Budapest Univesity of Technology and Economics
Department of Construction Technology and Management

# Construction Equipment
## Lifting & Transporting

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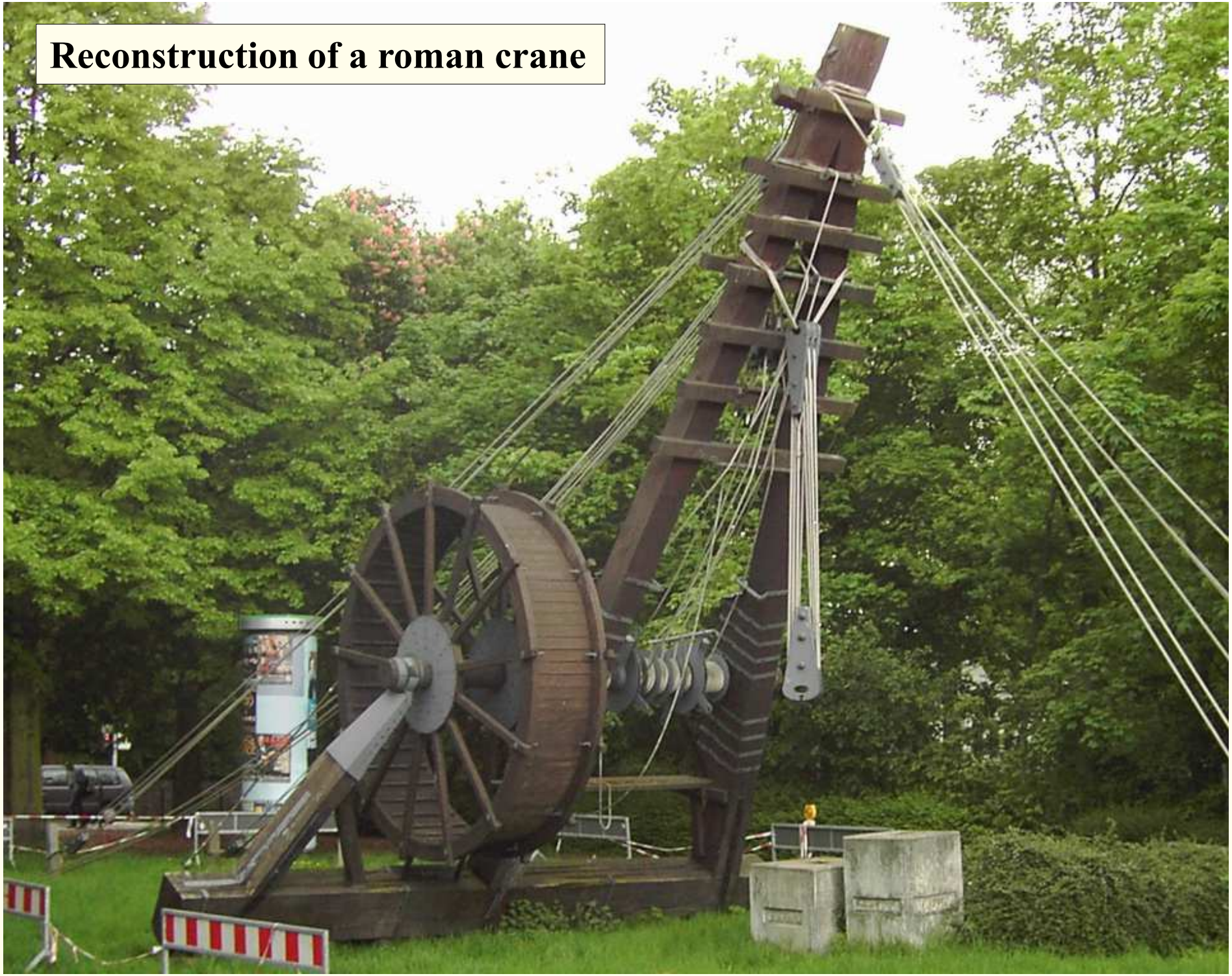
Budapest, 2010

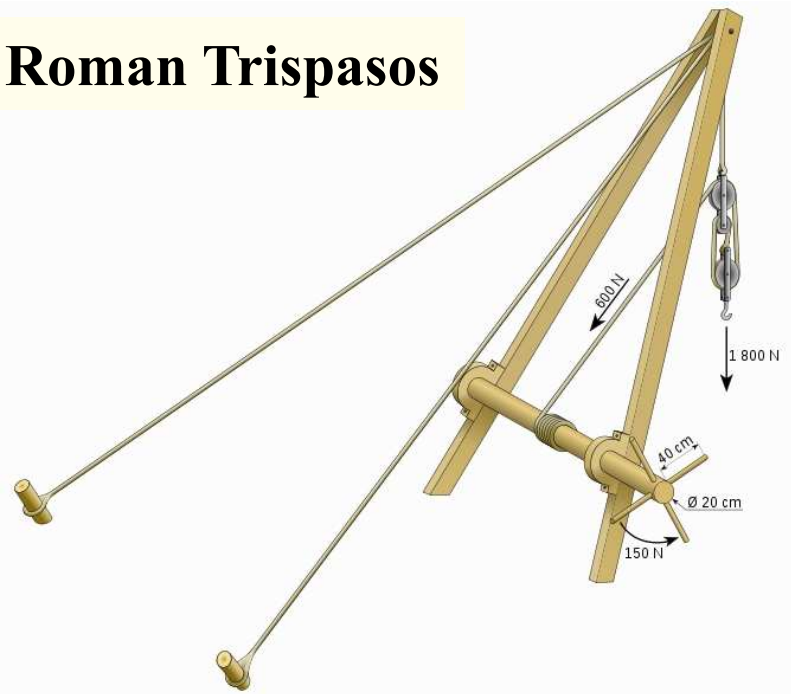
# Reconstruction of a roman crane



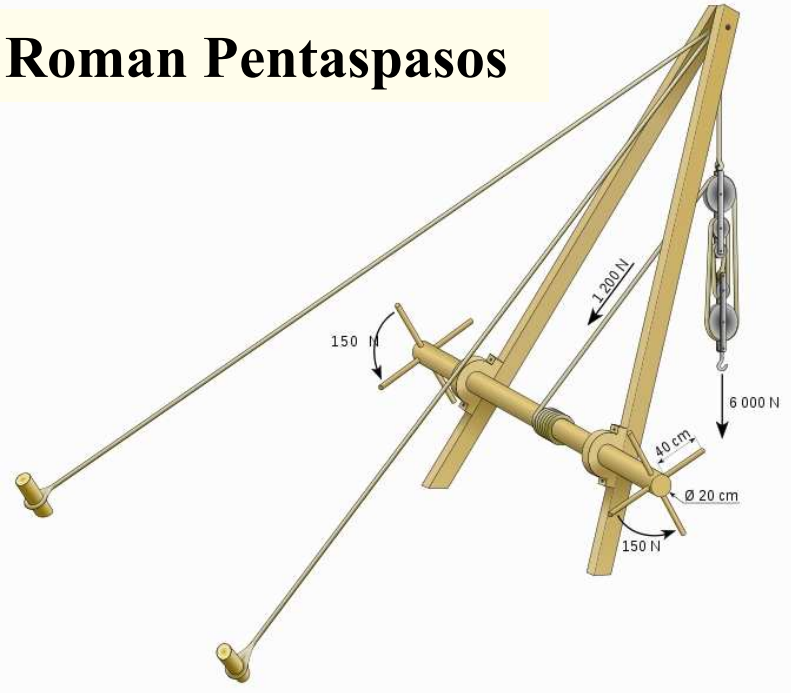
**Reconstruction of the temple of Jerusalem**

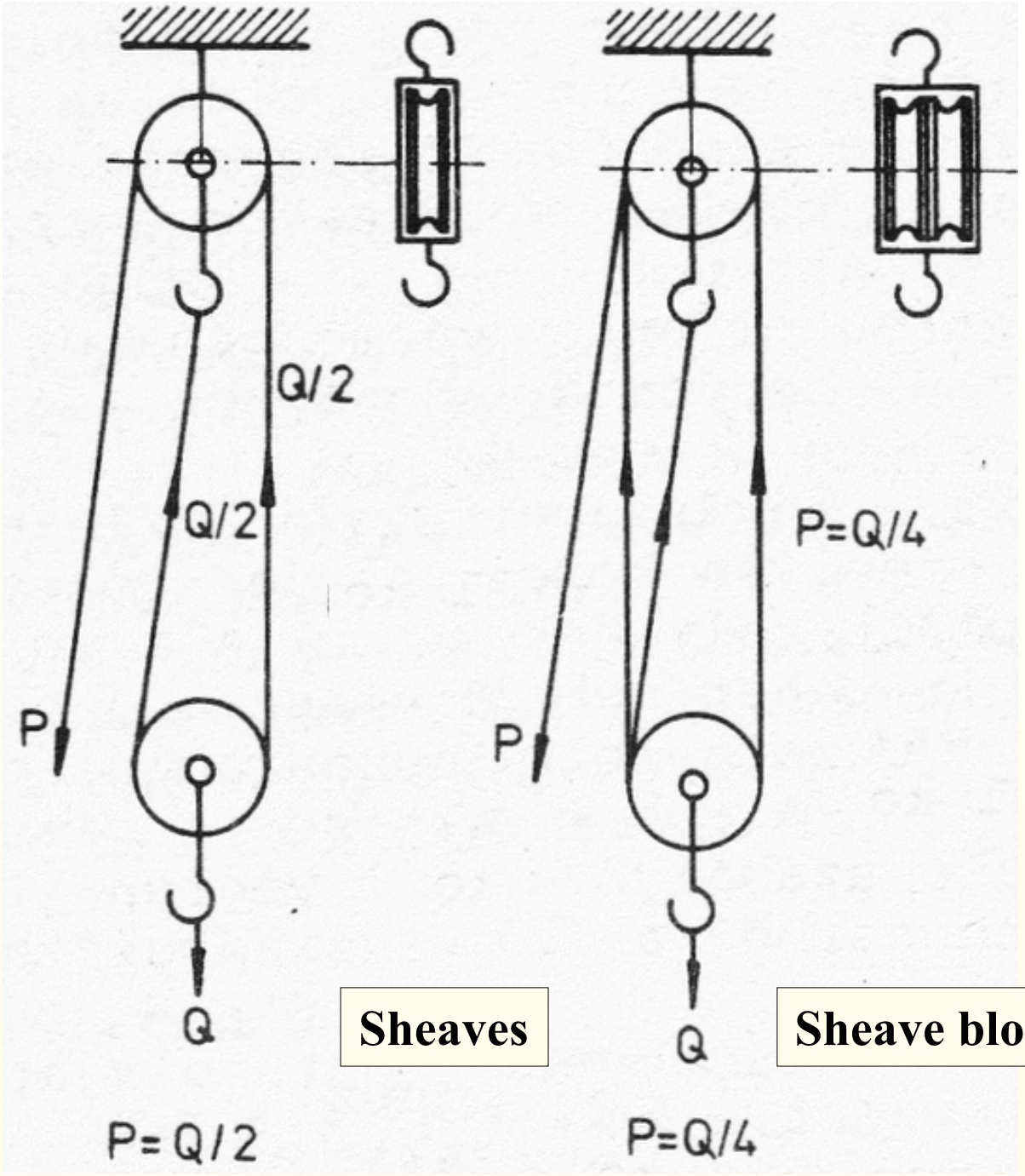
Treadle crane (Bruegel)

