



MAK 304 MAKİNE TASARIMI II – ME 304 MACHINE DESIGN II

2015- 2016 Bahar Dönemi - 2015- 2016 Spring Semester

Due Date (April 30, 2016)

Term Project

(Prepared by Mohammed Kassem)

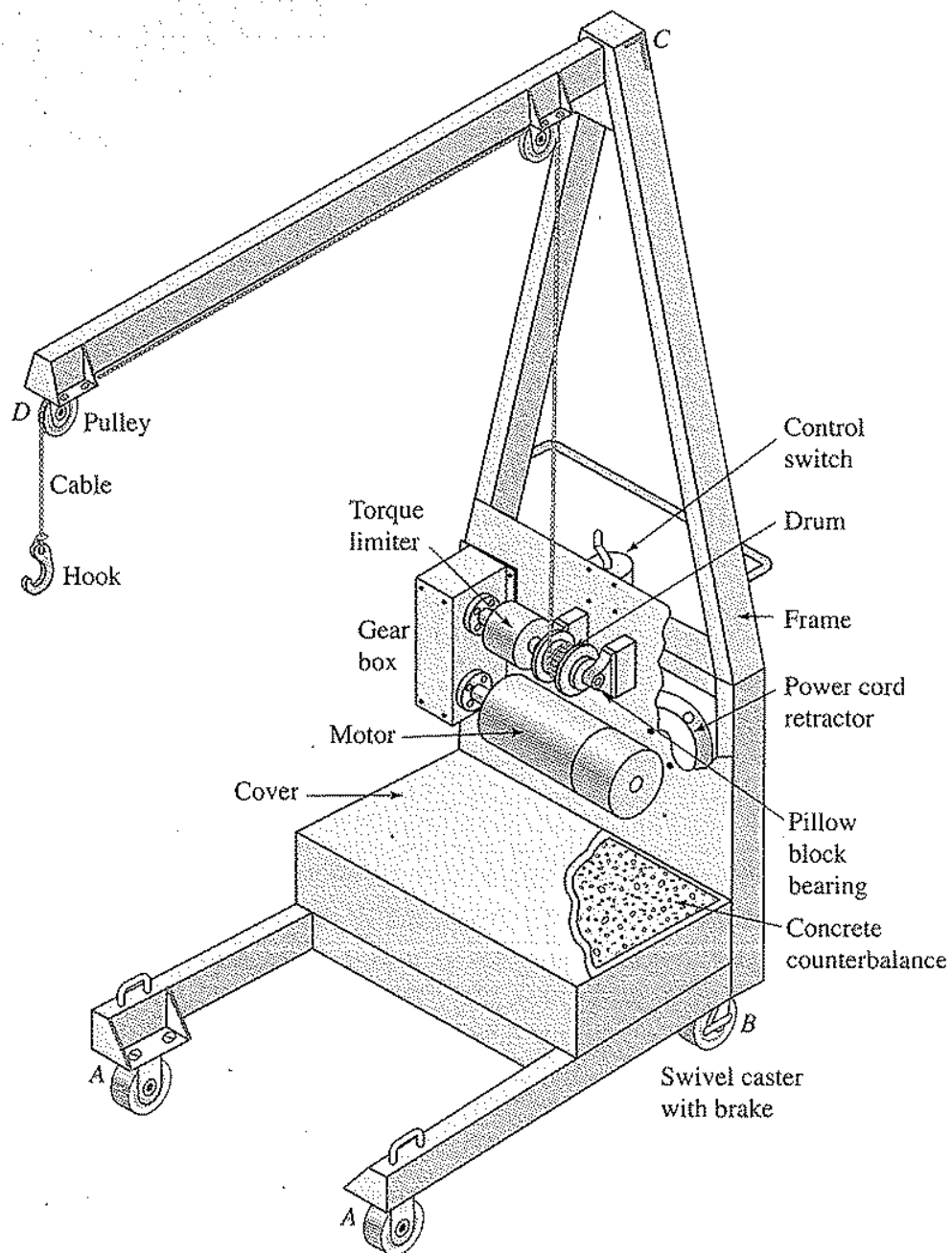


Figure 1.4 Winch crane.

