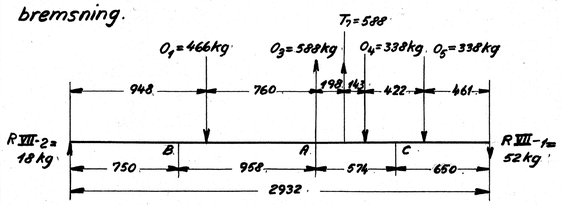
$\sigma_{A1} = -\frac{124000}{170} = -730\ kg/cm^2$ $\sigma_{A-2} = \frac{124000}{182} = 680\ kg/cm^2 < 800$

(bl. 21) B) statiske lodrette tryk med 30% stød og direkte bremsning.



Fra haandbremsen faas (bl. 12) $O_{8\,V} = 4930\ kg$ (122mm. under gitter) $O_1 = \frac{4930 \times 122}{7290} = 466\ kg$ fra luftbremse: (bl. 12) $O_{9\,V} = 8955\ kg$, $O_3 = T_7 = -\frac{8955 \times 122}{2 \times 930} = -588\ kg$.

I bremsecylinder faas et tryk paa: 3860 kg (18W-1.480) virkende 93 + 70 = 163mm under X-aksen i tværdrager IX, der skal optage det vandrette moment fra bremsecylindrenes tryk. $O_4 = O_5 = \frac{3860 \times 163}{2 \times 930} = 338\ kg$

$R_{VII}-1 = \frac{466 \times 948 - 588(1708 + 1906) + 338(2471 + 2049)}{2932} = 151 - 724 + 521 = -52\ kg$. $R_{VII}-2 = \frac{466 \times 1984 - 588(1026 - 1224) + 338(461 + 883)}{2932} = 315 - 452 + 155 = -18\ kg$.

Med haandbremse alene: $O_1 = 466\ kg$ $O_3 = T_7 = 0$ $O_4 = O_5 = 0$

$R_{VII}-1 = \frac{466 \times 948}{2932} = 151\ kg$ $R_{VII}-2 = \frac{466 \times 1984}{2932} = 315\ kg$

$M_{xA} = 151 \times 122{,}4 = 18500\ kg\ cm$ $M_{x\,B} = 315 \times 75 = 23600\ kg\ cm$

$M_{xC} = 151 \times 65 = 9800\ kg\ cm$.

Ialt: $M_{x-A} = 1{,}3 \times 124000 + 18500 = 161200 + 18500 = 179700\ kgcm$

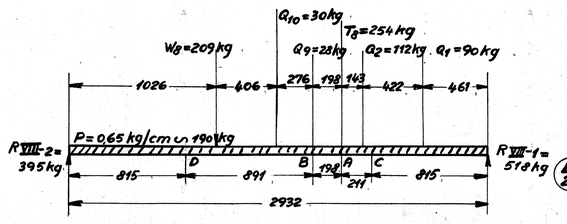
(bl. 22) $\sigma_{A1} = -\frac{179700}{170} = -1060\ kg/cm^2$ $\sigma_{A2} = \frac{179700}{182} = 990\ kg/cm^2 < 1400$

$M_{x\,B} = 1{,}3 \times 84700 + 23600 - 110000 + 23600 = 133600\ kg\ cm$

$\sigma_{B-1} = -\frac{133600}{143{,}5} = -930\ kg/cm^2$ $\sigma_{B2} = \frac{133600}{120} = 1110\ kg/cm^2 < 1400$ $M_{xC} = 1{,}3 \times 85200 + 9800 = 111000 + 9800 = 120800\ kg\ cm$

$\sigma_{C-1} = -\frac{120800}{143{,}5} = -840\ kg/cm^2$ $\sigma_{C-2} = \frac{120800}{120} = 1007\ kg/cm^2 < 1400$

8) beregning af tværdrager VIII (18W-15.101 pos. 3)



A) lodrette statiske tryk.

Egenvægt af drager ca 40kg væg ca. 150kg fordeles begge over 2932mm $p = \frac{150 + 40}{2932} = 0{,}65\ kg/cm \backsim 190\ kg$

vægt af gulv og toiletudstyr (bl. 18) 1/2 (200 + 86) = 143 kg

$W_8 = T_8 = \frac{143(440 + \frac{1}{2} \times 1026)}{2932} = 47\ kg$.

Gulvbærere $W_8 = 8\ kg$ $T_8 = 4\ kg$

Gulv i VIII - IX: 1/2 × 78 = 39kg $W_8 = T_8 = \frac{39 \times (440 + \frac{1}{2} \times 1026)}{2932} = 13\ kg$.

