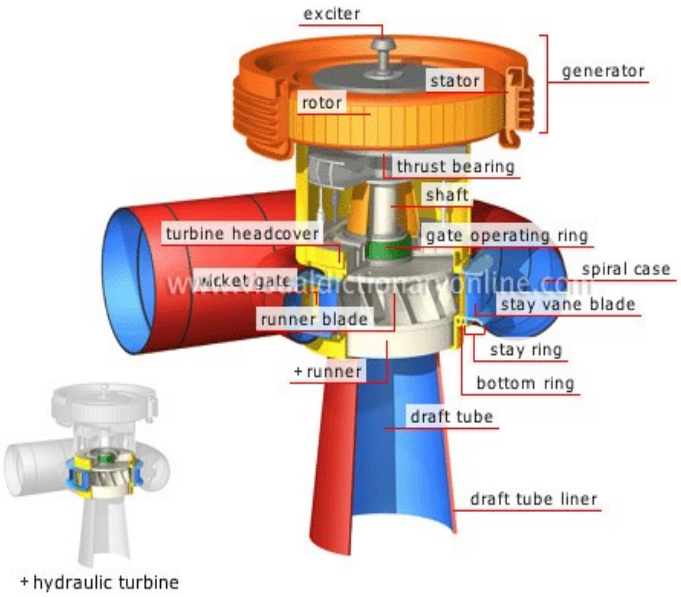


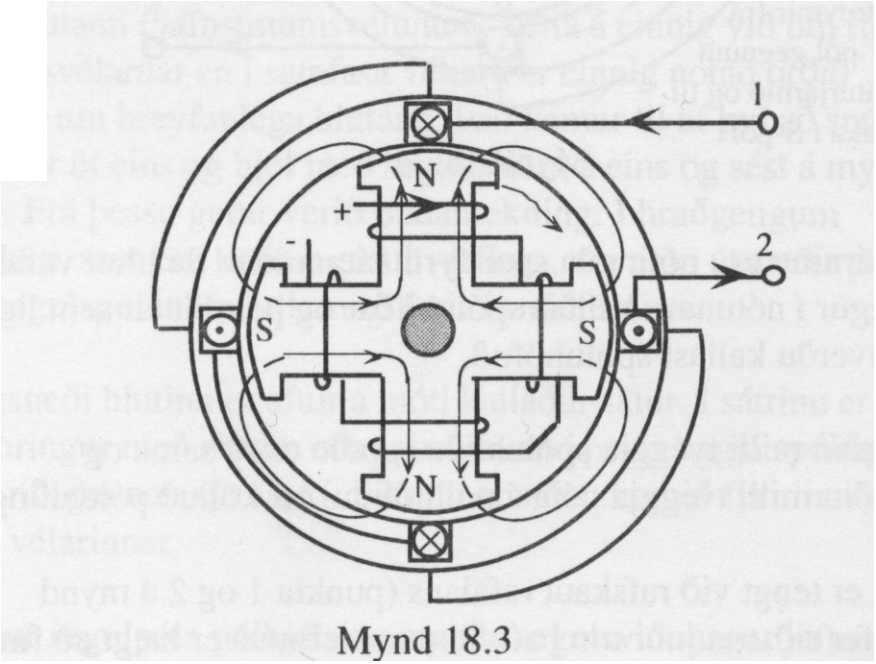




Fjarlægðin milli tveggja spóluhliða í spólu er sú sama og fjarlægðin milli tveggja póla á pólhjólinu, oft kölluð póldeiling.