## Roman Trispasos



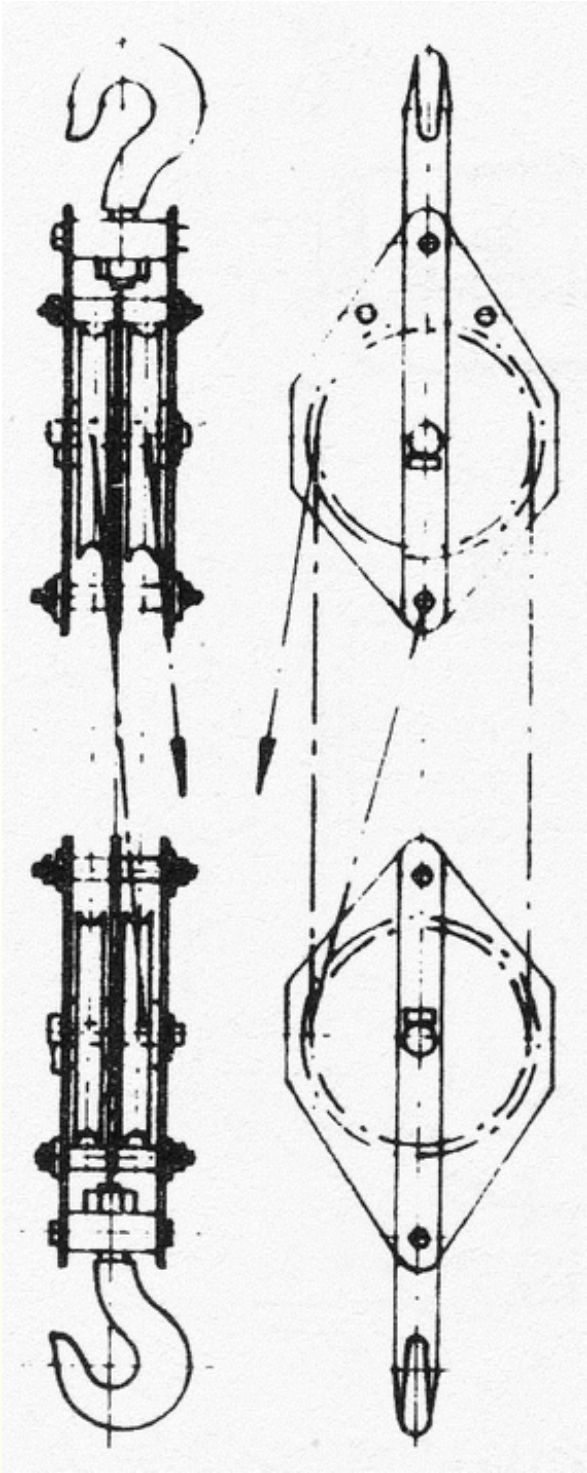

## Roman Pentaspasos

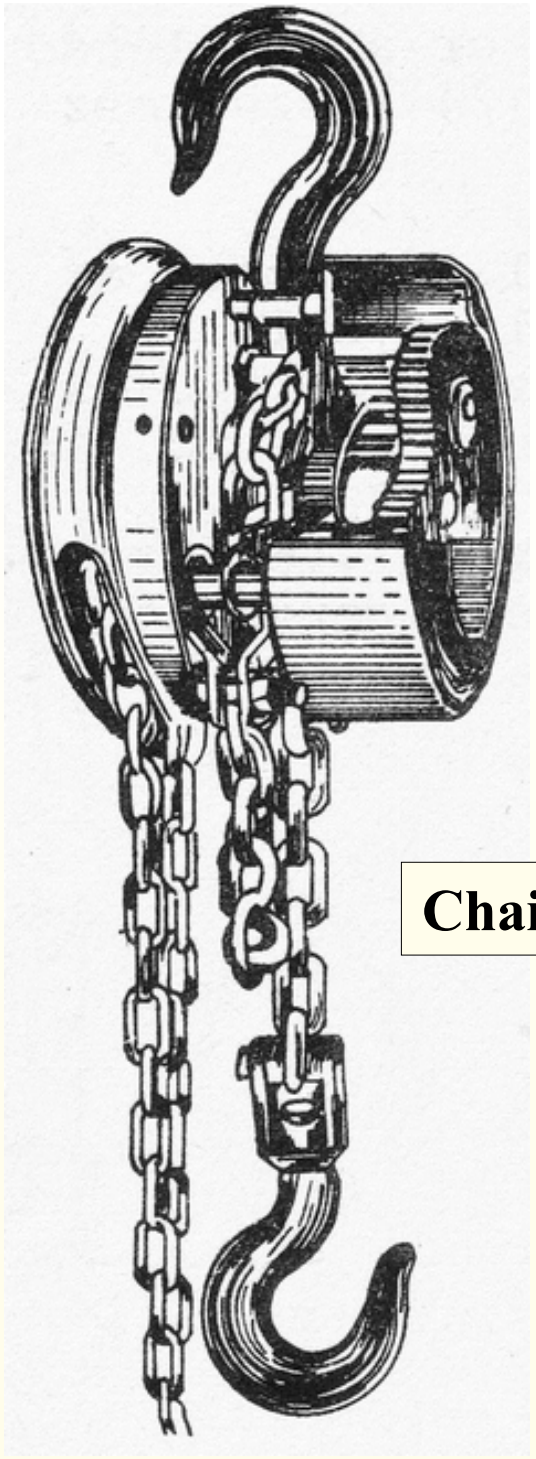




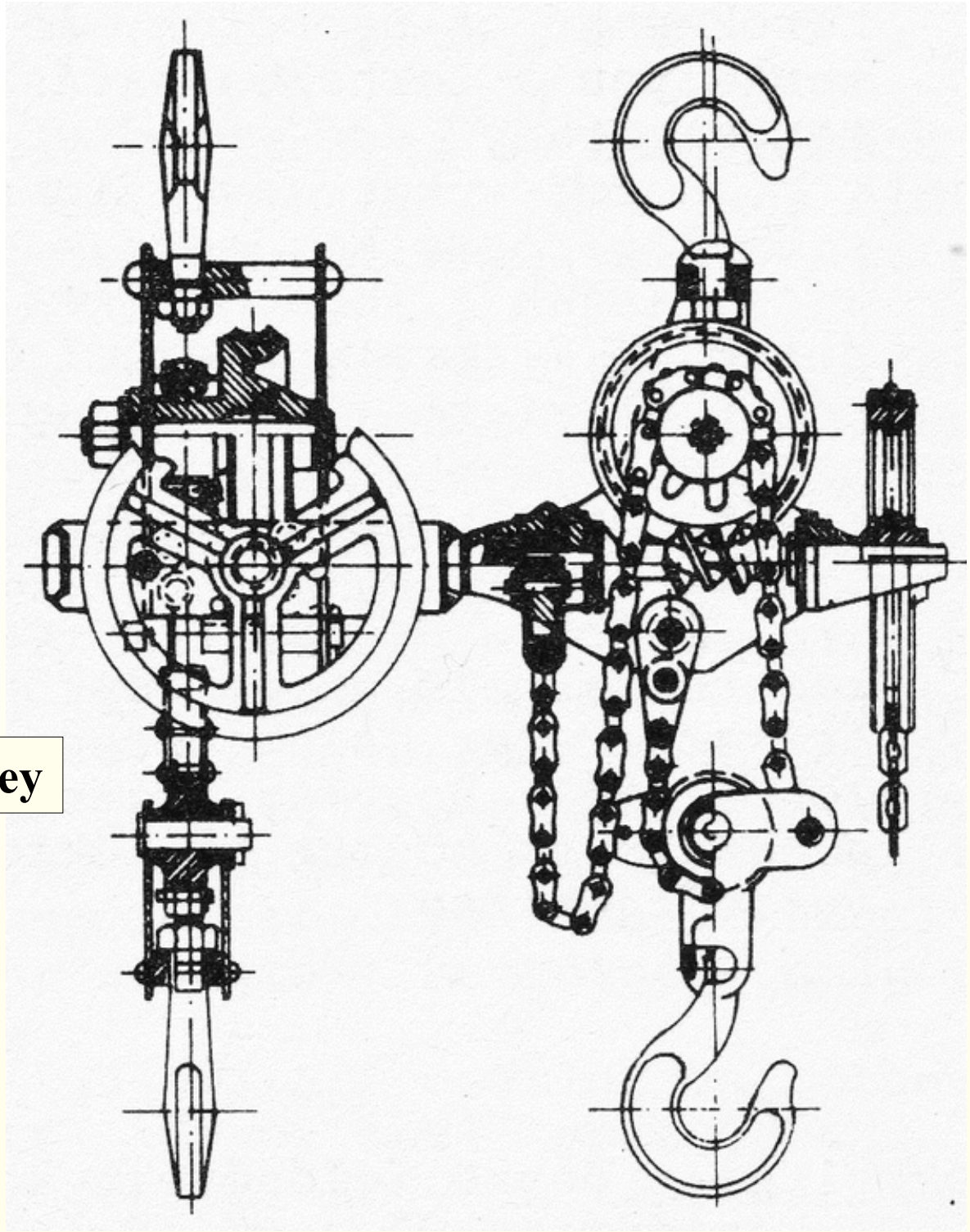

**Sheaves**

**Sheave blocks**

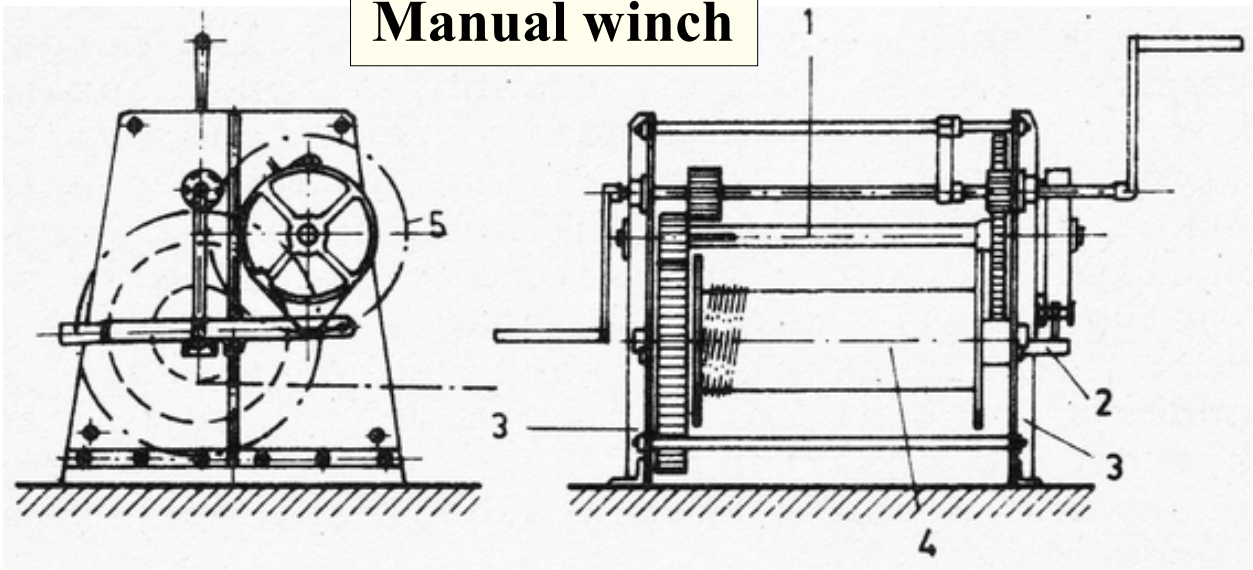




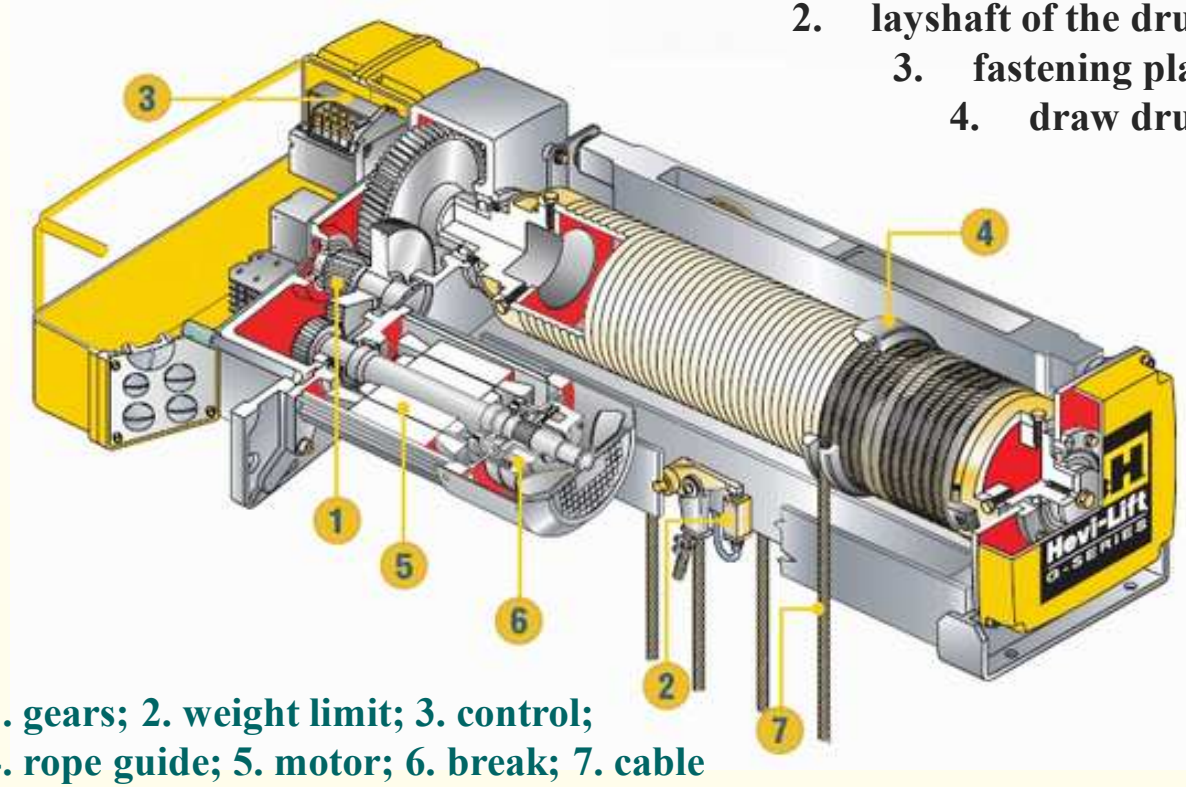
**Chain pulley**



# Manual winch

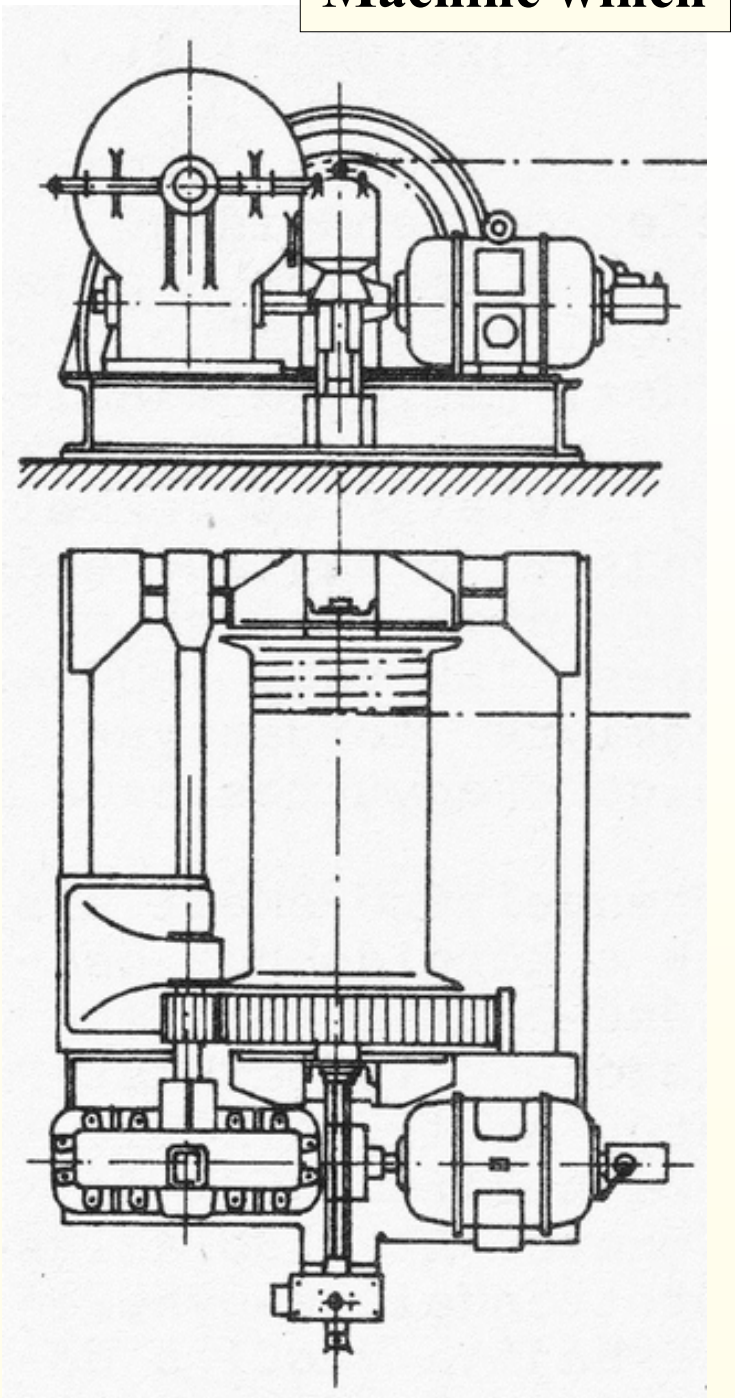


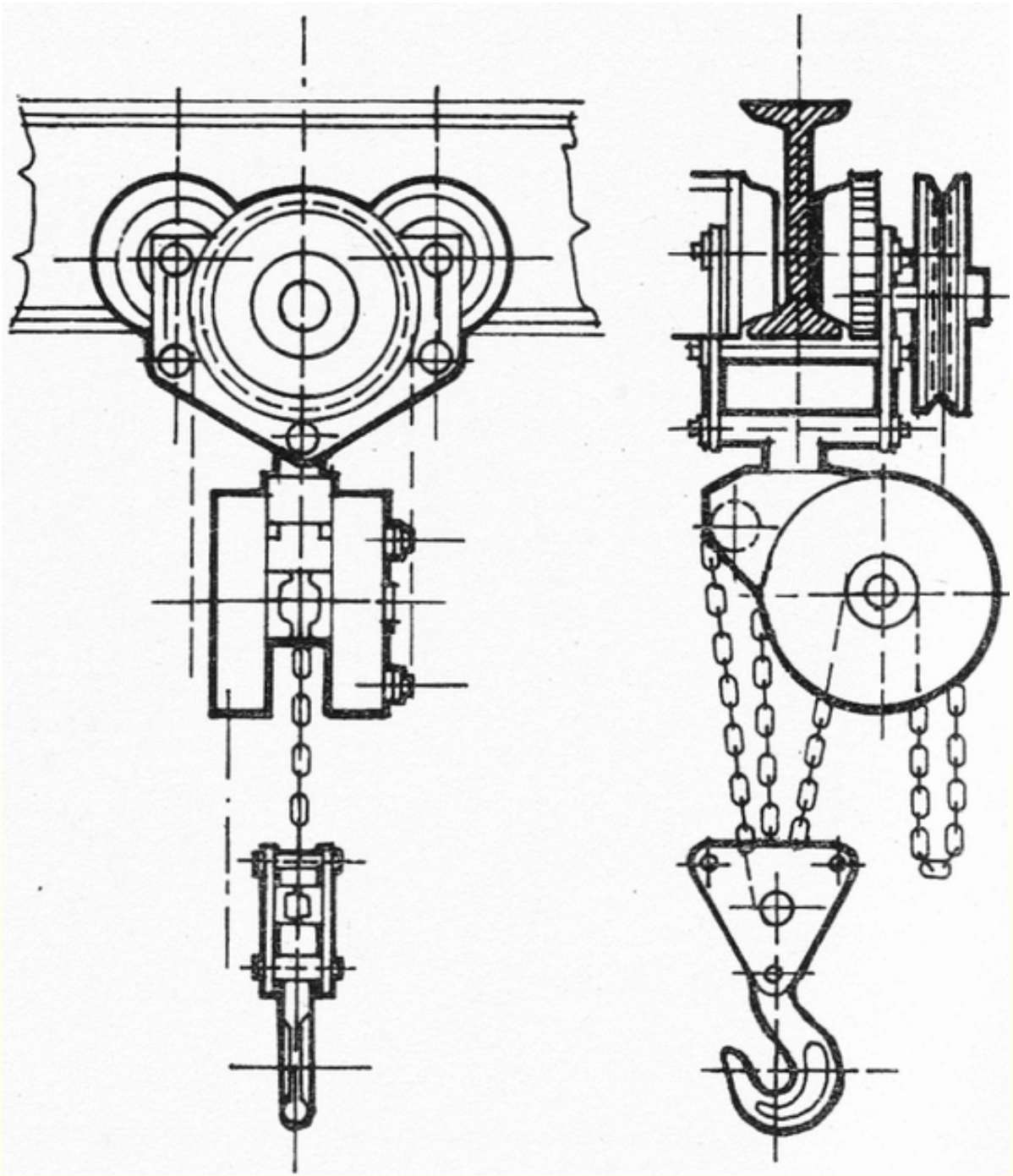

1. driving- and gear shaft
2. layshaft of the drum
3. fastening plate
4. draw drum




1. gears; 2. weight limit; 3. control;
4. rope guide; 5. motor; 6. break; 7. cable