Sofaer og passagerer (50% over vægt) udgør (18W-1.141) 700 + 1,5 × 2780 = 4870 kg fordelt over 9090mm og der regnes for sikkerheds skyld med passager helt hen til kedelrum.

Paa drage VIII falder: $\frac{4870 \times 1/2 (930 + 835)}{9090} = 474\ kg$

(bl. 23) $W_8 = T_8 = \frac{474 \times (440 + \frac{1}{2} \times 1026)}{2932} = 169\ kg$.

Bremsearm med bæring: $Q_9 = T_8 = \frac{120 \times 85}{2 \times 930} + \frac{14}{2} = 6 + 7 = 13\ kg$.

Bremsecylindre med bæring: $Q_1 = Q_2 = \frac{(120 + 10) \times 730}{2 \times 930} + \frac{(100 + 10) \times 40}{835} + \frac{1}{2}(14 + 12) = 51 + 26 + 13 = 90\ kg$

Batterikasser: 850 kg og 750 kg efter bl. 19 $P_4 = 420\ kg$

$W_8 = \frac{420 \times 155}{930} = 70\ kg$ kabelkanal: $Q_{10} = Q_9 = \frac{600 \times 1/2 (930 + 835)}{12000 \times 2} = 15\ kg$. Hjælpeluftbeholder: 75kg. Regnes at angribedrager i Q_{10} og Q_2. $Q_{10} = \frac{75(550 - 220)(474 - 284)}{(930 - 250) 474} = 15\ kg$ $Q_2 = \frac{75(550 - 220) \times 284}{(930 - 250) 474} = 22\ kg$ $W_8 = \frac{P_3 \times 250\ (bl.18)}{930} = \frac{8 \times 250}{930} = 2\ kg$ $T_8 = \frac{30 \times 250}{930} = 8\ kg$ (bl. 18).

Ialt: $W_8 = 47 + 8 + 13 + 169 + 70 + 2 = 209\ kg$ $Q_{10} = 15 + 15 = 30\ kg$.

$Q_9 = 13 + 15 = 28\ kg$ $T_8 = 47 + 4 + 13 + 169 + 13 + 8 = 254\ kg$

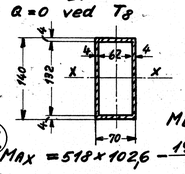
$Q_2 = 90 + 22 = 112\ kg$ $Q_1 = 90\ kg$ $R_{VIII}\,1 = 1/2 \times 190 + \frac{209 \times 1026 + 30 \times 1432 + 28 \times 1706 + 254 \times 1906 + 112 \times 2049 + 90 \times 2471}{2932} =$

$95 + 73 + 15 + 16 + 165 + 78 + 76 = 518\ kg$

$R_{VIII}\,2 = 1/2 \times 190 + \frac{209 \times 1906 + 30 \times 1500 + 28 \times 1224 + 254 \times 1026 + 112 \times 883 + 90 \times 461}{2932} = 95 + 136 + 15 + 12 + 89 + 34 + 14 = 395\ kg$

Q = 0 ved T_8

Snit A-A og B-B.



(bl. 24)

$F = 7 \times 14 - 13{,}2 \times 6{,}2 = 98 - 82 = 16\ cm^2$

$I_X = 1/12 \times (14^3 \times 7 - 13{,}2^3 \times 6{,}2) = 412{,}3\ cm^4$

$W_X = \frac{412{,}3}{7} = 58{,}9\ cm^3$

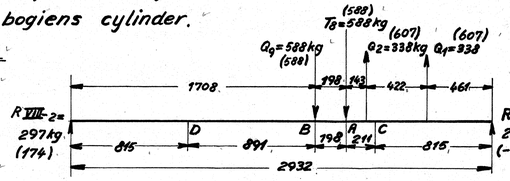
$M_{Bx} = 518 \times 122{,}4 - \frac{190 \times 1224 \times 612}{2932} - 90 \times 76{,}3 - 112 \times 44{,}1 - 254 \times 19{,}8 = 4700\ kgcm$

$M_{AX} = 518 \times 102{,}6 - \frac{190 \times 1026}{2932} \times 513 - 90 \times 56{,}5 - 112 \times 14{,}3 =$

$53000 - 3400 - 5100 - 1600 = 42900\ kg\ cm$ $\sigma_B = \frac{41700}{58{,}9} = 710\ kg/cm^2$

$\sigma_A = \frac{42900}{58{,}9} = 730\ kg/cm^2 < 900\ kg/cm^2$

B) lodrette tryk + 30% stød + bremsekraft i maskinbogiens cylinder.