Uppbygging Riðstraumsrafala

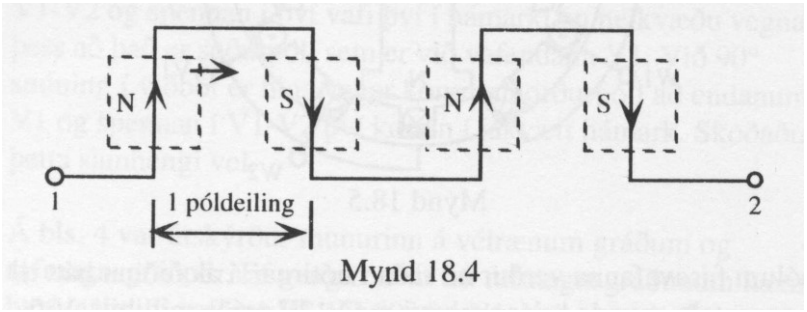




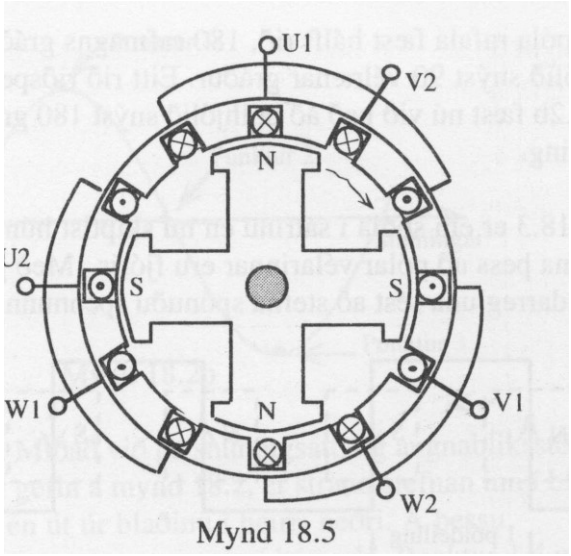
Mynd 18.3

https://www.youtube.com/watch?v=2dW4d7LMr1E

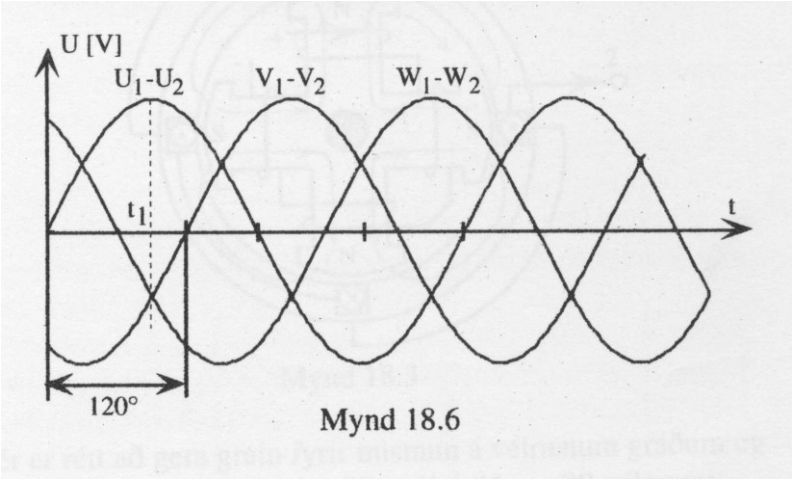
Vinnumáti riðstraumsrafala



Mynd 18.4



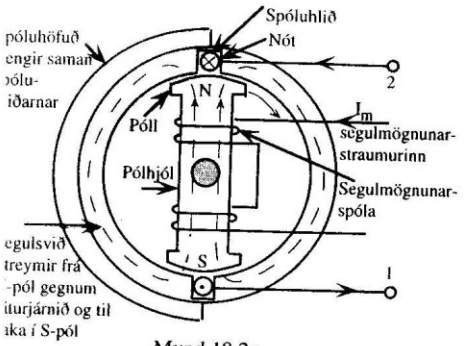
Mynd 18.5



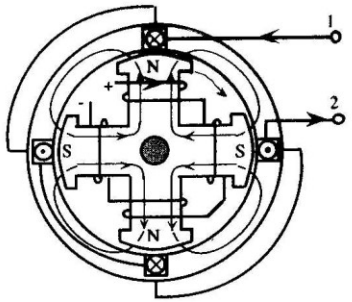
Mynd 18.6

Vinnumáti riðstraumsrafala

Fjarlægðin milli tveggja spóluhliða í spólu er sú sama og fjarlægðin milli tveggja póla á pólhjólinu, oft kölluð póldeiling.

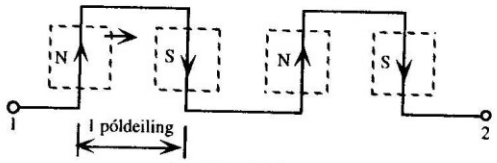


Mynd 18.2a

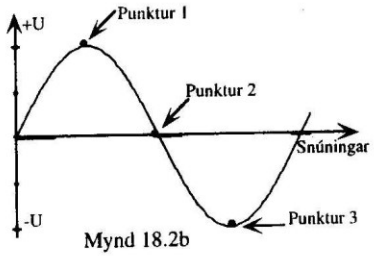


Mynd 18.3

Mynd 18.3 er fjögurra póla einfasa vél.
Bilið milli spóluliða er 90 vélrænar gráður en jafnframt er það 180 rafmansgráður