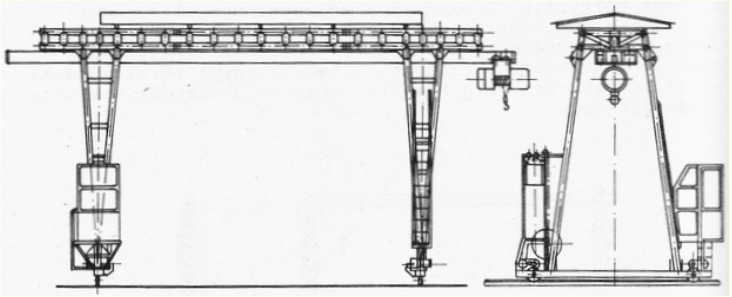
# Machine winch



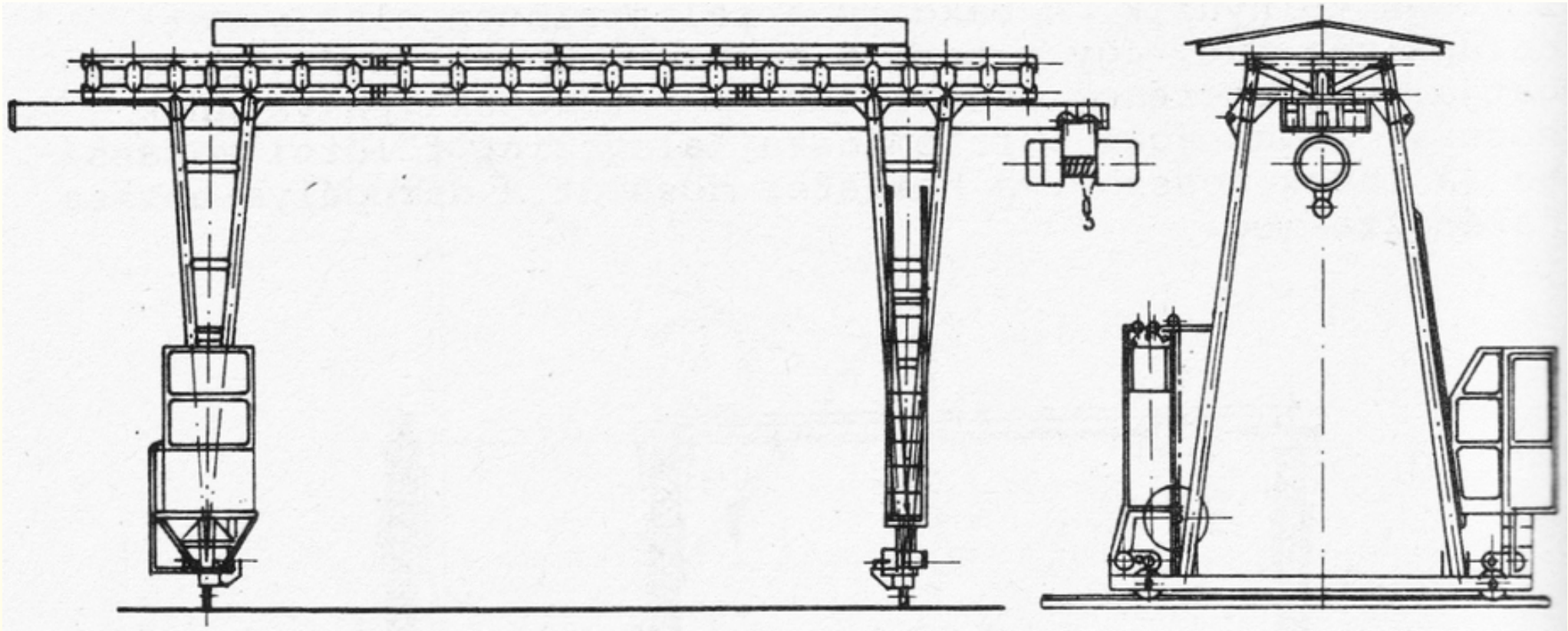


**Crane Crab**

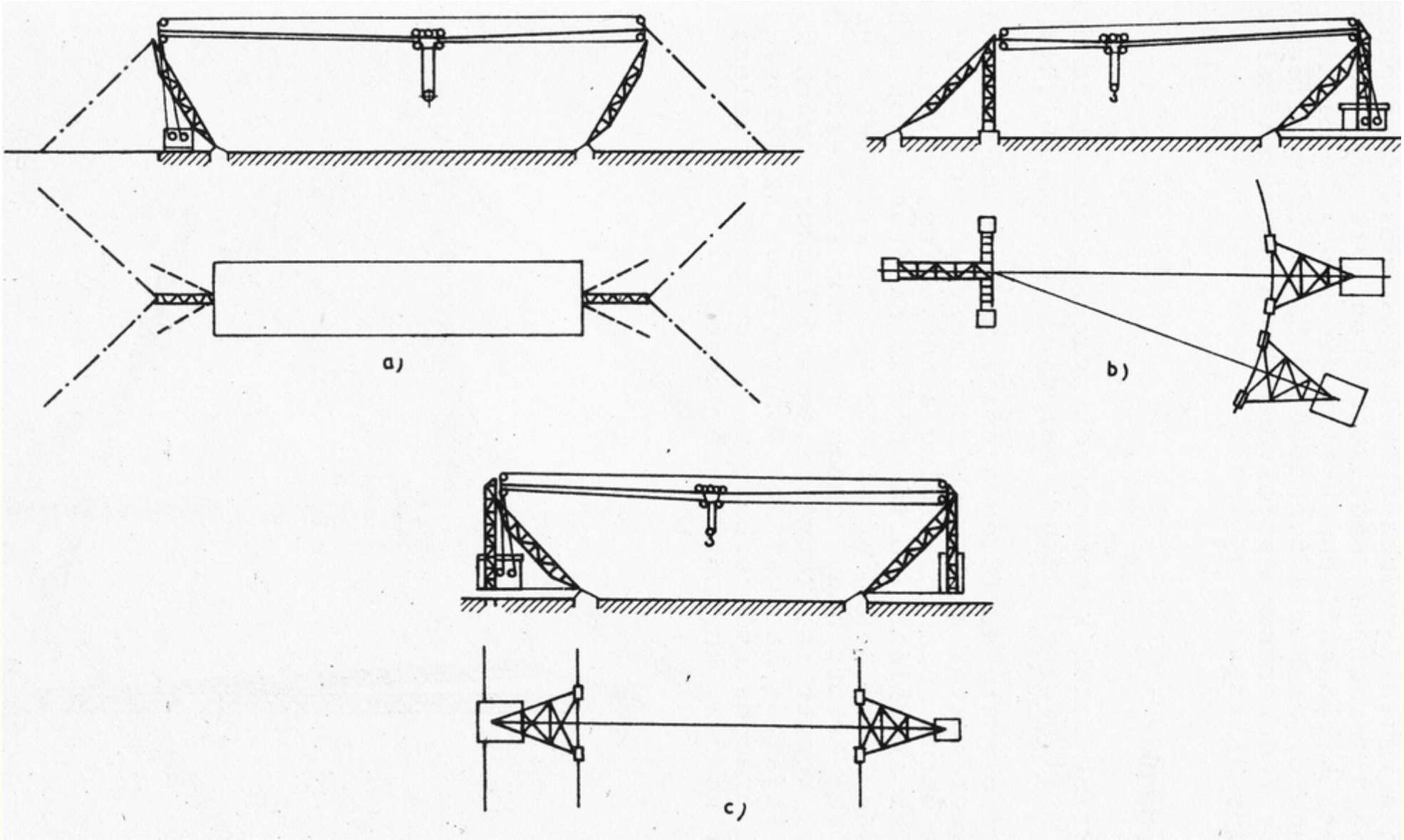
**Gantry Crane**



# rail mounted , two-cantilevered Gantry Crane (Portal Crane)

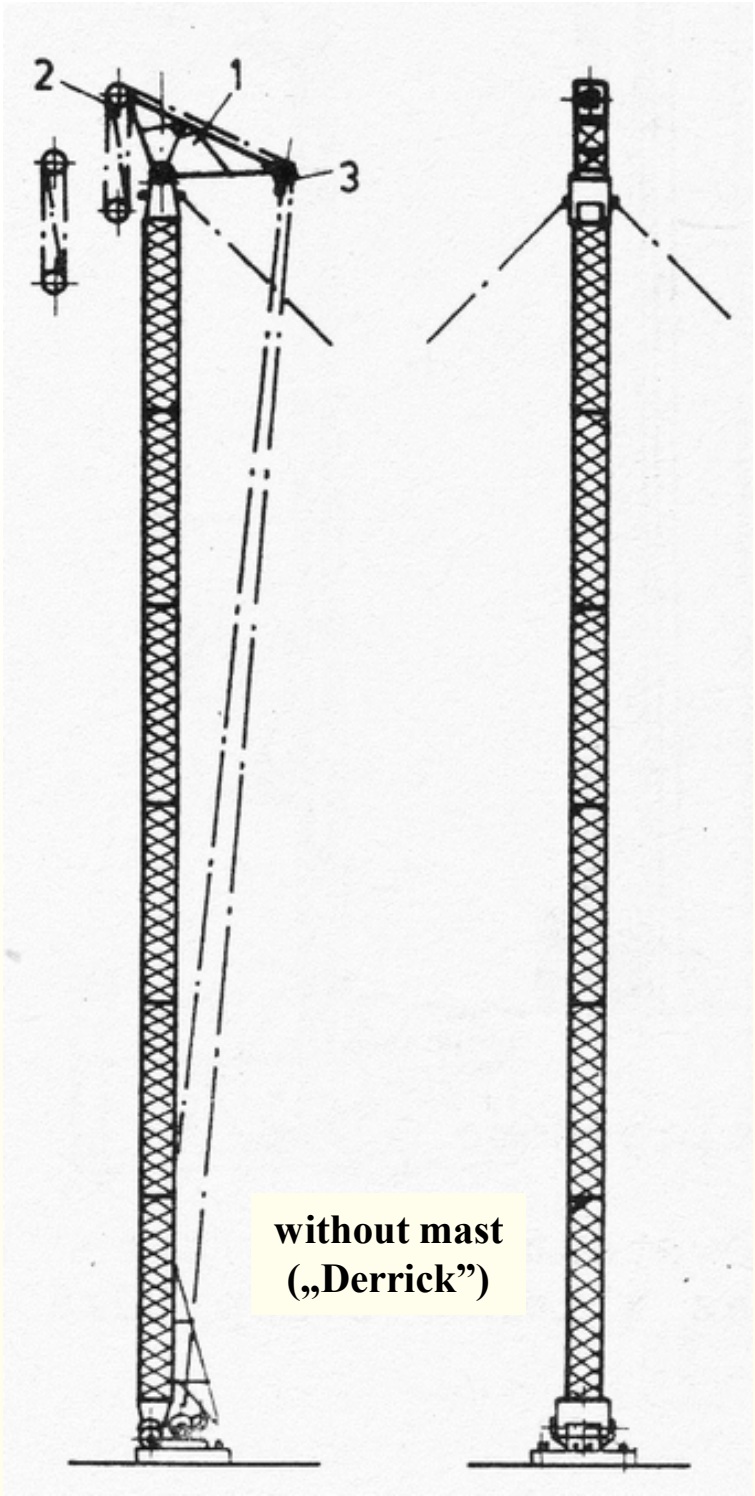


# Cable Crane

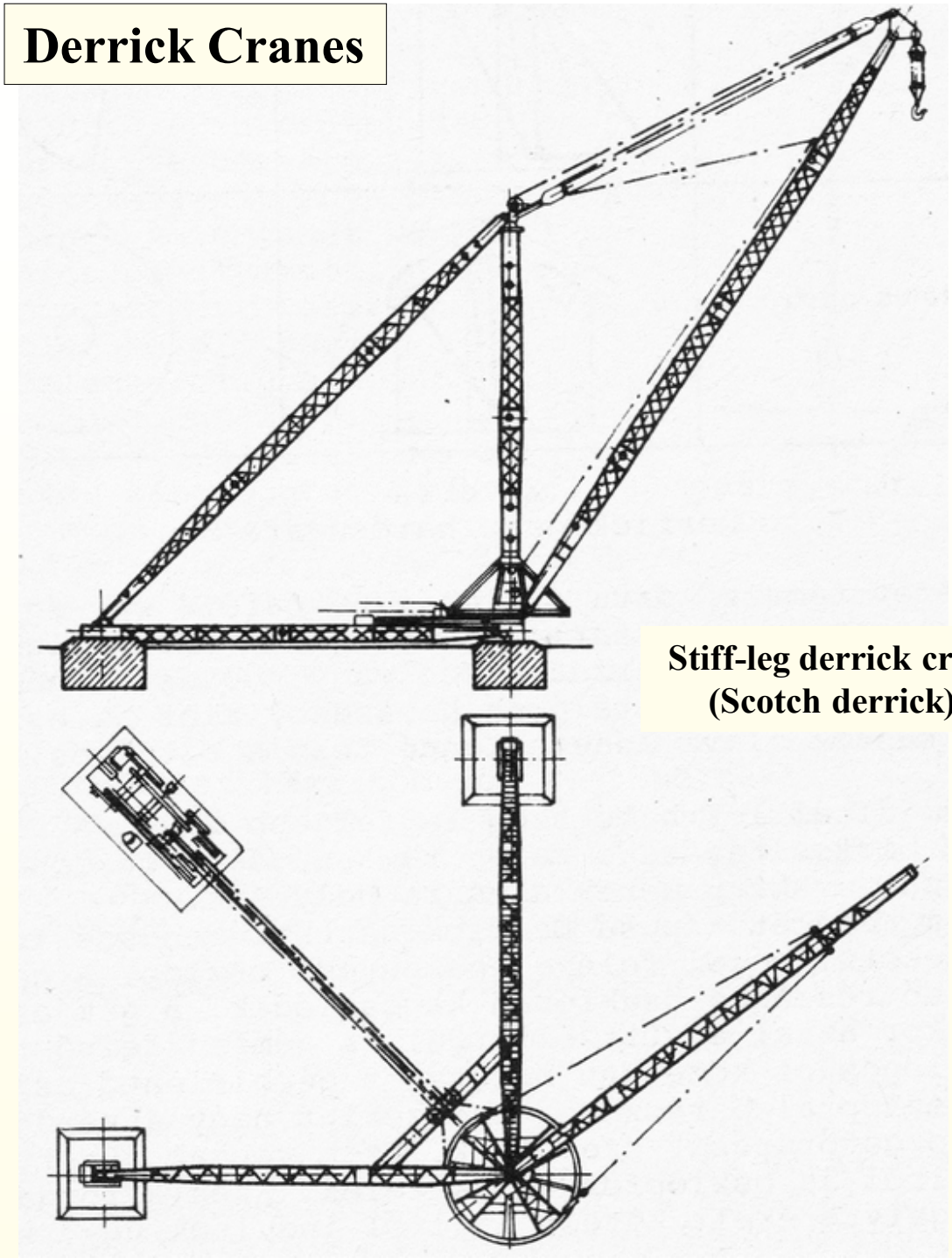



**a. fix crane posts;  b. fix post + curved rail mounted;  c. parallel rails mounted**

# Derrick Cranes

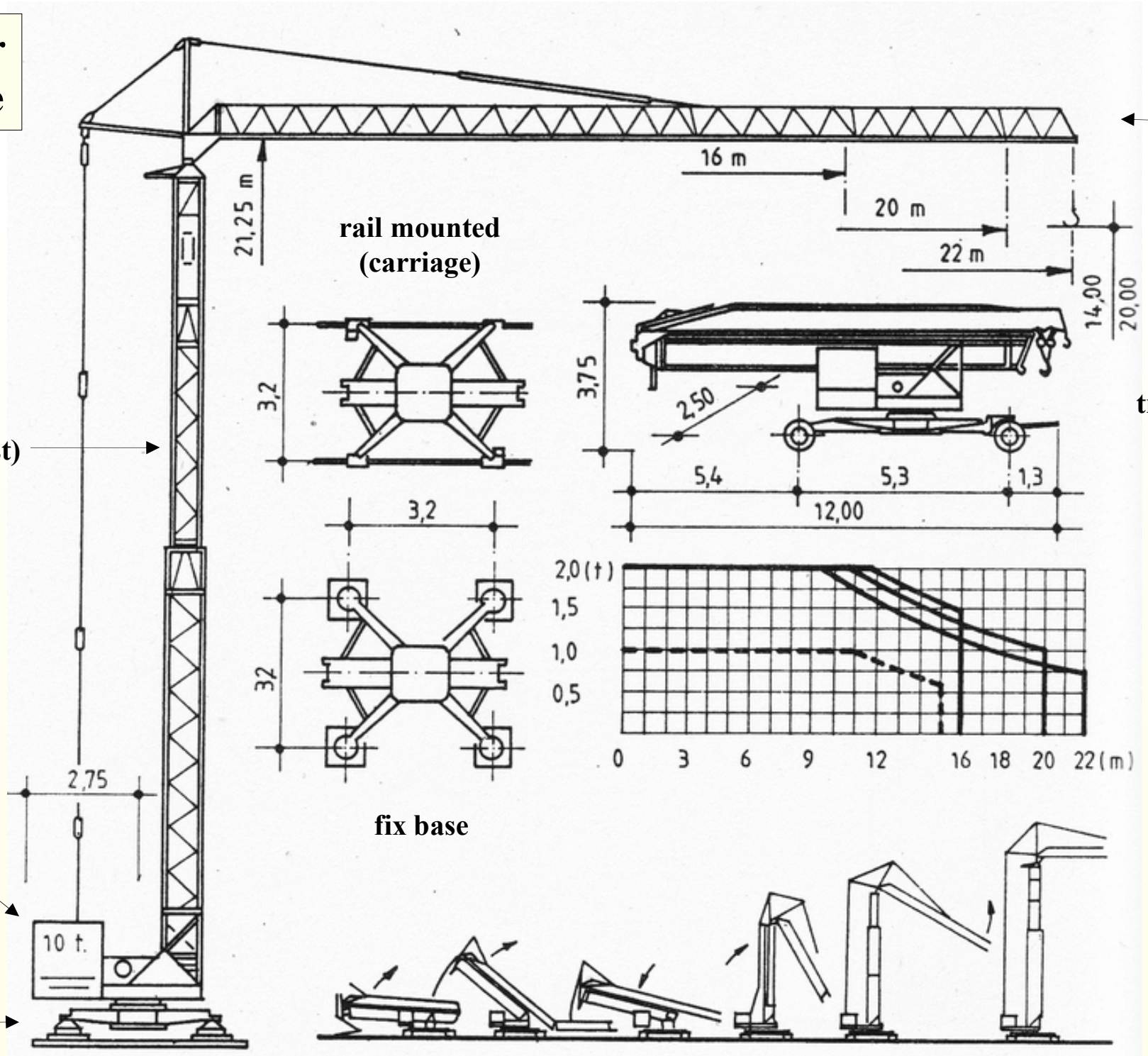



without mast („Derrick")