Tryk i leje fra bremsning O_{9-V} (bl. 12) = 8955 kg, der virker 122 mm under bremsegitter. $T_8 = Q_9 = \frac{8955 \times 122}{2 \times 930} = 588\ kg$

Tryk i bremsecylinder (bl. 21) 3860 kg, der virker 163 mm under tværdragere $Q_1 = Q_2 = -\frac{3860 \times 163}{2 \times 930} - 338\ kg$

$R_{VIII}\,1 = \frac{588(1708 + 1906) - 338(2471 + 2049)}{2932} = 724 - 521 = 203\ kg$

$R_{VIII}\,2 = \frac{588(1224 + 1026) - 338(461 + 883)}{2932} = 452 - 155 = 297\ kg$

Hvis der bremses med begge cylindre faas fra motorbogiens bremse (18W-1.480): 2760 kg virkende 163 mm under tværdragere: $-Q_1 = -Q_2 = Q_3 = Q_4 = \frac{2760 \times 163}{2 \times 835} = 269\ kg$

(bl. 25) Ialt $Q_9 = T_8 = 588\ kg$ $Q_1 = Q_2 = -338 - 269 = -607\ kg$

$R_{VIII}\,1 = \frac{588(1708 + 1906) - 607(2471 + 2049)}{2932} = 724 - 936 = -212\ kg$

$R_{VIII}\,2 = \frac{588(1224 + 1026) - 607(461 + 883)}{2932} = 452 - 278 = 174\ kg$.

Første tilfælde: $M_{AX} = 203 \times 102{,}6 + 338\,(14{,}3 + 56{,}5) =$

$20800 + 23900 = 44700\ kg\ cm$ $M_{Bx} = 297 \times 170{,}8 = 50600\ kg\ cm$.

I andet tilfælde: $M_{AX} = -212 \times 102{,}6 + 607(14{,}3 + 56{,}5) =$

$21700 + 43000 = +21300\ kg\ cm$ $M_{Bx} = 174 \times 170{,}8 =$

$29700\ kg\ cm$.

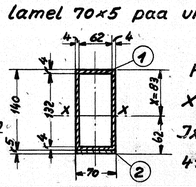
Med direkte bremsning og 30% stød faas ialt

$M_{AX} = 1{,}3 \times 42900 + 44700 = 55600 + 44700 = 100300\ kg\ cm$

$M_{Bx} = 1{,}3 \times 41700 + 50600 = 54100 + 50600 = 104700\ kg\ cm$.

Spændingerne bliver for store, og der anbringes en lamel 70×5 paa undersiden til C-C og D-D

Snit: A-A og B-B.



$F = 16 + 7{,}0 \times 0{,}5 = 16 + 3{,}5 = 19{,}5\ cm^2$

$X = \frac{16 \times 7 + 3{,}5 \times 14{,}25}{19{,}5} = 5{,}72 + 2{,}56 \backsim 8{,}3\ cm$

$J_X = 412{,}3 + 16 \times 1{,}3^2 + 1/12 \times 7{,}0 \times 0{,}5^3 + 3{,}5 \times 5{,}95^2 =$

$412{,}3 + 27{,}0 + 0{,}1 + 124 = 563{,}4\ cm^4$

$W_{x1} = \frac{563{,}4}{8{,}3} = 68{,}0\ cm^3$ $W_{x2} = \frac{563{,}4}{6{,}2} = 91\ cm^3$

$\sigma_{A-1} = -\frac{100300}{68} = 1475\ kg/cm^2 < 1550\ kg/cm^2$ (st. 42)

$\sigma_{A-2} = \frac{100300}{91} = 1105\ kg/cm^2 < 1400\ kg/cm^2$

$\sigma_{B1} = -\frac{104700}{68} = 1535\ kg/cm^2 < 1550\ kg/cm^2$ (st. 42)

$\sigma_{B2} = \frac{104700}{91} = 1150\ kg/cm^2 < 1400\ kg/cm^2$.

(bl. 26) Snit: C-C.