Mynd 18.4

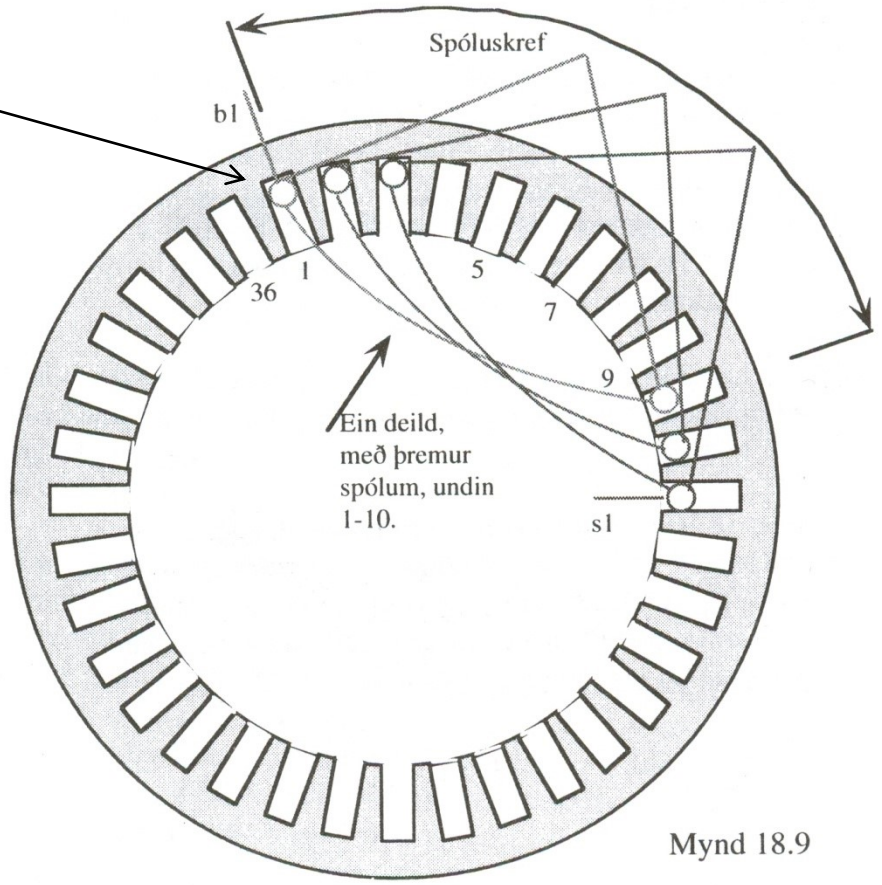


Mynd 18.2b

Hver spóla er með marga vindinga sem liggja í sömu nótinni og margar spólur í mismunandi nótum eru tengdar saman í eina heild sem kallast spóludeild.

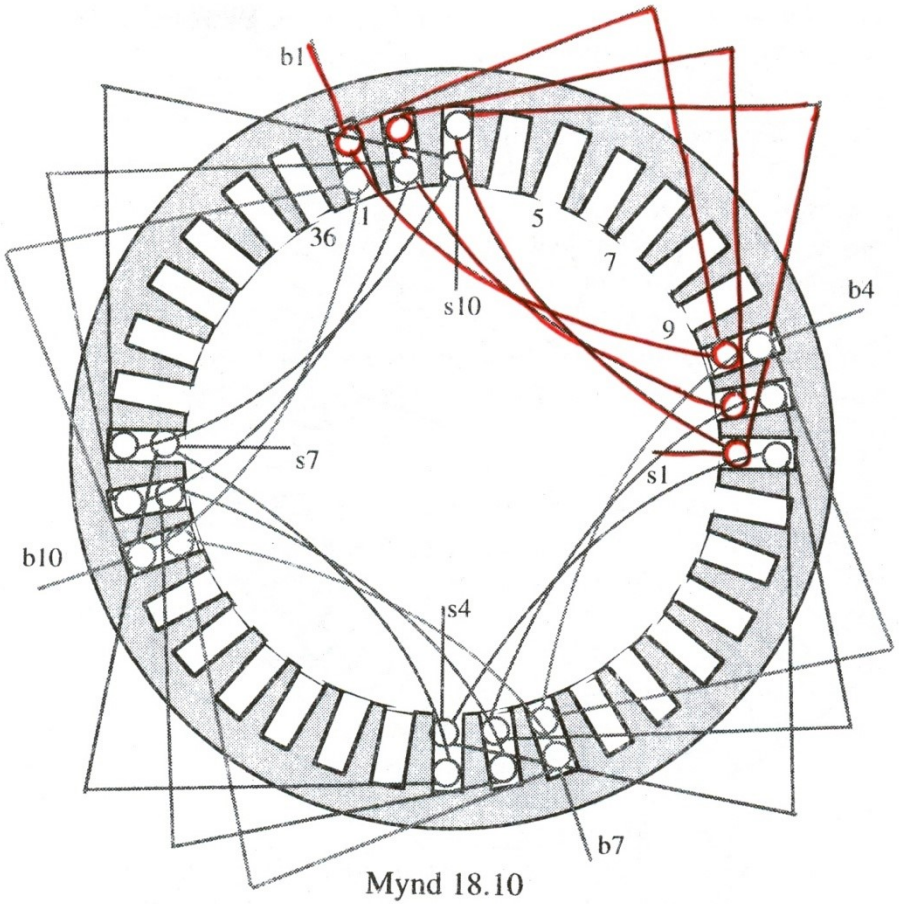
Spóludeild myndar segulpól í mótor, eða nær á milli tveggja póla í pólhjóli rafala.

Spóludeildirnar eru síðan tengdar saman í fasavaf.



Mynd 18.9

Spóludeildirnar eru tengdar saman í fasavaf.