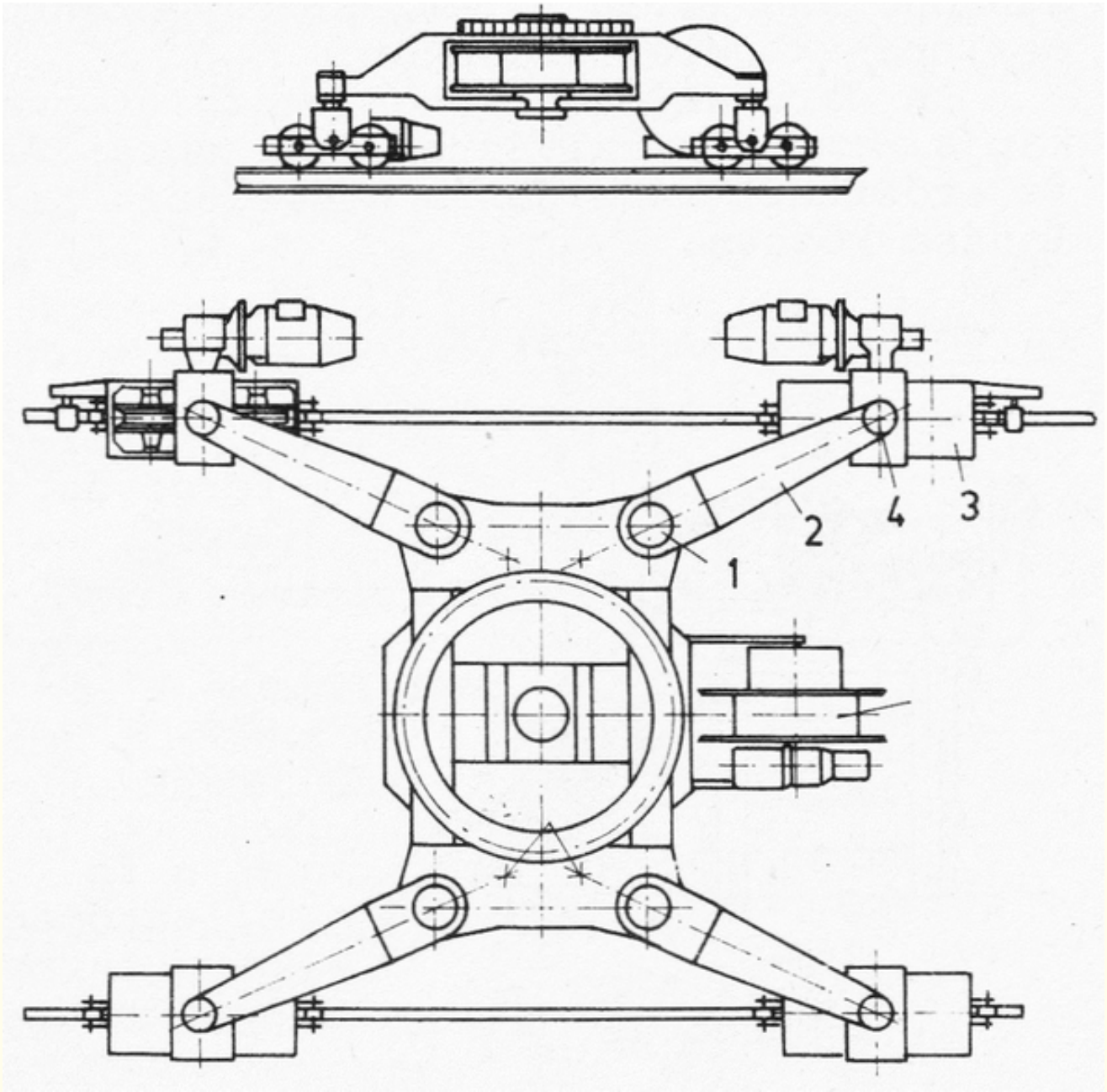


Stiff-leg derrick crane (Scotch derrick)

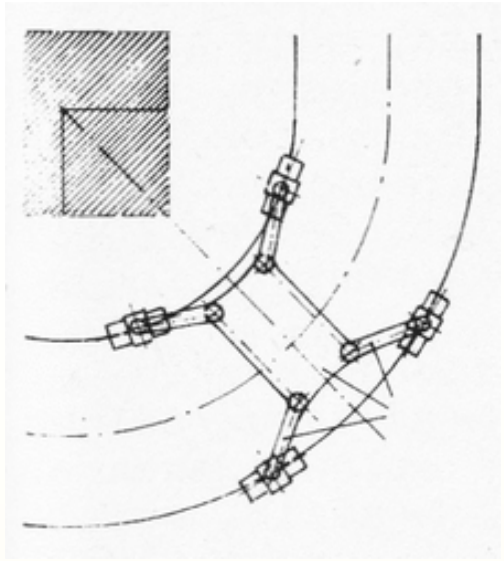
# Tower Crane


jib
16 m
20 m
22 m
21,25 m
14,00
20,00
rail mounted
(carriage)
3,2
3,75
2,50
5,4
5,3
1,3
12,00
transport
position
mast (post)
3,2
3,2
2,0 (t)
1,5
1,0
0,5
0 3 6 9 12 16 18 20 22 (m)
lifting
capacity
2,75
counter-
weight
10 t.
fix base
carriage
(base)
erecting
the crane

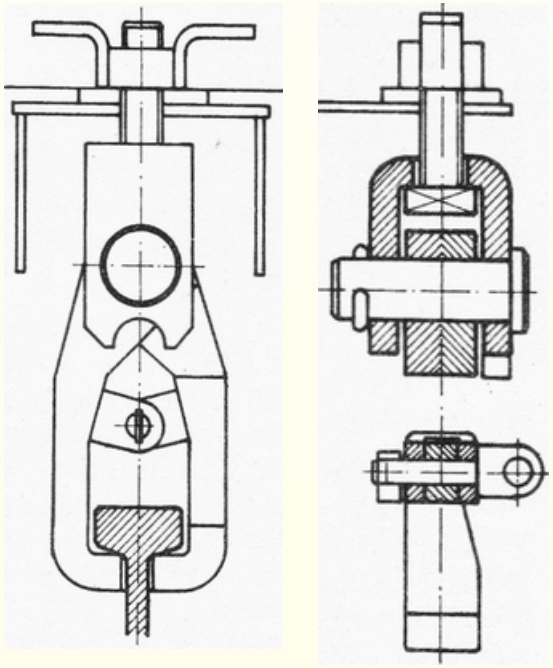
# Tower crane carriage (bogie)

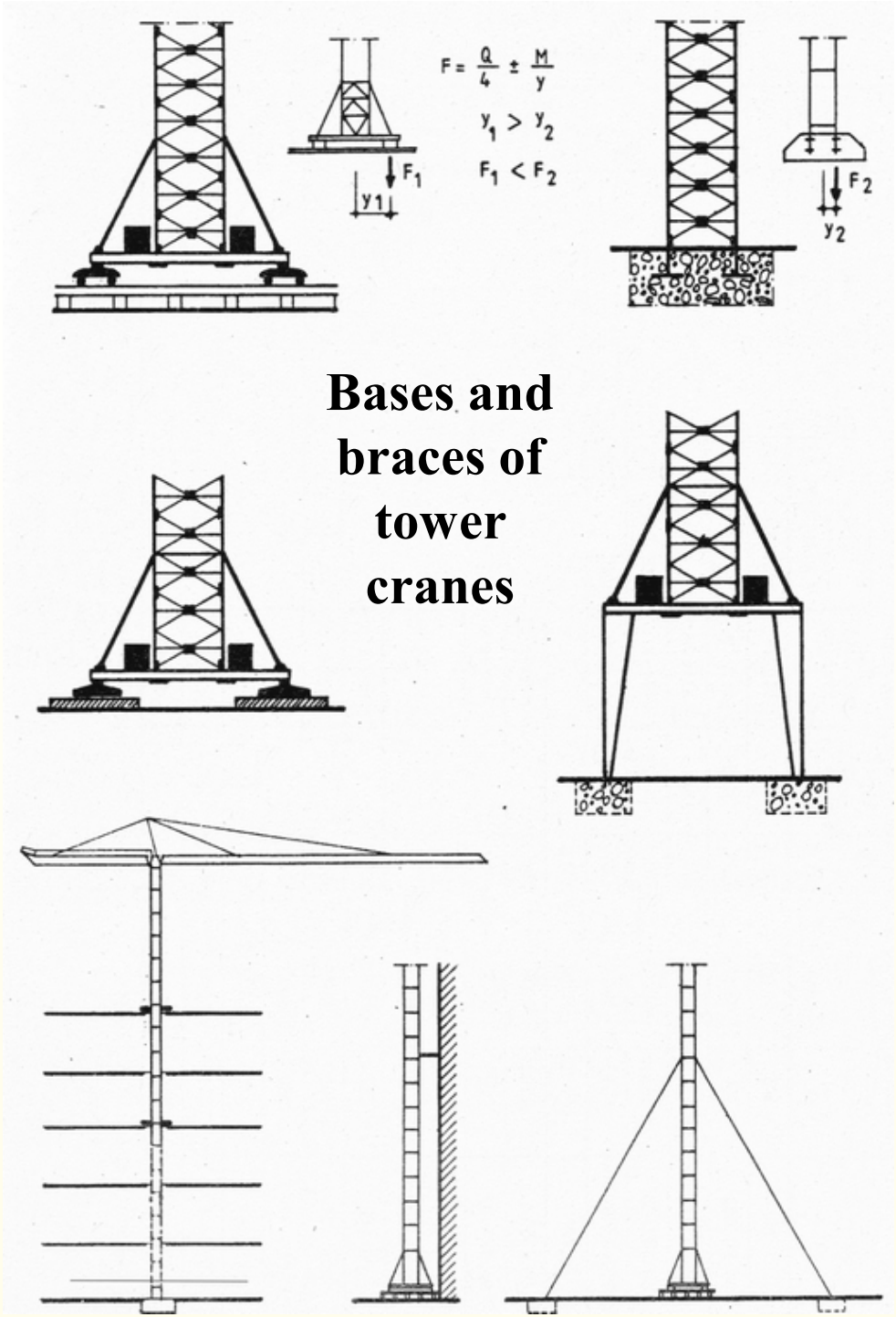



1. pivot; 2. box girder; 3. wheel-box; 4. king-pin



## Grip break






# Bases and braces of tower cranes

a-b. on trailer(s)

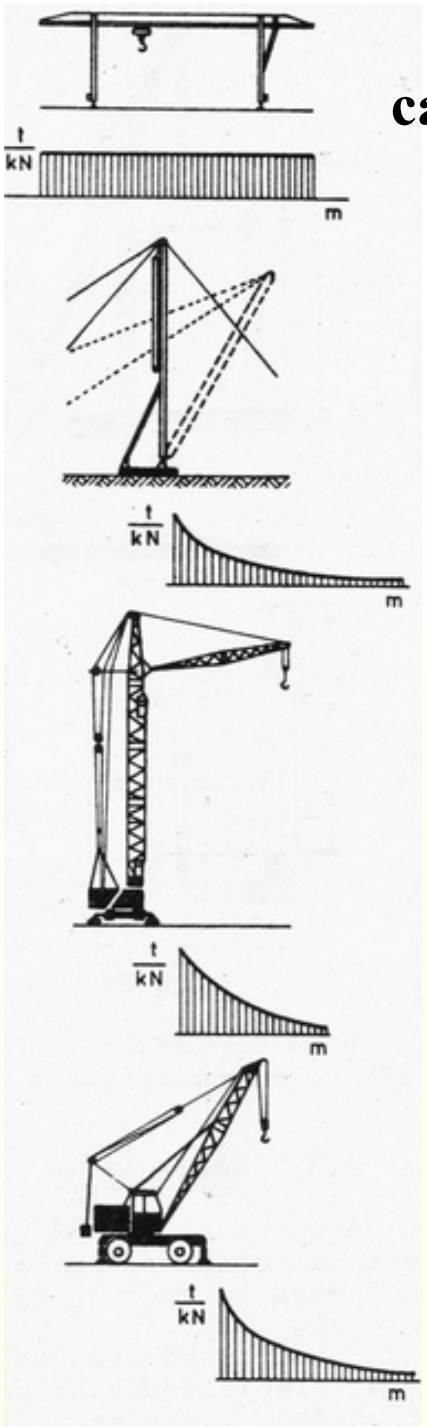
c. with folded boom

# Transporting tower cranes

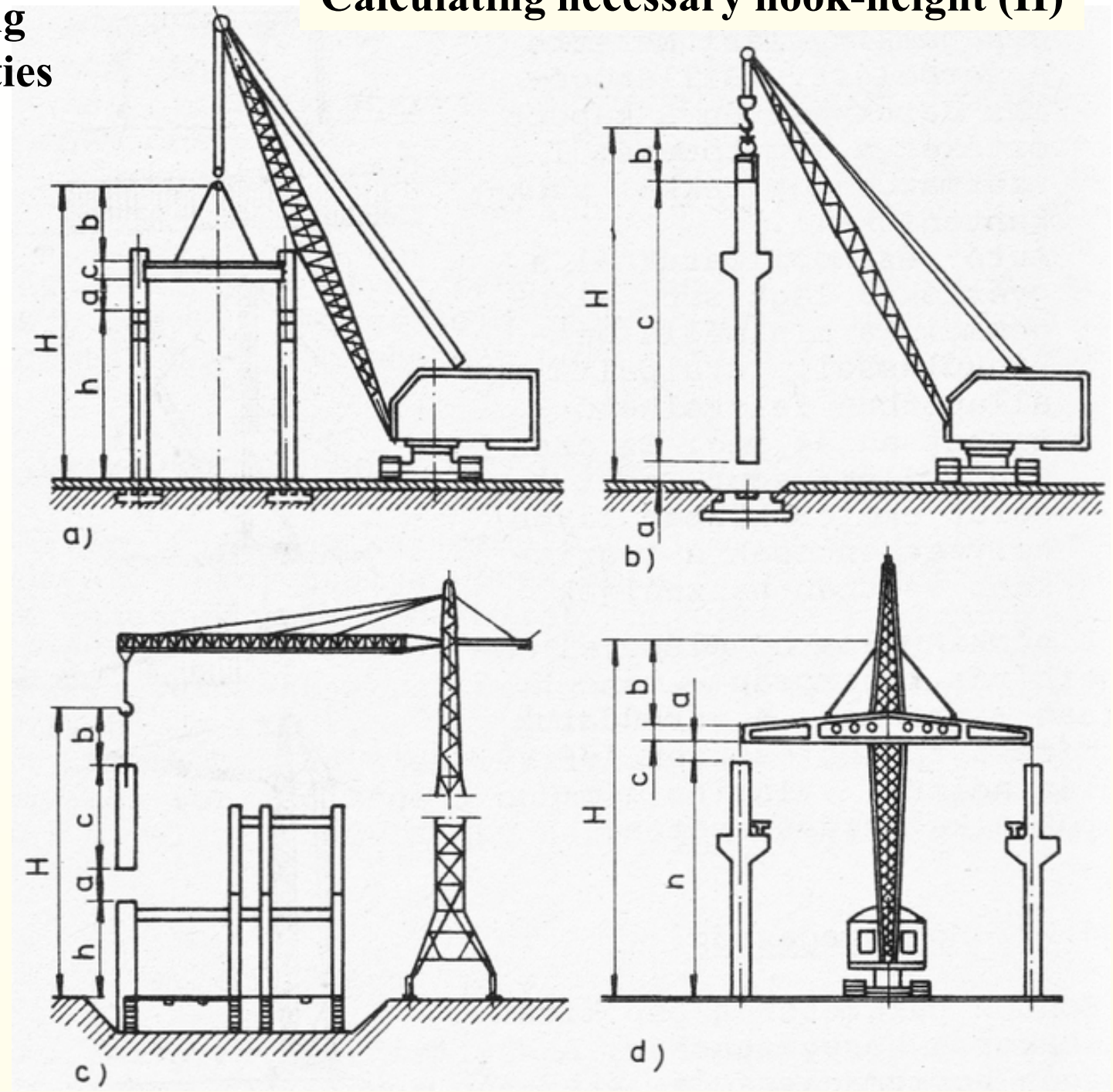
d-e. with retracted boom

f-g. long vehicle (train)