Tværsnit bestaar af □ 140 × 70 × 4: $F = 16\ cm^2$

$W_X = 58{,}9\ cm^3$. Med direkte bremsning med cylinder for maskinbogie og 30% stød: $M_{XC} = 1{,}3(518 \times 81{,}5 - 90 \times 35{,}4 - \frac{190 \times 815}{2932} \times 40{,}75) + 203 \times 81{,}5 + 338 \times 35{,}4 =$

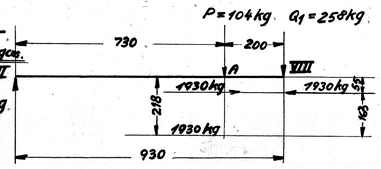
$1{,}3(42200 - 3200 - 2200) + 16500 + 12000 = 47800 + 28500 =$

$76300\ kg\ cm$ $\sigma_C = \frac{76300}{58{,}9} = 1300\ kg/cm^2 < 1400\ kg/cm^2$

Snit: D-D: $M_{X\,D} = (395 \times 81{,}5 - \frac{190 \times 815 \times 40{,}75}{2932}) \times 1{,}3 + 297 \times 81{,}5 = (32200 - 3200) \times 1{,}3 + 24200 = 37700 + 24200$

$61900\ kg\ cm$ $\sigma_D = \frac{61900}{58{,}9} = 1050\ kg/cm^2 < 1400\ kg/cm^2$.

9) Længdedragere $Q_5 - Q_1$ og $Q_4 - Q_7$ (18W-22.520)



Egenvægt af cylinder og drager pr. længdedrager 1/2 (120 + 40) = 80kg + 30% stød = 104 kg anbringes som en enkeltkraft P. Fra bremsecylinder 1/2 × 3860 = 1930 kg. Kraften flyttes til x-akse i tværdrager VIII $O_5 = Q_1 = \frac{1930 \times 16{,}3}{93{,}0} = 340\ kg$. Hertil fra egenvægt + stød $O_5 = \frac{104 \times 200}{930} = 22\ kg$ $Q_1 = \frac{104 \times 730}{930} = -82\ kg$

ialt: $O_5 = 340 + 22 = 362\ kg$ $Q_1 = 340 - 82 = 258\ kg$.

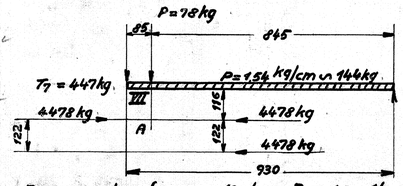
(bl. 27) $M_{XA} = -262 \times 73 = 26500\ kg\ cm$ $S = 0$ eller:

$M_{XA} = -258 \times 20 - 1930 \times 5{,}5 = -5200 - 10600 = -17900\ kgcm$

$S = -193\ 0kg$. Profil C NP 12: $F = 17\ cm^3$

$W_X\ 60{,}7\ cm^3$ $\sigma_A = \frac{26500}{60{,}7} = 435\ kg/cm^2$ eller $\sigma_A = -\frac{17900}{60{,}7} - \frac{1930}{170} = -295 - 114 = -409\ kg/cm^2$

10) beregning af længdedrager $T_7 - T_8$ (18W-22.050).



Egenvægt af arm: 120kg. $P = 1{,}3 \times 1/2 \times 120 = 78\ kg$.

Egenvægt af drager, passager med 50% overlast + gulv i fag: VII - VIII. Paa $T_7 - T_8$: $16 + \frac{86 \times (440 + 341 + 1125) \times 1/2}{2932 \times 2} + \frac{4870 \times 930 \times 1/2 (440 + 341 + 1125)}{9090 \times 2932 \times 2} = 16 + 14 + 81 = 111\ kg$

$p = \frac{111}{930} = 1{,}19\ kg/cm$ med stød: $1{,}19 \times 1{,}3 = 1{,}54\ kg/cm$

$\backsim 144\ kg$. Kraften: 1/2 × 8955 kg optages af bremsegitter, der ligger 122mm over kraften $T_7 = -1/2 \times 144 - \frac{78 \times 845}{930} + \frac{4478 \times 122}{930} = -72 - 71 + 590 = 447\ kg$, $T_8 = -1/2 \times 144 + \frac{78 \times 85}{930} + \frac{4478 \times 122}{930} = 72 + 7 + 590 = 669\ kg$ $M_{XA} = 669 \times 84{,}5 - \frac{144 \times 845 \times 42{,}25}{930}$

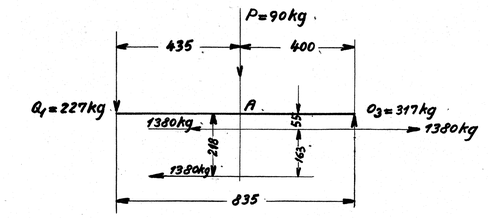
$= 56500 - 5500 = 51000\ kg\ cm$ og $M_{XA} = -447 \times 8{,}5 - 4478 \times 11{,}6 =$