Mynd 18.10

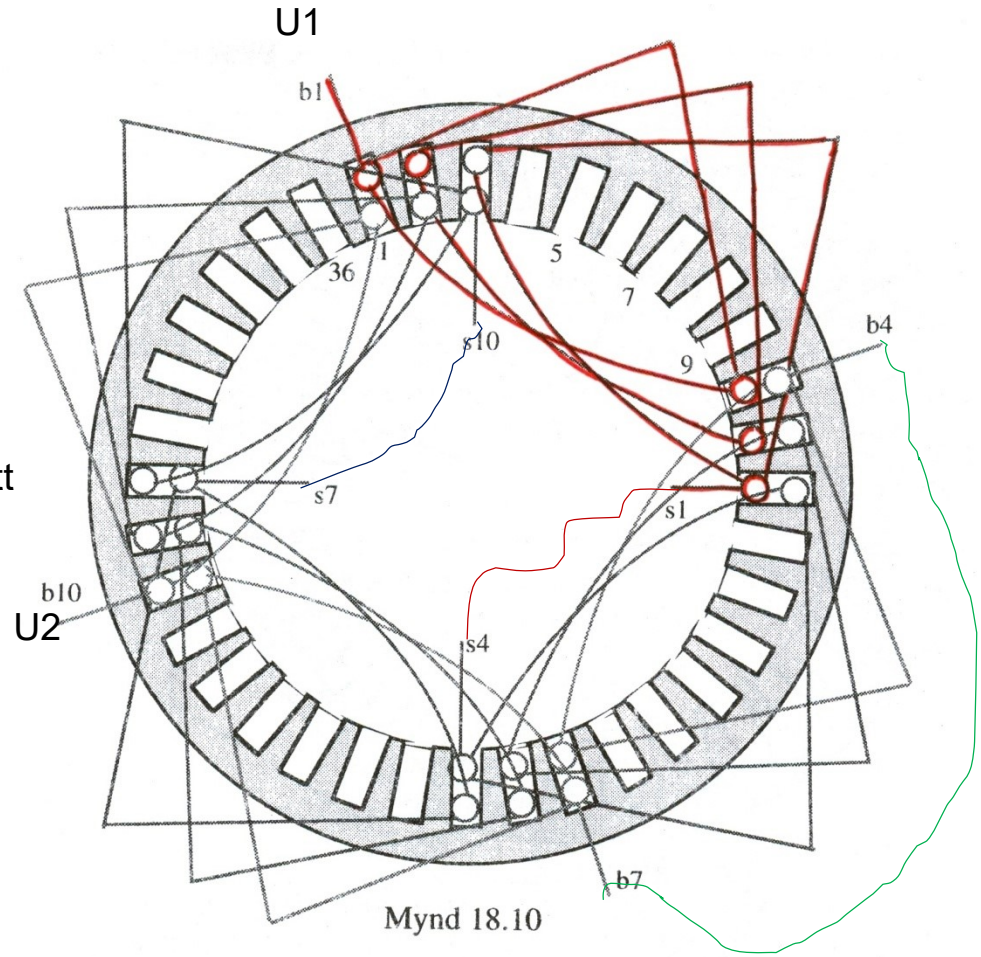
Eitt fasavaf.

Til að deildirnar vinni rétt saman þarf að tengja:

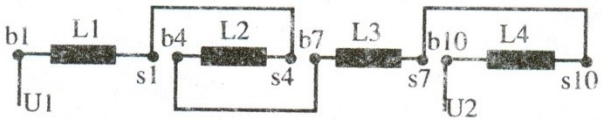
B4 við b7

S1 við S4

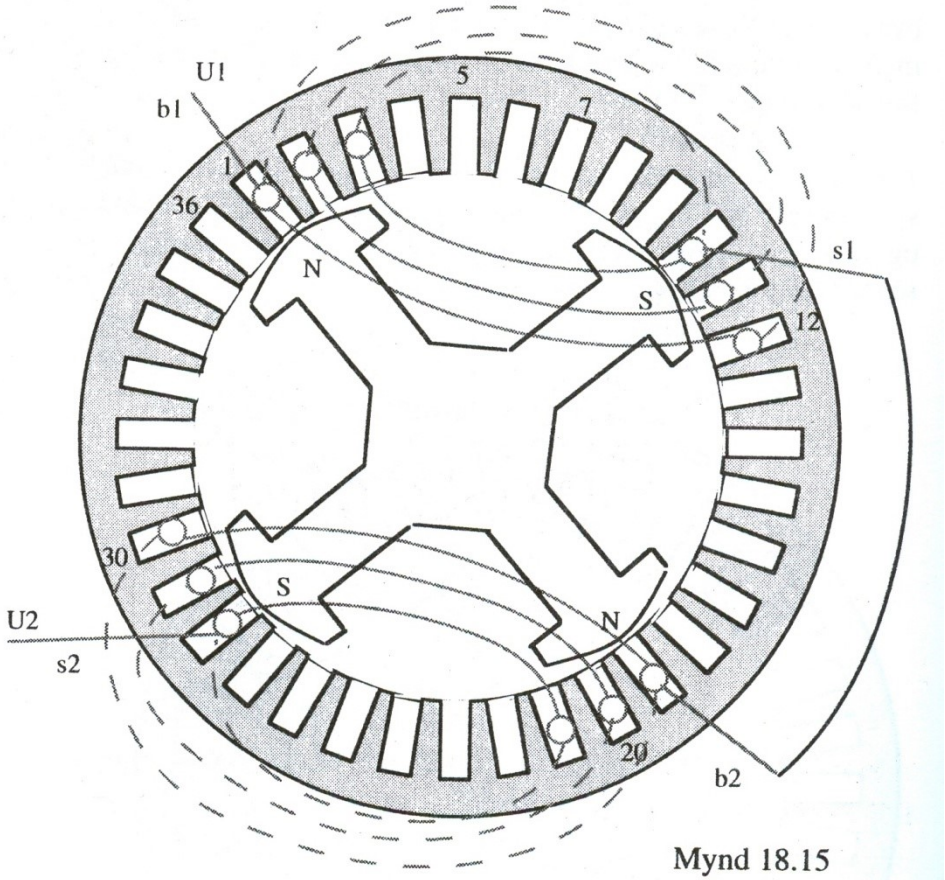
S7 við S10.