# Lifting capacities

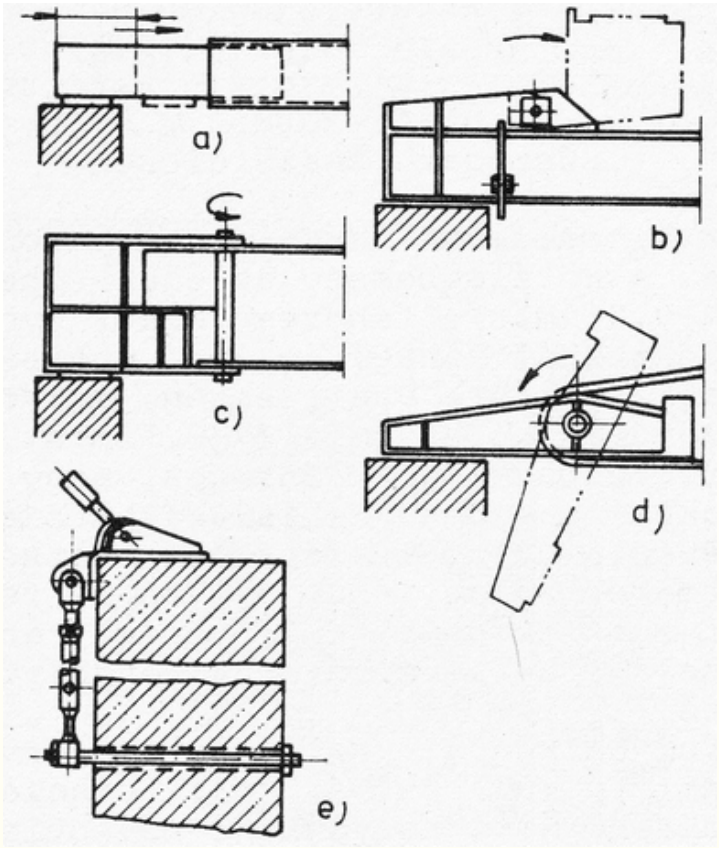



# Calculating necessary hook-height (H)



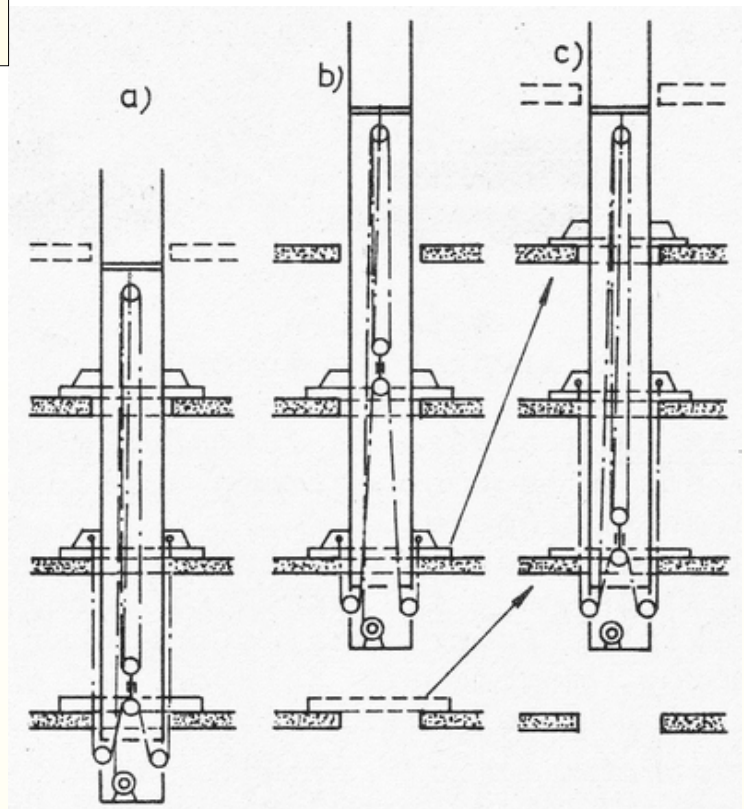

a. hogging; b. spreader height; c. member height; h. level of placement less level of crane footing

# Climbing Crane

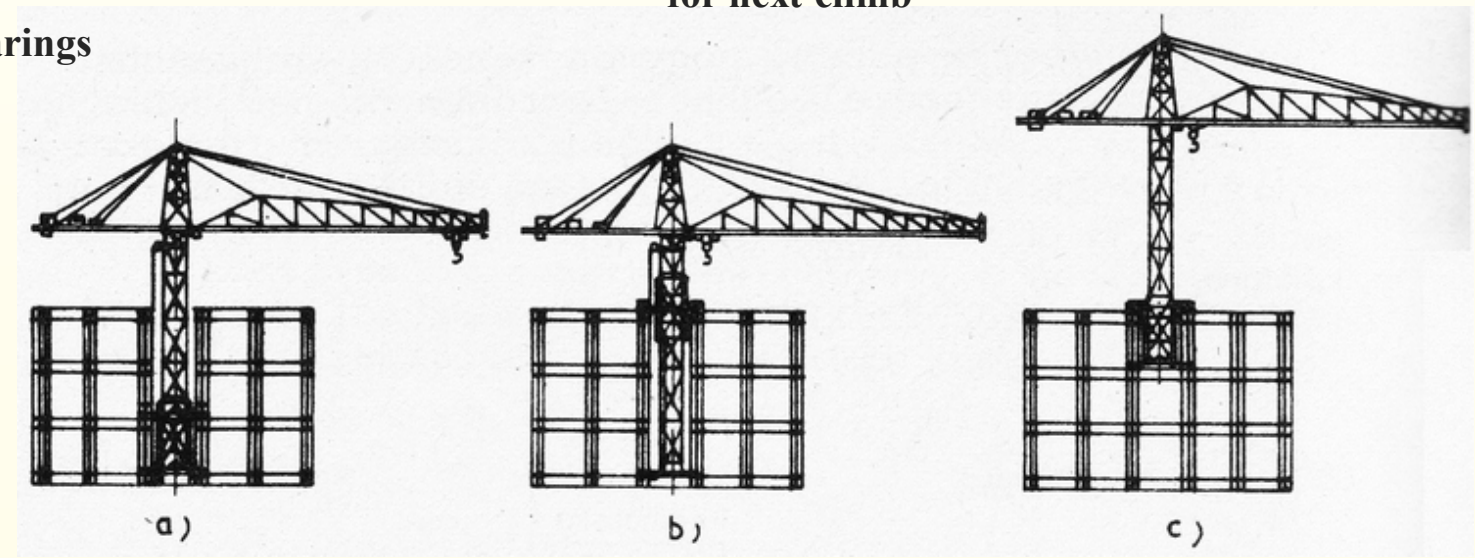



a-e. different types of bearings of climbing cranes

Load-bearing structure of the building must be designed for the weight and climb of the crane

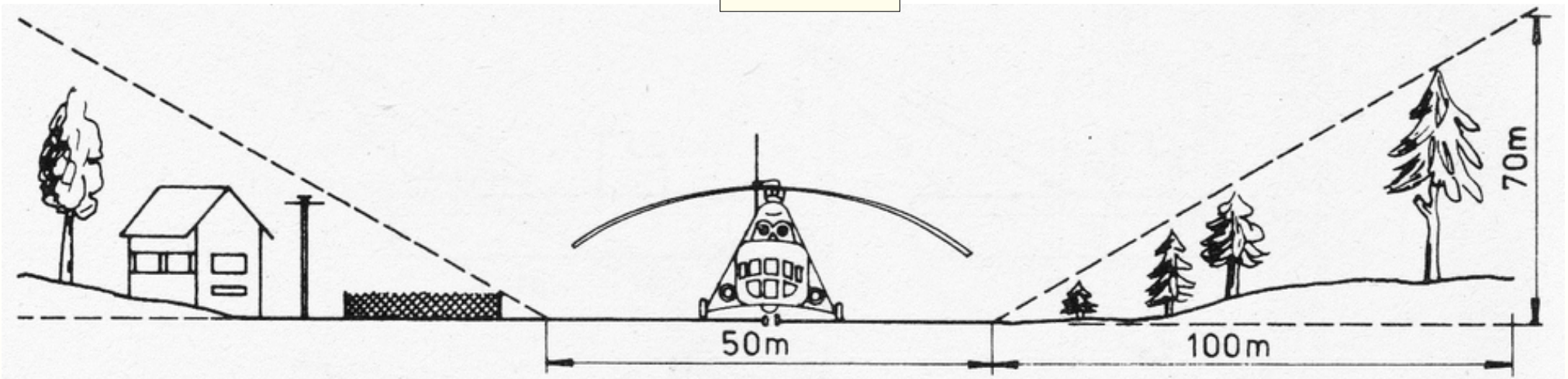



a. start position; b. climbing; c. preparation for next climb

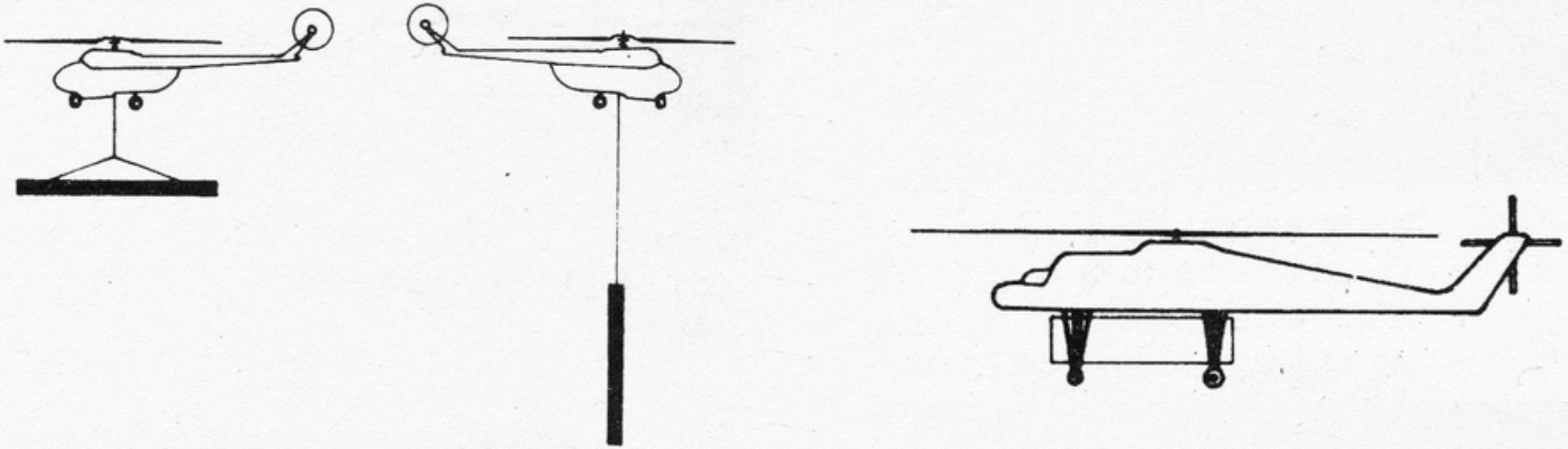



Telescopic Mast: a. start position; b. lifting bush; c. climbing and fixing

# Airlift

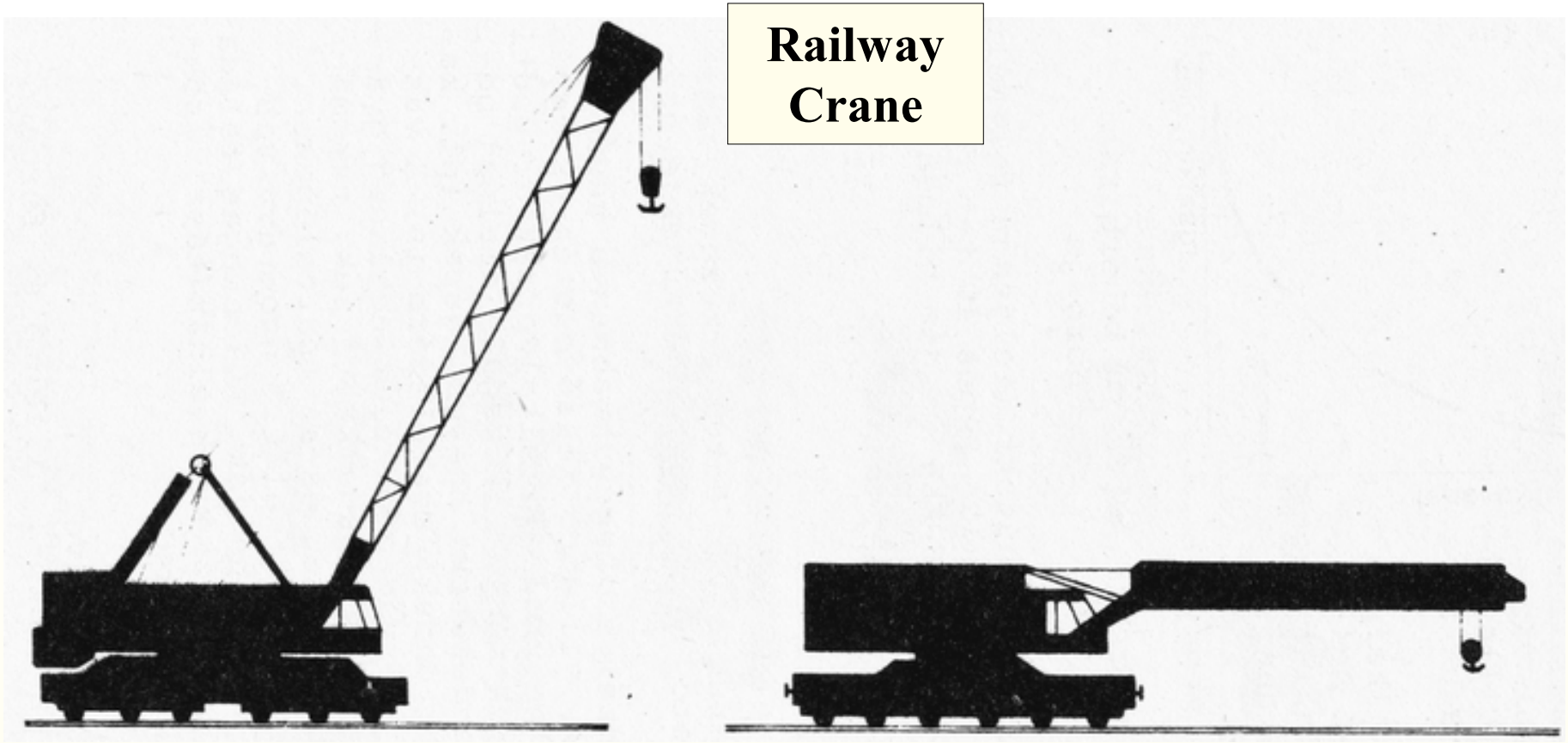


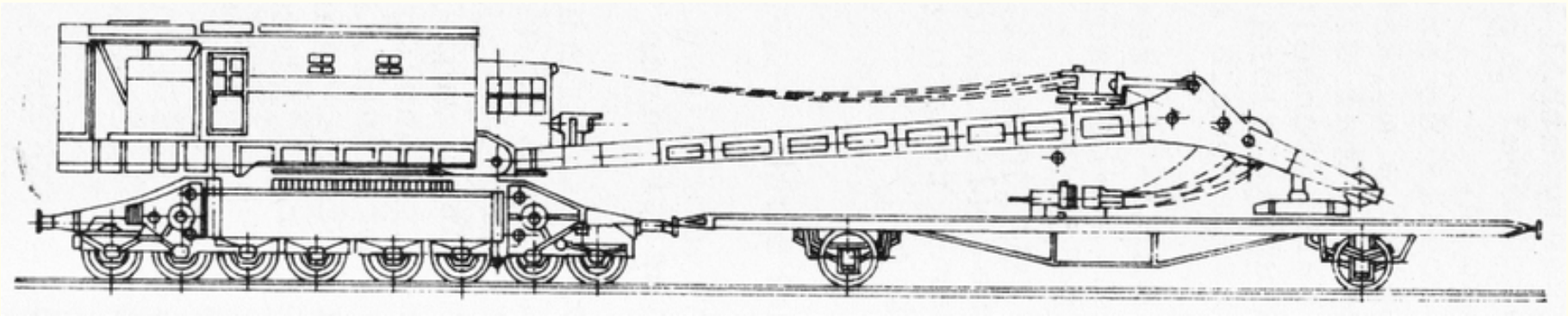

**Necessary free landing (and take-off) zone**



**Load positions: hung on short rope, horizontally; hung on long rope, vertically; fixed to the shell body (or to legs)**