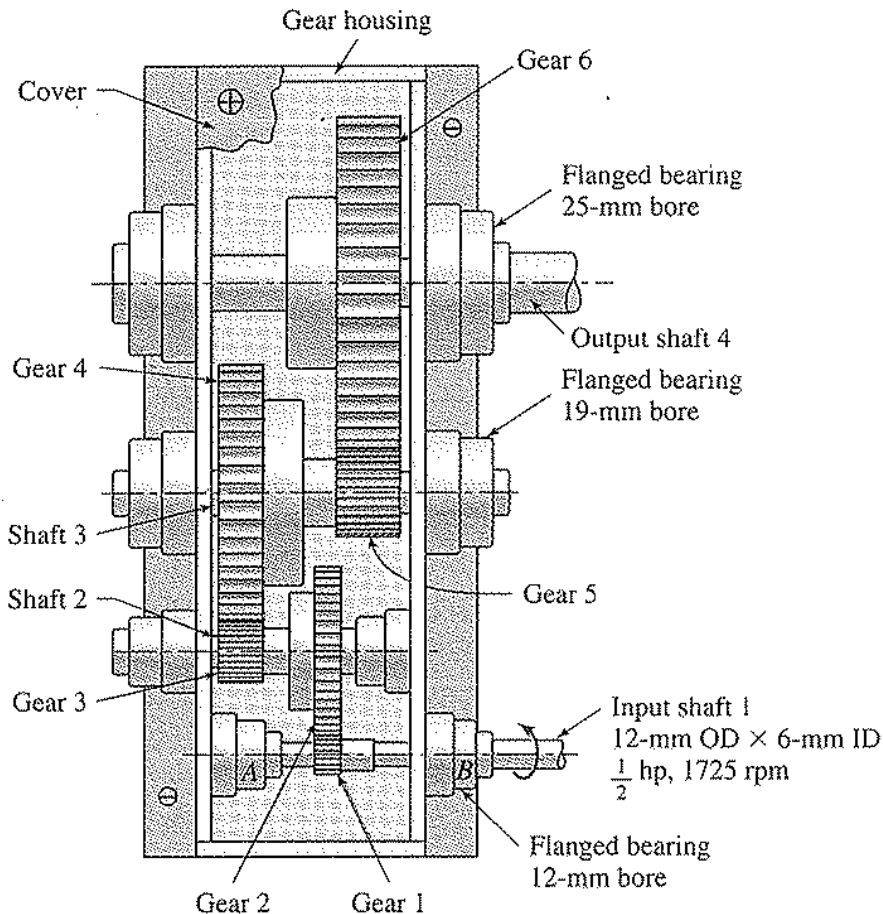


Figure 11.20 Gearbox of the winch crane shown in Figure 1.4.

The spur gearbox of winch crane (Figure 1.4) is illustrated in Figure 11.20. Analyze the design of each gearset using the AGMA method (both bending and contact stress).

Given : The geometry and properties of each element are known. A 0.5 hp, 1700 rpm electric motor at 95% efficiency delivers 0.475 hp to the 85-mm diameter drum (see Case Study 1-1). The maximum capacity of the crane is $P = 3$ kN. All gears have $\phi = 20^\circ$ pressure angle. Shafts 1 or 2, 3, and 4 are supported by, 12, 19, and 25-mm bore flanged bearings respectively.

Assumptions:

1. The pinions are made of carburized 60 R_C steel. Gears are Normalized, 140 Bhn steel.
2. All gears and pinions are high precision shaved and ground; manufacturing quality corresponds to curve A in Figure 11.14.
3. Loads are applied at highest point of single-tooth contact

Design Decisions: The following reasonable values of the bending and wear strength factors for pinions and gears are chosen (from Tables 11.3, 11.5, 11.7, 11.8, 11.10):

$$K_o = 1.5, \quad K_s = 1.0 \text{ (from Section 11.9)}$$

$$K_m = 1.6, \quad K_L = 1.1$$

$$K_T = 1.0 \text{ (from Section 11.9)}, \quad K_R = 1.25$$

$$C_H = 1.0 \text{ (by Equation (11.40))}, \quad C_p = 191\sqrt{\text{MPa}}$$

$$C_f = 1.25 \text{ (from Section 11.11)},$$

$$C_L = 1.1 \text{ (from Section 11.18)},$$

The Data for each group is given below.

Group 1

Gear	m(mm)	N	d(mm)	b
1	1.3	12	16	13
2	1.3	48	64	13
3	1.6	15	25	19
4	1.6	60	100	19
5	2.5	12	30	31
6	2.5	48	120	31

Group 2

Gear	m(mm)	N	d(mm)	b
1	1.3	9	12	12
2	1.3	36	48	12
3	1.6	18	30	17
4	1.6	72	120	17
5	2.5	9	22.5	29
6	2.5	36	90	29

Group 3

Gear	m(mm)	N	d(mm)	b
1	1.3	18	24	15
2	1.3	72	96	15
3	1.6	21	28	21
4	1.6	84	112	21
5	2.5	18	45	33
6	2.5	72	180	33

Group 4

Gear	m(mm)	N	d(mm)	b
1	1.3	15	20	14
2	1.3	60	80	14
3	1.6	16	26.67	20
4	1.6	64	106.67	20
5	2.5	15	37.5	32
6	2.5	60	150	32

Group 5

Gear	m(mm)	N	d(mm)	b
1	1.3	21	28	18
2	1.3	84	112	18
3	1.6	24	40	23
4	1.6	96	160	23
5	2.5	21	52.5	35
6	2.5	84	210	35

Group 6

Gear	m(mm)	N	d(mm)	b
1	1.3	12	16	13
2	1.3	48	64	13
3	1.6	16	26.67	19
4	1.6	64	106.67	19
5	2.5	12	30	31
6	2.5	48	120	31

Group 7

Gear	m(mm)	N	d(mm)	b
1	1.3	18	24	15
2	1.3	72	96	15
3	1.6	24	40	21
4	1.6	96	160	21
5	2.5	18	45	33
6	2.5	72	180	33

Group 8

Gear	m(mm)	N	d(mm)	b
1	1.3	9	12	12
2	1.3	36	48	12
3	1.6	15	25	17
4	1.6	60	100	17
5	2.5	9	22.5	29
6	2.5	36	90	29

Group 9, Group 10

Gear	m(mm)	N	d(mm)	b
1	1.3	15	20	14
2	1.3	60	80	14
3	1.6	18	30	20
4	1.6	72	120	20
5	2.5	15	37.5	32
6	2.5	60	150	32

MAK 304/ ME 304 Student number	Group Number	MAK 304/ Öğrenci Numarası	Grup Numarası
20144009	1	20143540	1
20147407	1	20143541	1
20155062	2	20143542	2
20112173	2	20143766	2
20158846	3	20143152	3
?	3	20143188	3
20133193	4	20142889	4
20132983	4	20135787	4
20145325	5	20145788	5
20145454	5	20142912	5
20154651	6	20143258	6
20113313	6	20145748	6
20133653	7	20134519	7
20144555	7	?	7
20158953	8	20143352	8
20159175	8	20132867	8
20133601	9	?	9
20133664	9	?	9
20146534	10	?	10
20133652	10	?	10