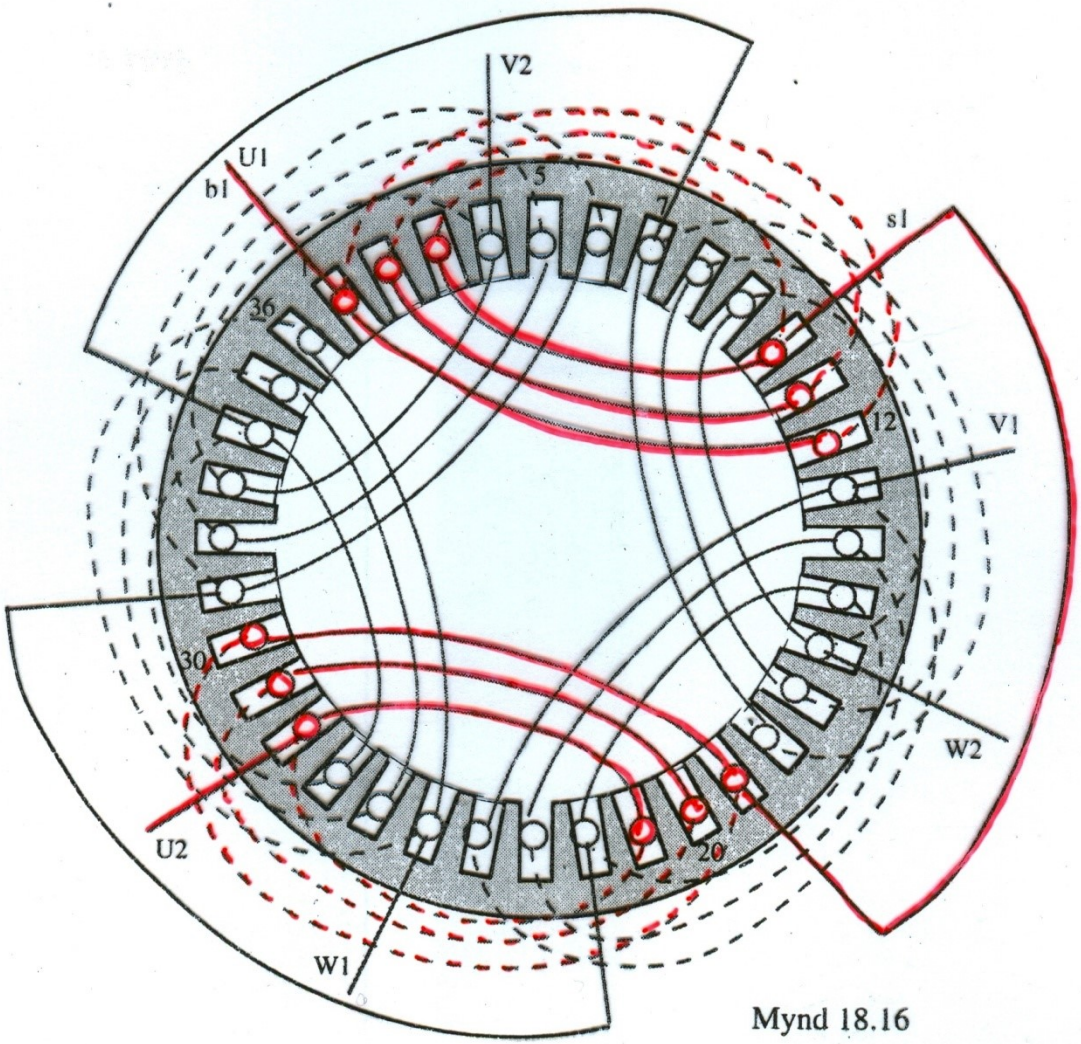
Mynd 18.10



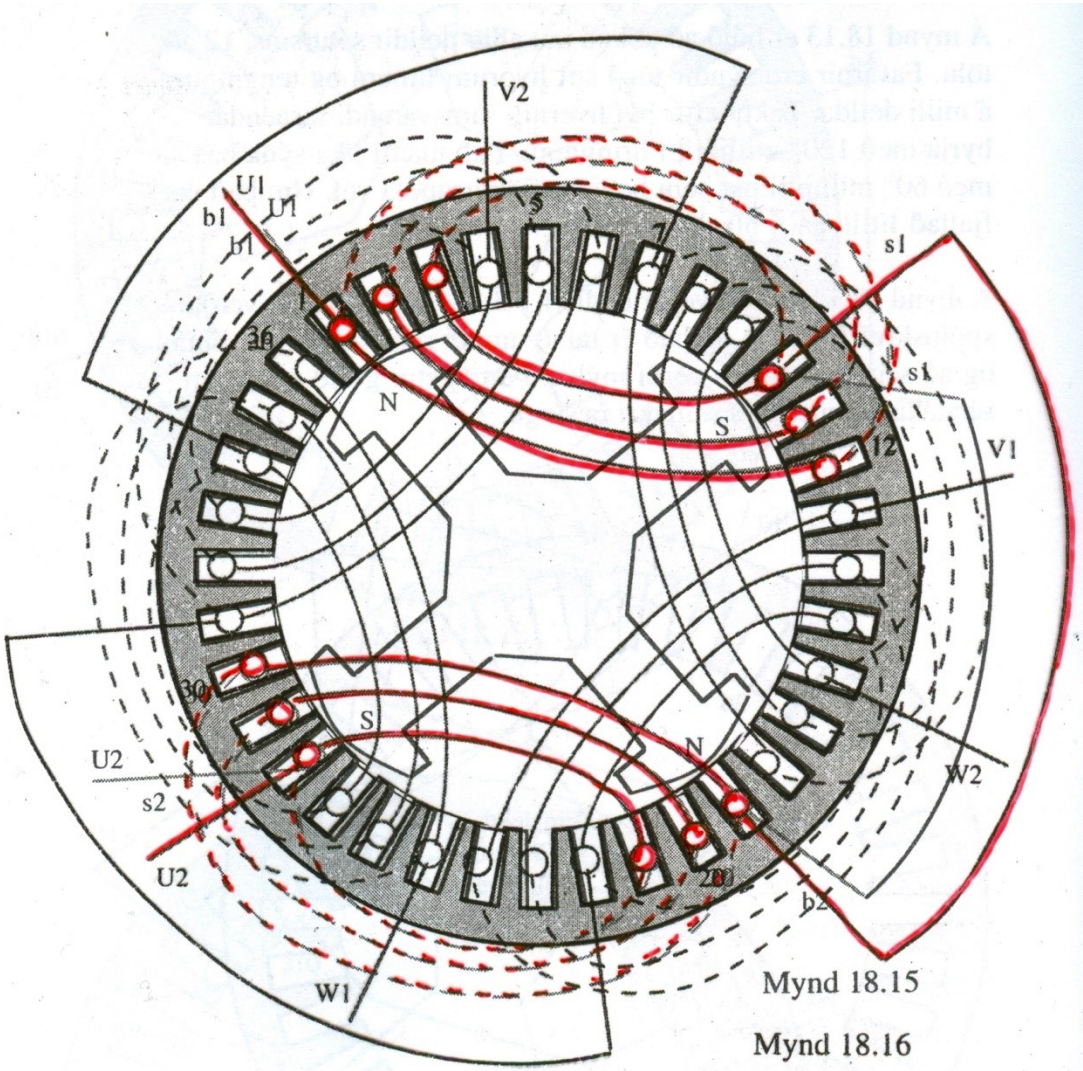
Mynd 18.11



Mynd 18.15

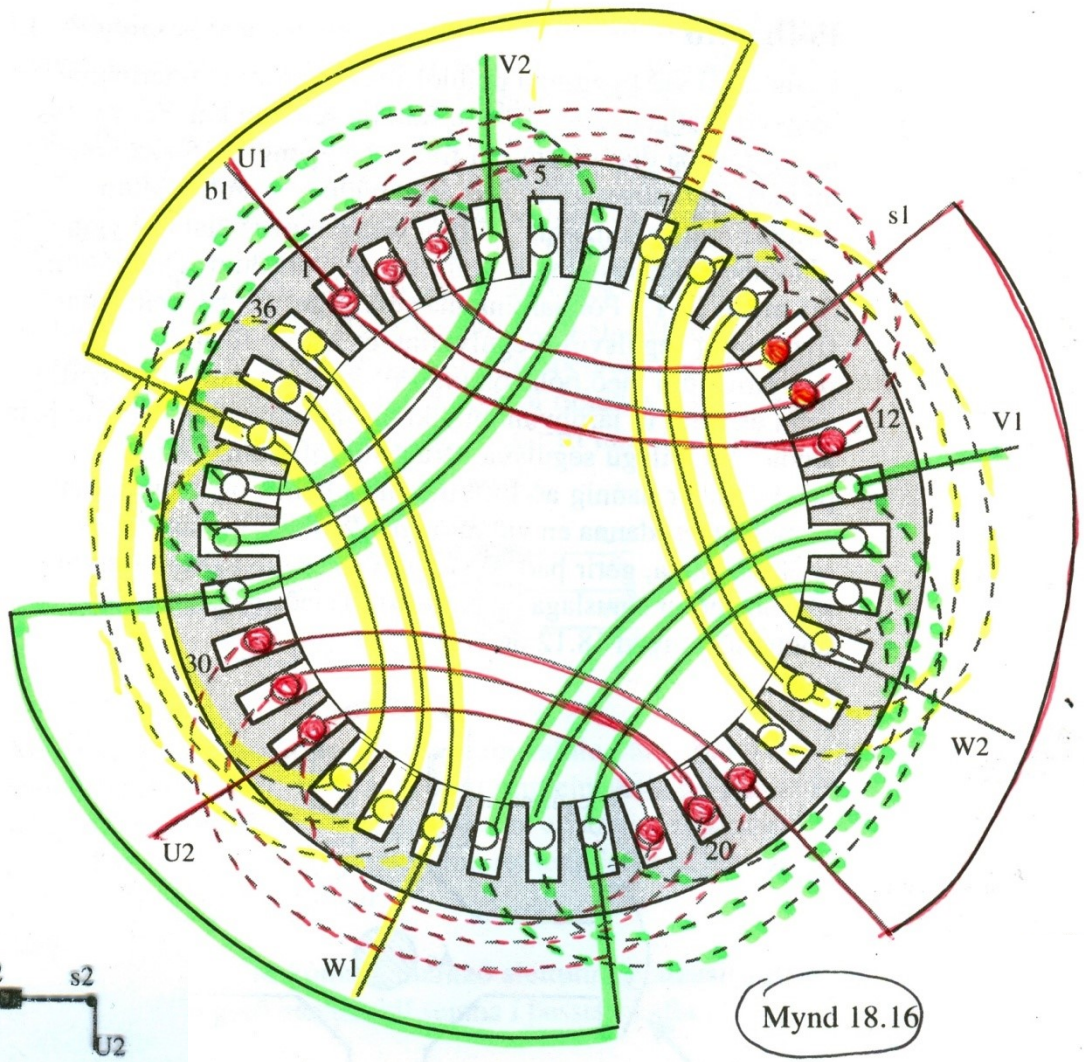


Mynd 18.16

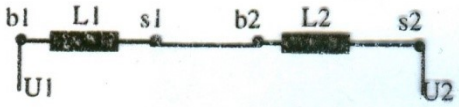


Mynd 18.15

Mynd 18.16



Mynd 18.16



Mynd 18.16a

Pólhjólið

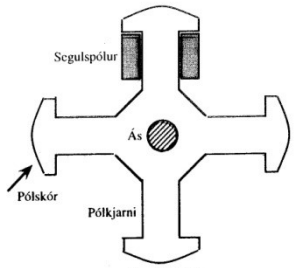
Sáturspyrna

Segulsvið pólhjólsins spanar spennu í sárurvöfum.