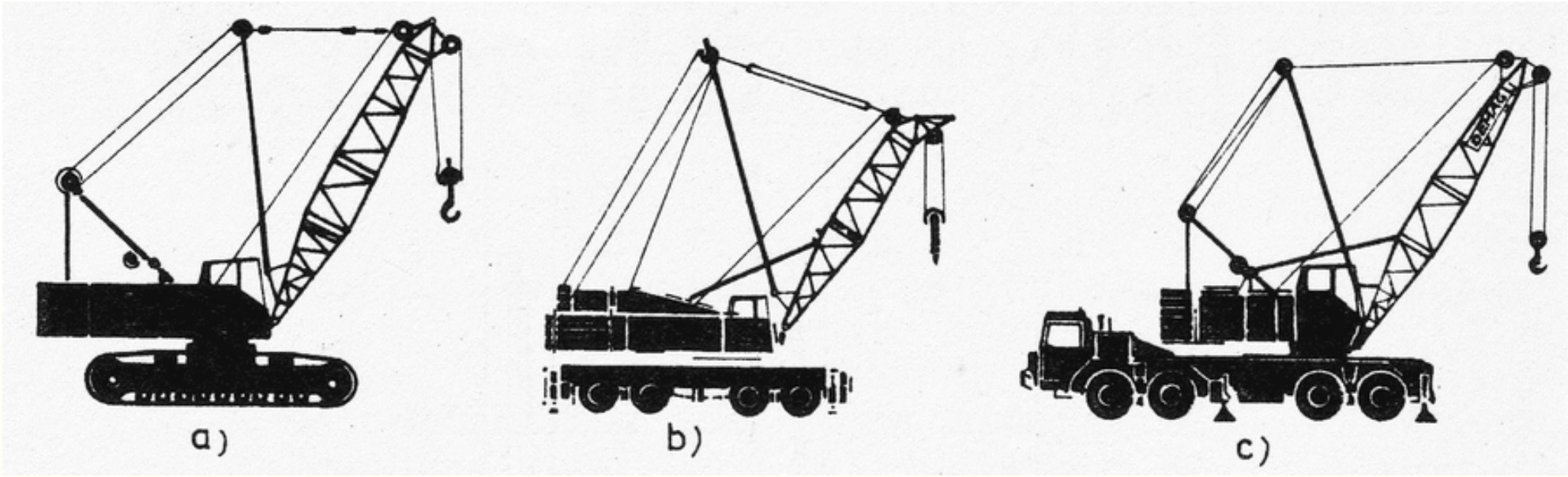
# Railway Crane



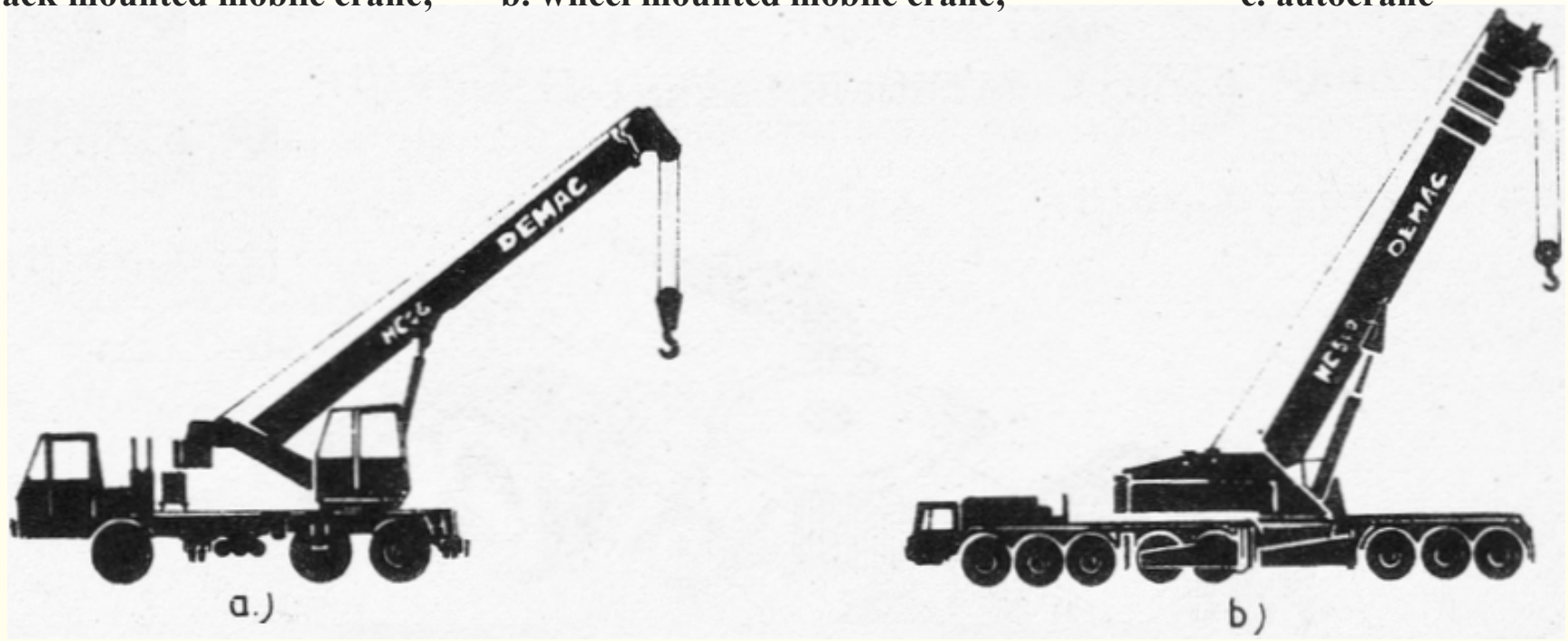


**Railway crane in travelling (riding) position**

# Vehicle Cranes

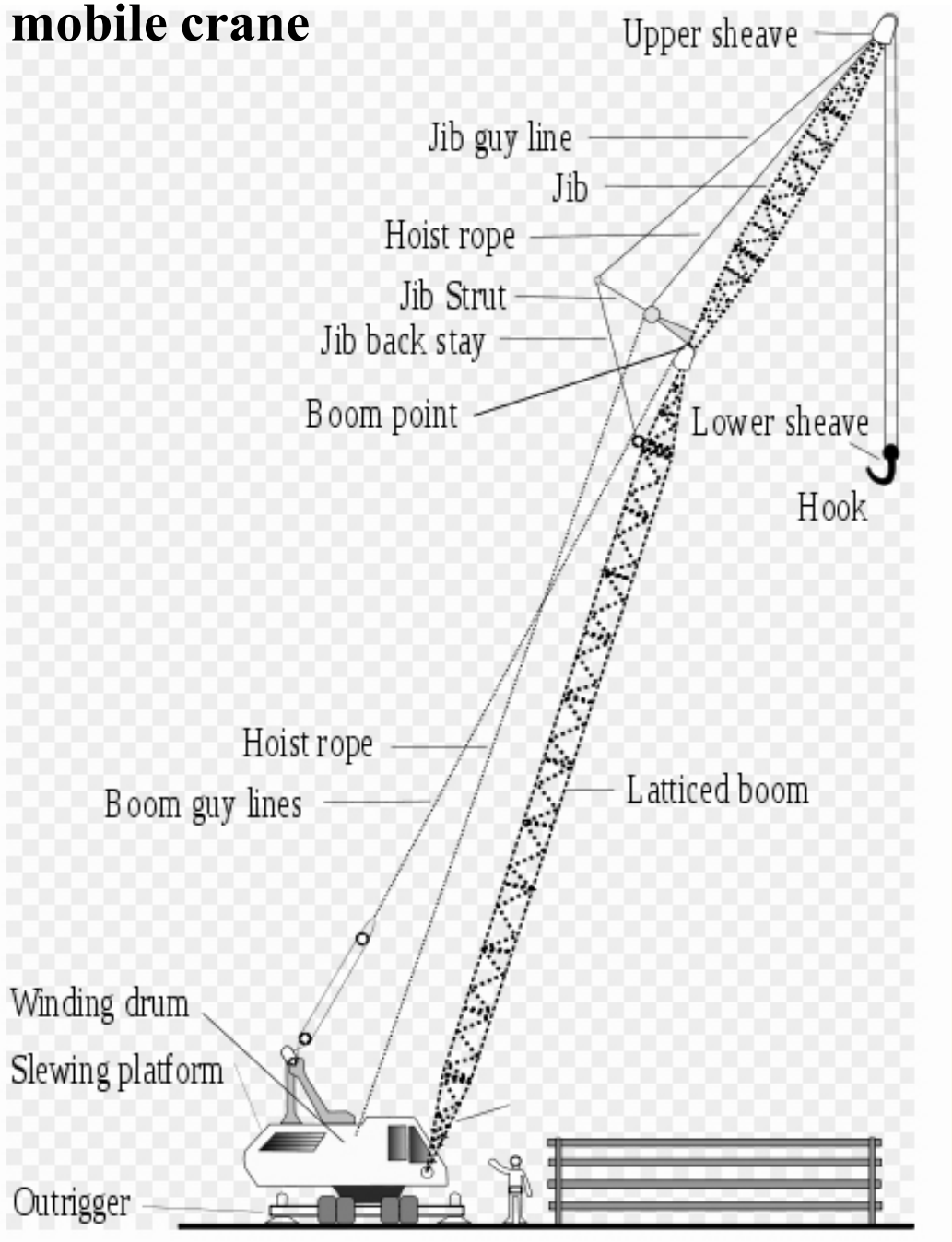



**a. track mounted mobile crane;** **b. wheel mounted mobile crane;** **c. autocrane**



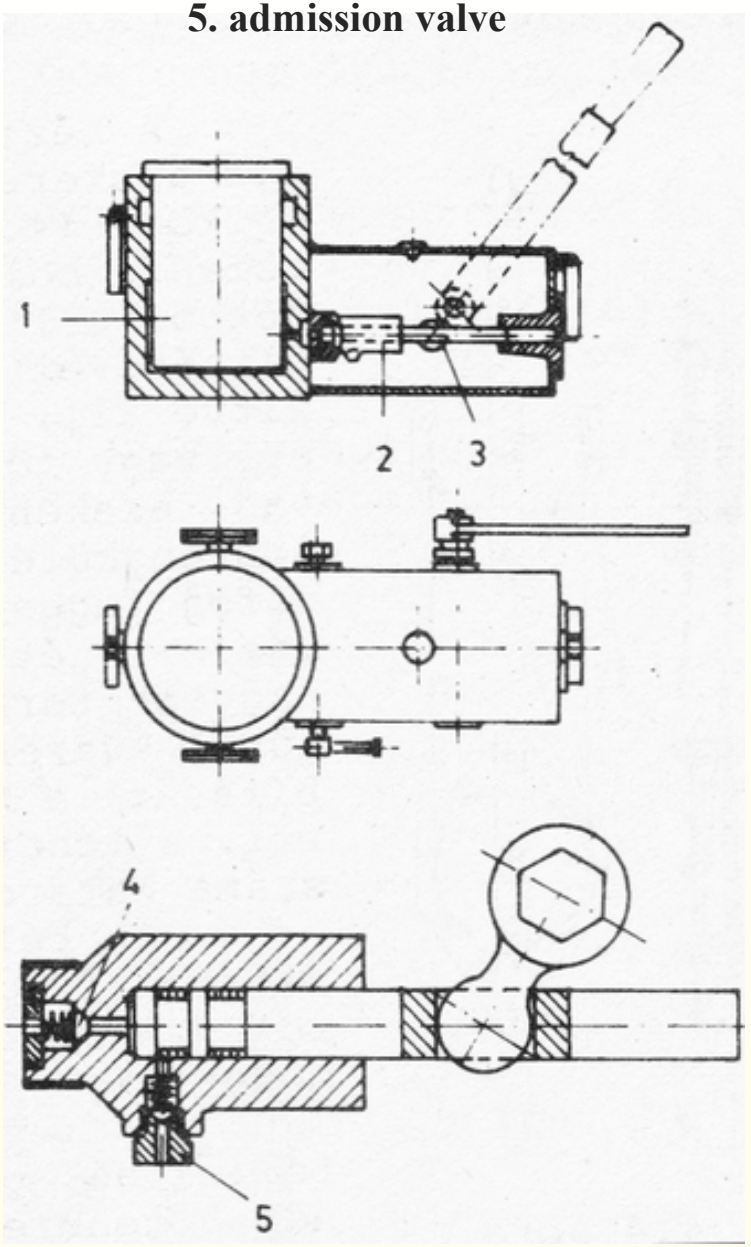

**a. general truck carriage (for smaller cranes);** **b. special carriage (for bigger cranes)**

## Lattice-boom mobile crane



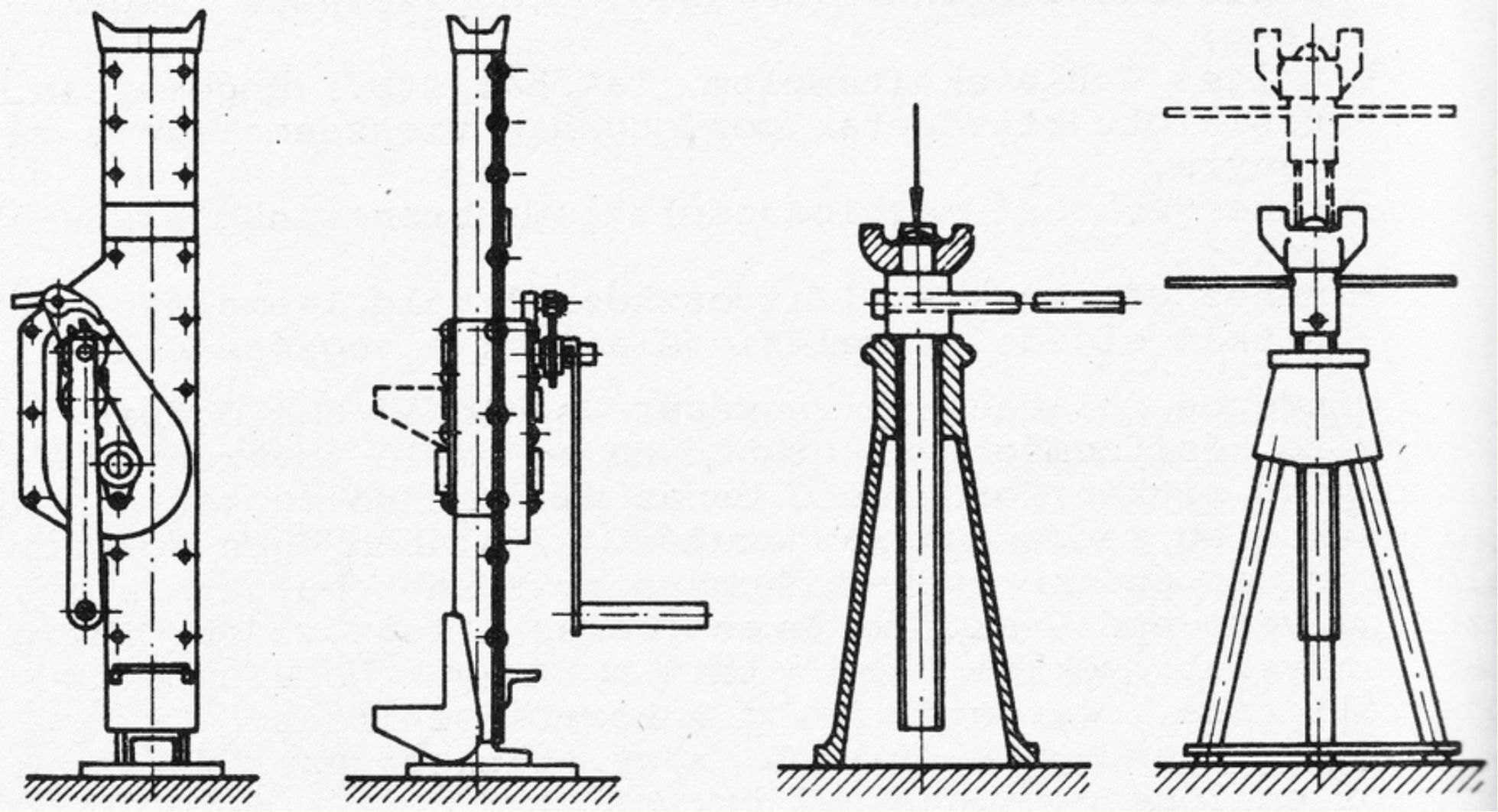