$-3800 - 51900 = -55700\ kg\ cm$ Tryk: 4478 kg

C NP 12. $F = 17{,}0\ cm^2$

$W_X = 60{,}7\ cm^3$ $\sigma = -\frac{55700}{60{,}7} - \frac{4478}{17{,}0} = -920 - 264 = -1184\ kg/cm^2 < 1400$

bl. 28. 11) beregning af længdedrager $Q_1 - Q_3$ (18W-22.520)



Egenvægt af cylinder 100kg. Bæring: 20kg. Begge anbringes ved P. $P = 1/2 \times 100 + 20 = 70\ kg$. Med stød: P = 90 kg. Tryk i bremsecylinder. (18W-1.480): 2760 kg der virker 170 + 108 - 60 = 218mm under X-akse i drager, og 93 + 70 = 163mm under Xakse i tværdrager. Vandret tryk optages af tværdrager IX. Tryk pr. drager fra cylinder 1/2 × 2760 = 1380 kg $Q_1 = -\frac{900 \times 400}{835} + \frac{1380 \times 163}{835} = -43 + 270 = 227\ kg$ $Q_3 = \frac{900 \times 435}{835} + \frac{1380 \times 163}{835} =$

$47 + 270 = 317\ kg$ $M_{XA} = -227 \times 43{,}5 = -9900\ kg\ cm$ og

$M_{XA} = 317 \times 40 + 1380 \times 5 + 12700 + 6900 = 19600\ kg\ cm$

$S = +1380\ kg$ C N P. 12 $F = 17{,}0\ cm^2$ $W_X = 60{,}7\ cm^3$

$\sigma = \frac{19600}{60{,}7} + \frac{1380}{17} = 324 + 82 = 406\ kg/cm^2 < 1400\ kg/cm^2$

12) beregning af tværdrager IX. (18W-15.102 pos. 1).

Egenvæg af drager mm. ca. 90 kg fordelt over 2932 mm $p = \frac{90}{293{,}2} = 0{,}31\ kg$. Gulv i VIII - IX: 78kg

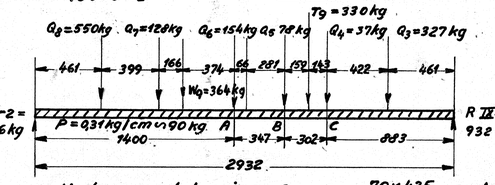
$T_9 = W_9 = \frac{78(440 + 1/2 \times 1026)}{2 \times 2932} = 13\ kg$. Gulv i IX - X: $\frac{78 \times 2290}{835} =$

214 kg. $T_9 = W_9 = \frac{214(440 + 1/2 \times 565)}{2 \times 2932} = 25\ kg$

$Q_3 = Q_8 = \frac{214 \times 1/2 (461 + 565)}{2 \times 2932} = 19\ kg$.

(bl. 20) Kabelkanal fordeles i Q_5 og Q_6

$Q_5 = Q_6 = \frac{600 \times 1/2 (835 + 2290)}{18000 \times 2} = 26\ kg$



Bremsecylinder med bæring: $Q_3 = Q_4 = \frac{70 \times 435}{835} = 37\ kg$.

Gulvbærere: $W_9 = T_9 = 12\ kg$.

Lændedrager ved indstigning $Q_8 = Q_3 = 80\ kg$.

Bremsegitter: $S_3 = 8 + 22 = 30\ kg$

$S_2 = \frac{30 \times 724}{2010} + 1/2 \times 18 = 11 + 9 = 20\ kg$

$S_1 = \frac{30 \times 1286}{2010} + 1/2 \times 18 = 19 + 9 = 28\ kg$.

Bremsearm med leje: ca. 130.

Stk.	Betegnelse	Pos.	Materiale kvalitet	Model nr. eller materiale størrelse	rå	færdig Vægt/stk.
5						
4						
3						
2						
1						

Tegn. M. A. Rev. 23/2-1951 Ed. Afd. IIL
Kalk. B. F. 13/1-51 Norm. Dato

Dato	Rettelse	Indeks

Målestok:

FRICHS

Anvendelse	Stykliste nr.
Diesel-el. 500/550 HK. motorvogn	—
Tegningens benævnelse	**Tegningens nummer**
Beregning af dragere i undervogn.	18W-1.193.

Indeks:

FRICHS nr. 147