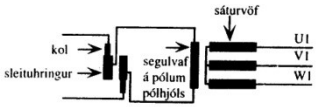
Straumurin í sáturvöfunum myndar eigið segulsvið sem virkar aftur til baka á segulsvið pólhjólsins.

Snúðspyrna er háð straumstyrknum í sáturvöfunum og fasviki álagsins.

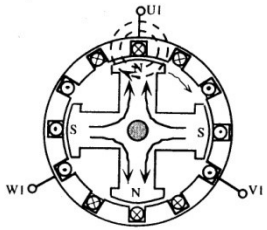
Snúðspyrnan getur haft mikil áhrif á segulmögnun rafalans.



Mynd 18.17

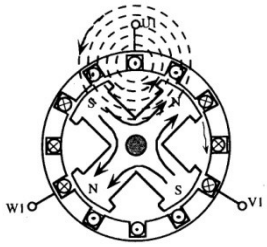


Mynd 18.18

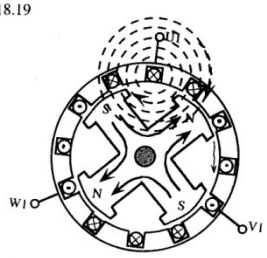


Mynd 18.19

Raunálag.
Auka þarf segulmögnunina með vaxandi álagi



Mynd 18.21



Mynd 18.20

Spanálag.
Auka þarf segulmögnunina en meira en þegar álagið var hreint raunálag

Rýmdarálag.
Straumur er 90 gráður á undan spenunni. Minnka þarf segulmögnunarstrauminn

Töp í riðstraumsrafa eru:

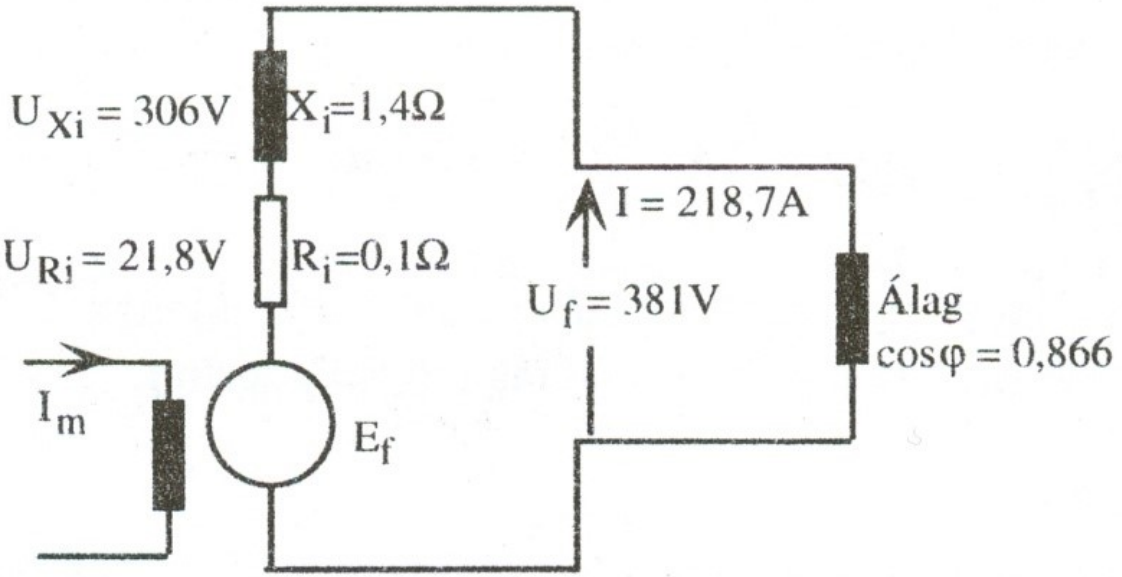
- Núningstöp, vegna legu – og loftviðnáms *Vaxa með snúningshraðanum*
- Járntöp, skiptast í segultregðu- og hvirfilstraumatöp *Þau eru háð tíðni spönuðu spennunnar*
- Eirtöp *Þau eru straumhitatöp í spólum eða vöfum vélarinnar. Þau breytast með álasstrauminum í öðru veldi*

$$\eta = \frac{P_{út}}{P_{inn}}$$

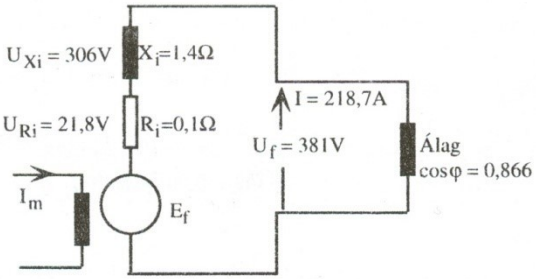
Nýtni getur verið 87% í litlum vélum upp í u.þ.b. 98% í stórum vélum

Sýnidæmi 2.