## Hydraulic jack

**1. cylinder; 2. piston (pump);**
**3. camshaft; 4. delivery valve;**
**5. admission valve**



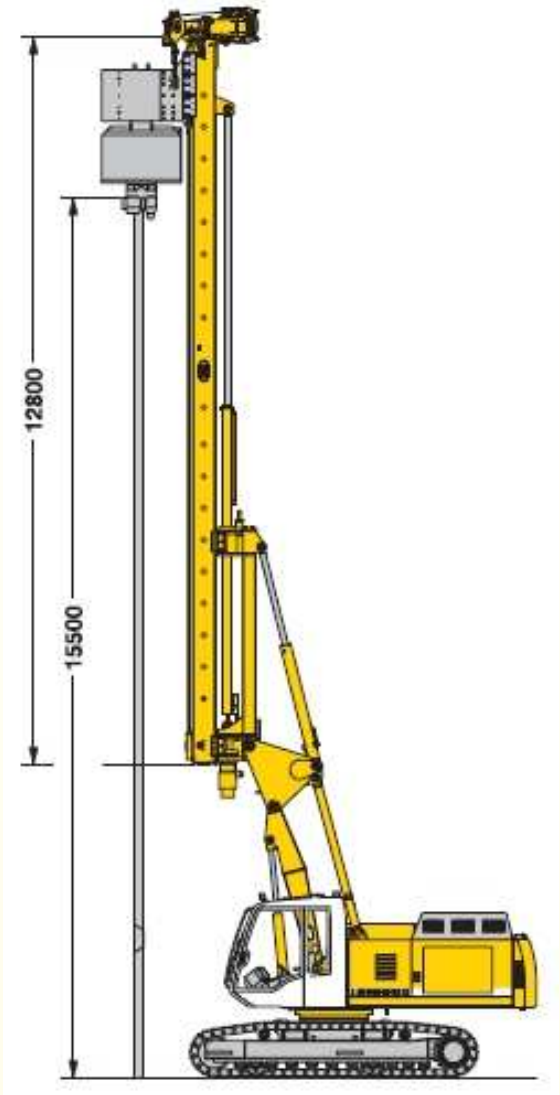
**Ratchet jack**

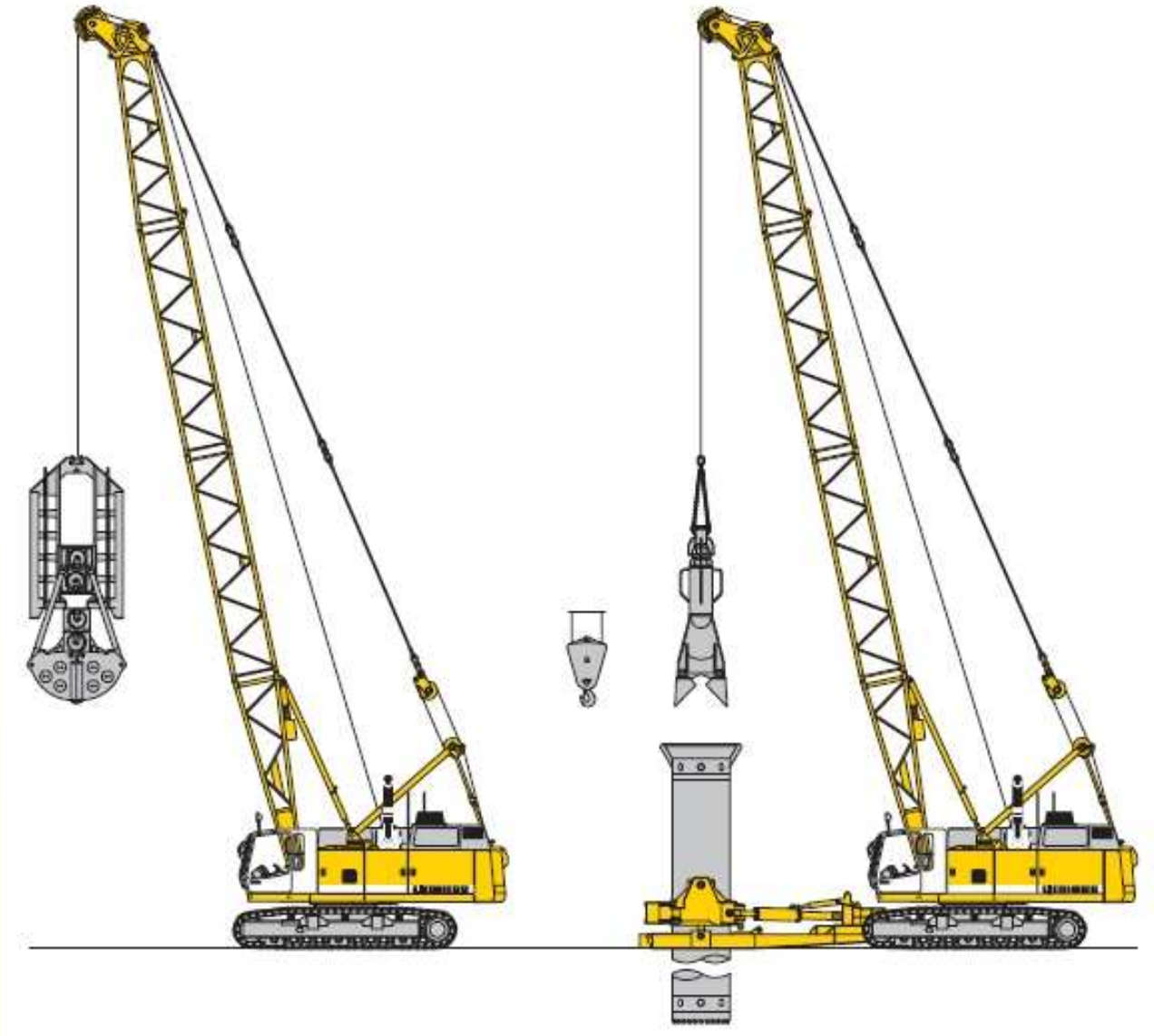
**Screw jack**
**(tripod jack)**



# Crawler Cranes

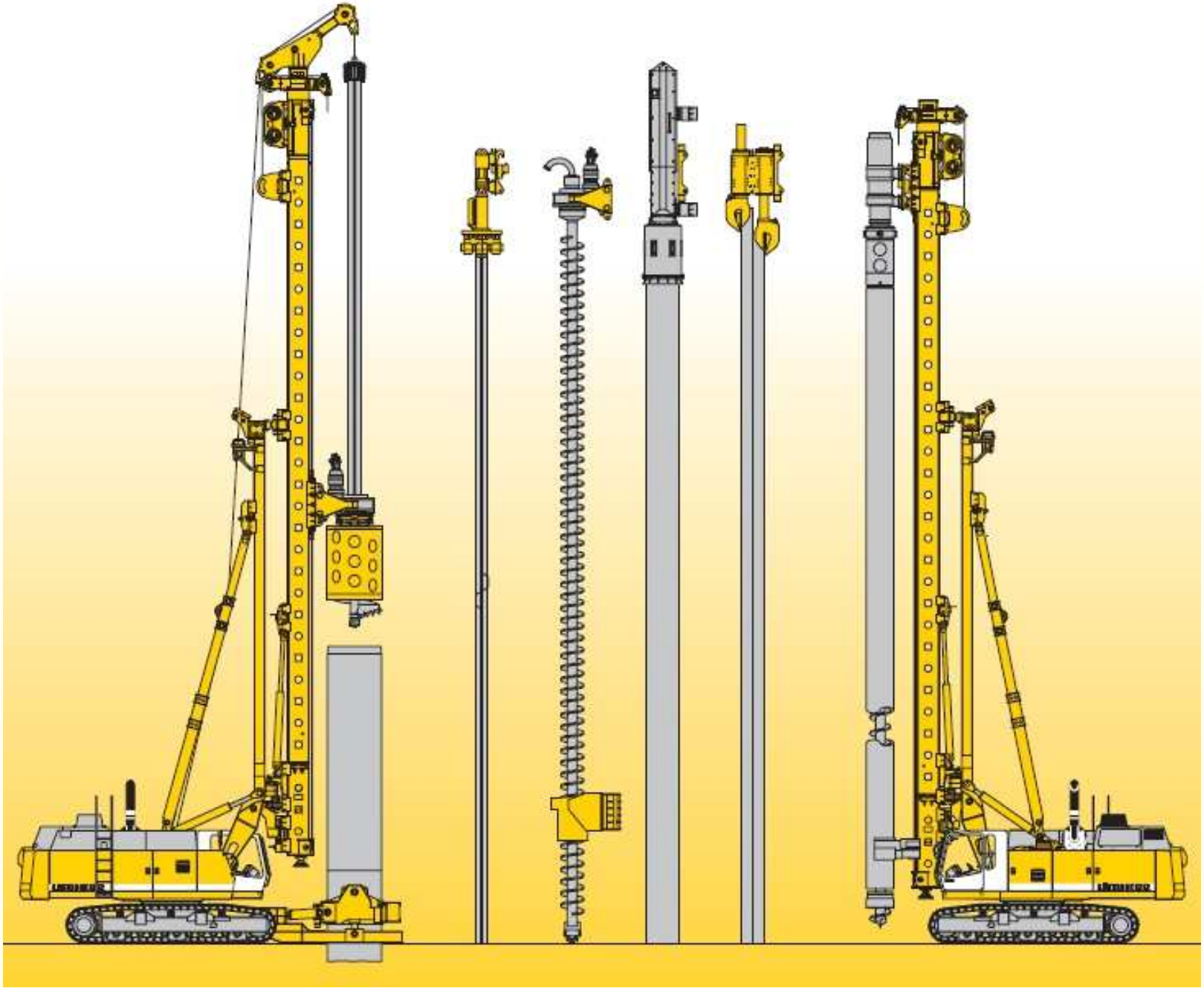
## Typical at deep foundation works



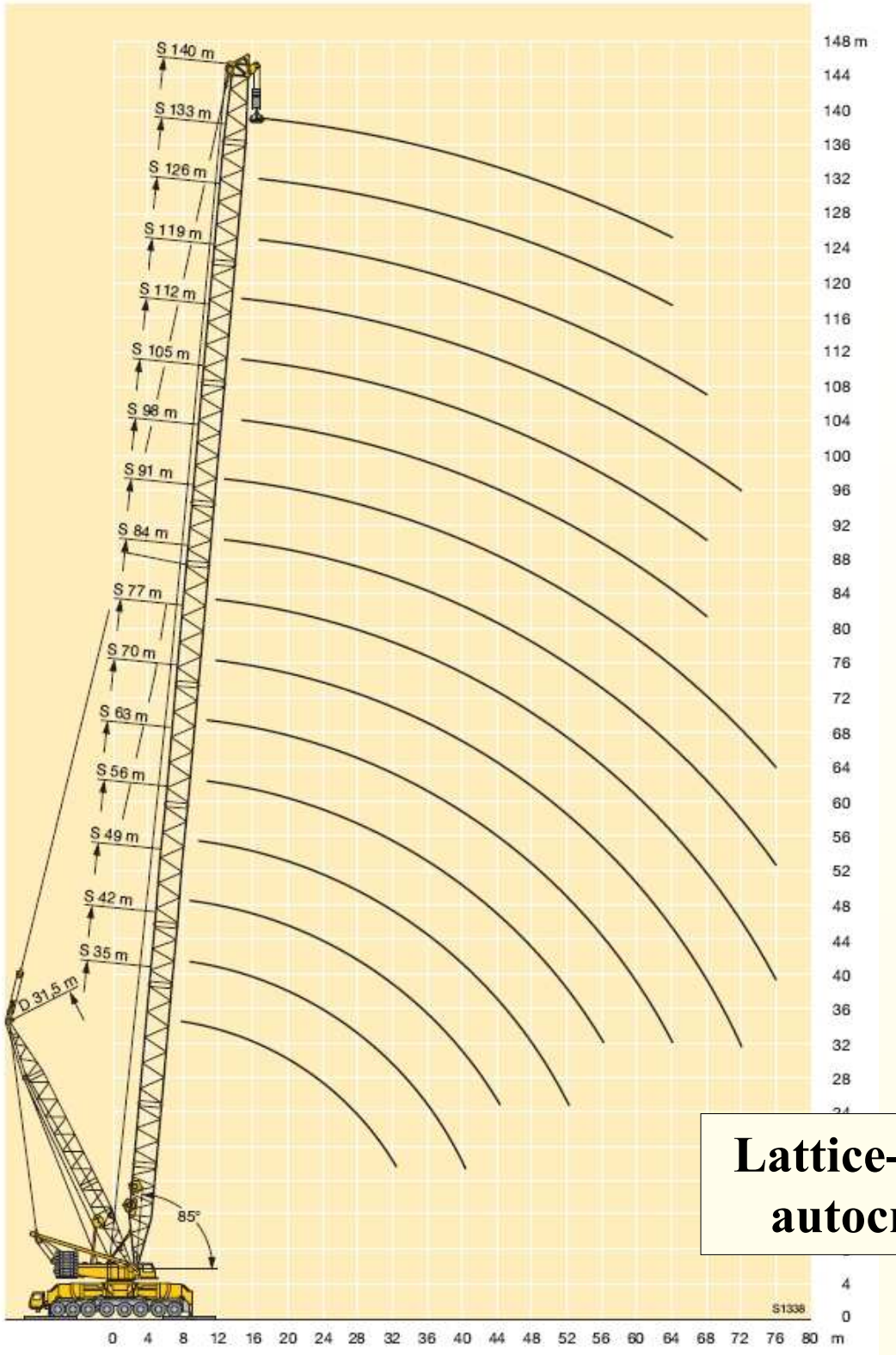



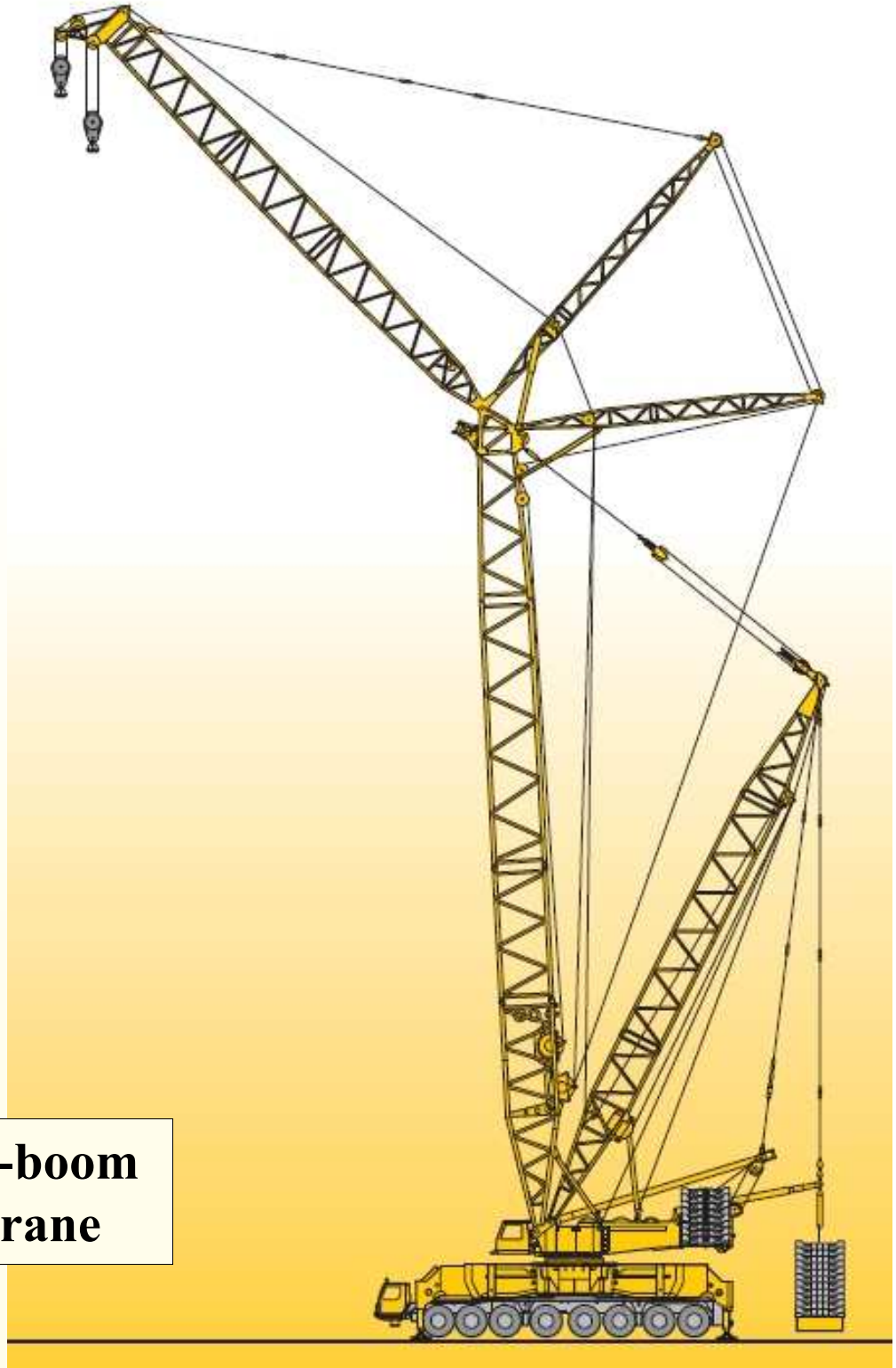
**Drilling** **Slurry-wall excavation** **Pile boring**