Samfasarafali er stimplaður 250kVA, 660V, 50Hz.
Raunviðnám sáturvafanna er 0,1Ω í hverjum fasa og launviðnám þeirra 1,4Ω í fasa.
Reiknaðu innri spennu rafalans þegar hann gefur málstraum út á álag með raunaflstuðull $\cos\varphi = 0{,}866$



Mynd 18.25a



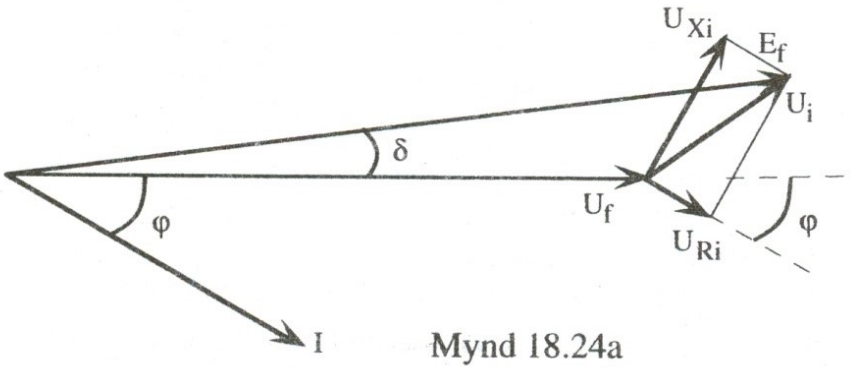
Mynd 18.25a

$\alpha + \varphi = 90°$

E_f = spönuð spenna í rafalanum

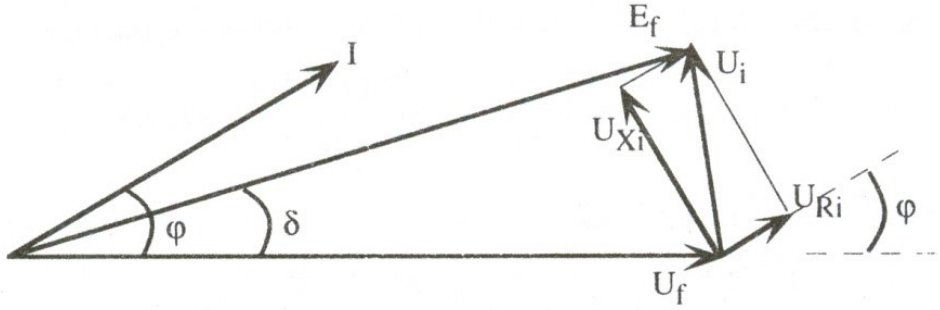
U_f = skautspenna (fasaspenna rafala)

$$E_f = \sqrt{\left(U_f + U_{Xi} \cdot \cos\alpha + U_{Ri} \cdot \cos\gamma\right)^2 + \left(U_{Xi} \cdot \sin\alpha - U_{Ri} \cdot \sin\gamma\right)^2}$$



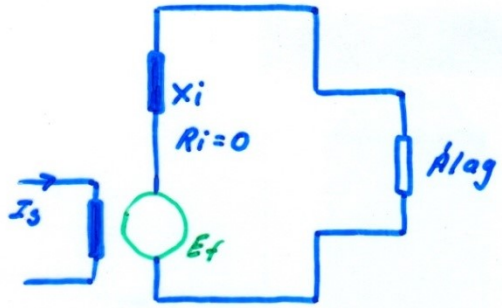
Mynd 18.24a

Straumurinn kemur á eftir spennunni.
=> panálag

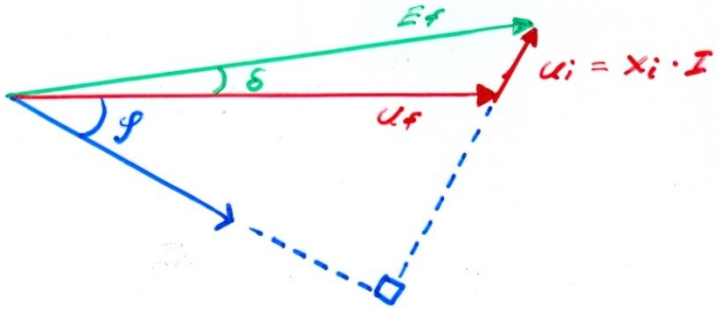


Mynd 18.24b

Straumurinn kemur á undanspennunni
=> rýmdarálag.



mynd 18.26



mynd 18.27

$$P = 3 \frac{E_f \cdot U_f}{X_i} \cdot \sin \delta$$

δ = aflhorn rafalans

Sýnidæmi 2.

Samfasarafali er stimplaður 250kVA, 660V, 50Hz.
Raunviðnám sáturvafanna er 0,1Ω í hverjum fasa og
launviðnám þeirra 1,4Ω í fasa.
Reiknaðu innri spennu rafalans þegar hann gefur
málstraum út á álag með raunaflstuðull $\cos\varphi = 0{,}866$

Þegar við höfum farið í gegnum Sýnidæmi 2

Þá skulum við reikna aflhorn rafalans

Vektoramynd - sýnidæmi 2