# Crawler Cranes



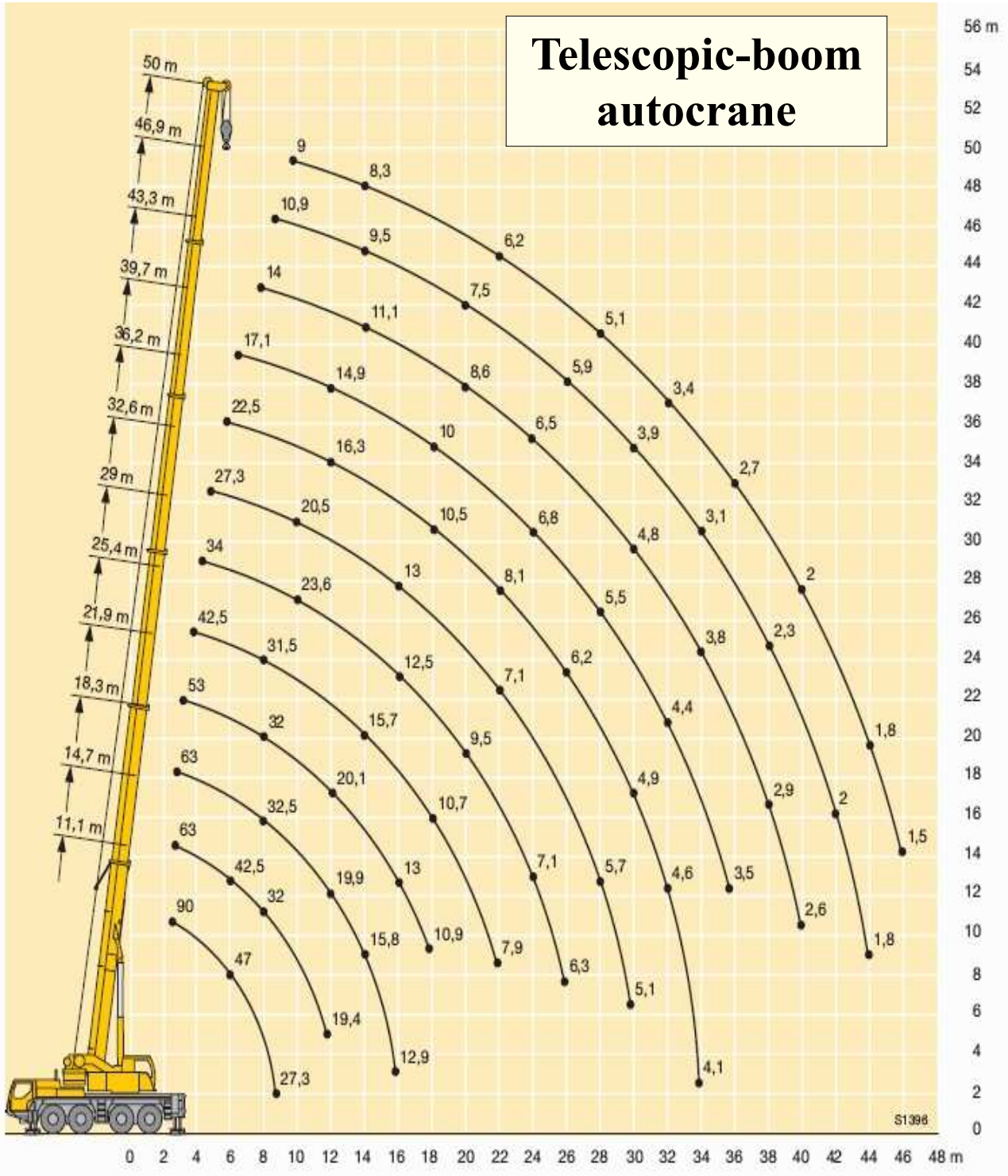
**Deep inside below (deep foundations, explorations)**

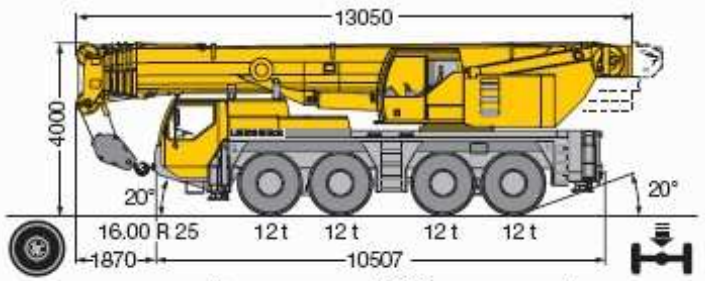


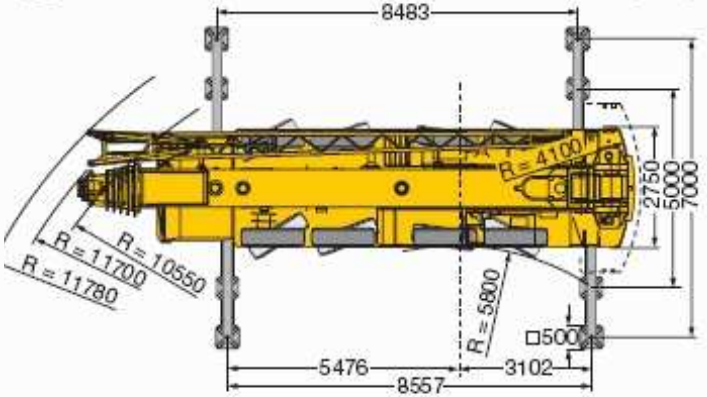



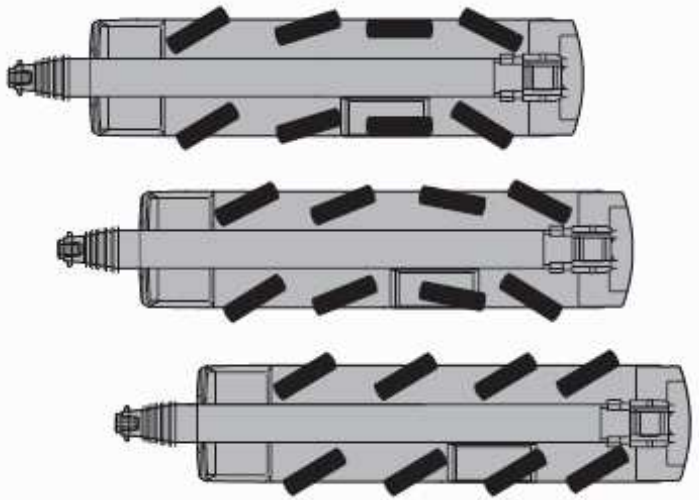
# Lattice-boom autocrane

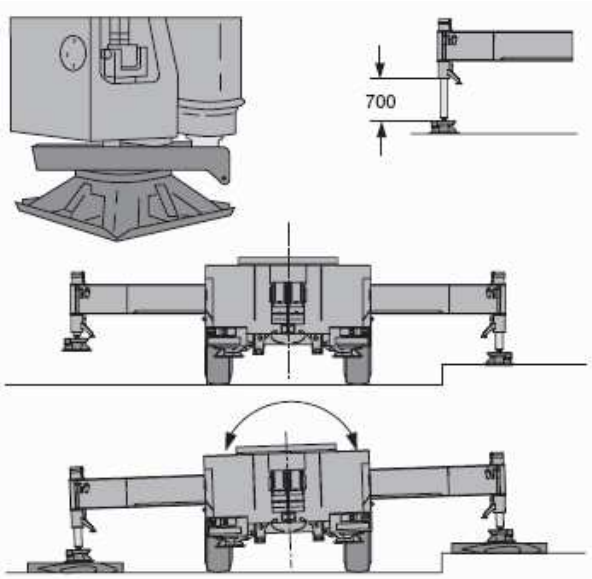
# Telescopic-boom autocrane

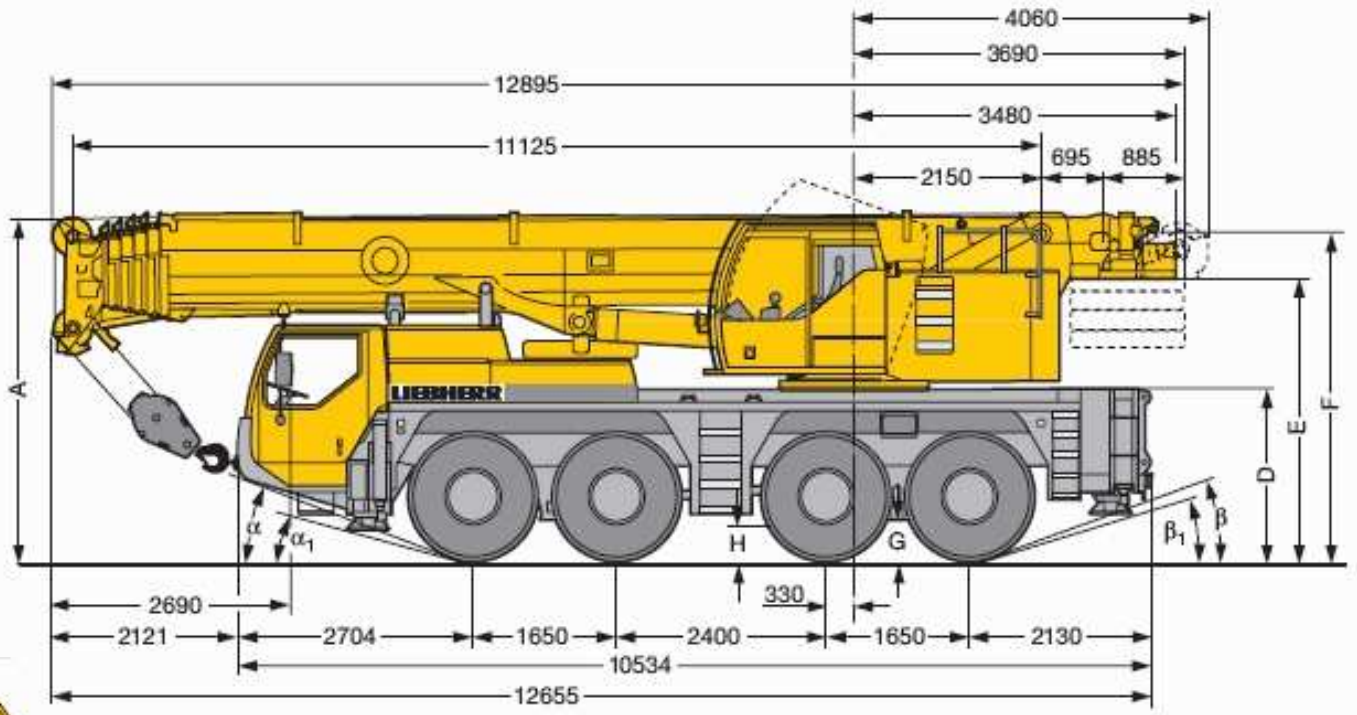



700


4060
3690
12895
3480
11125
695
885
2150
A
D
E
F
α
α1
H
G
β1
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2400
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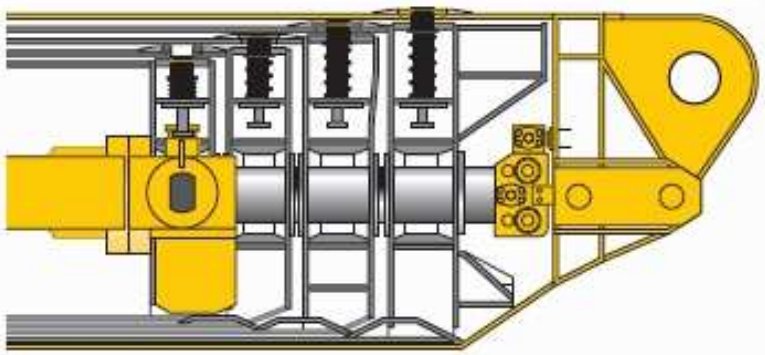
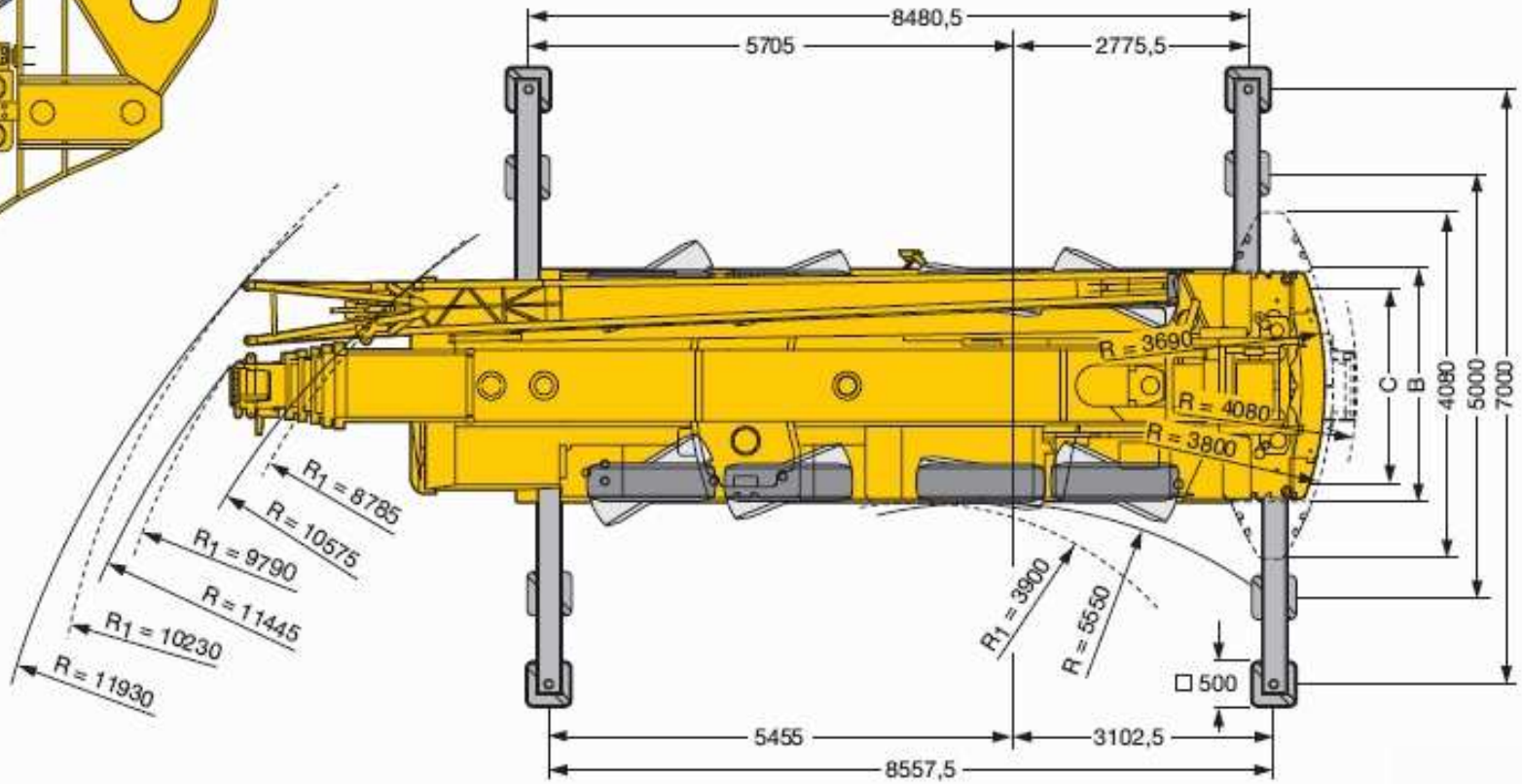
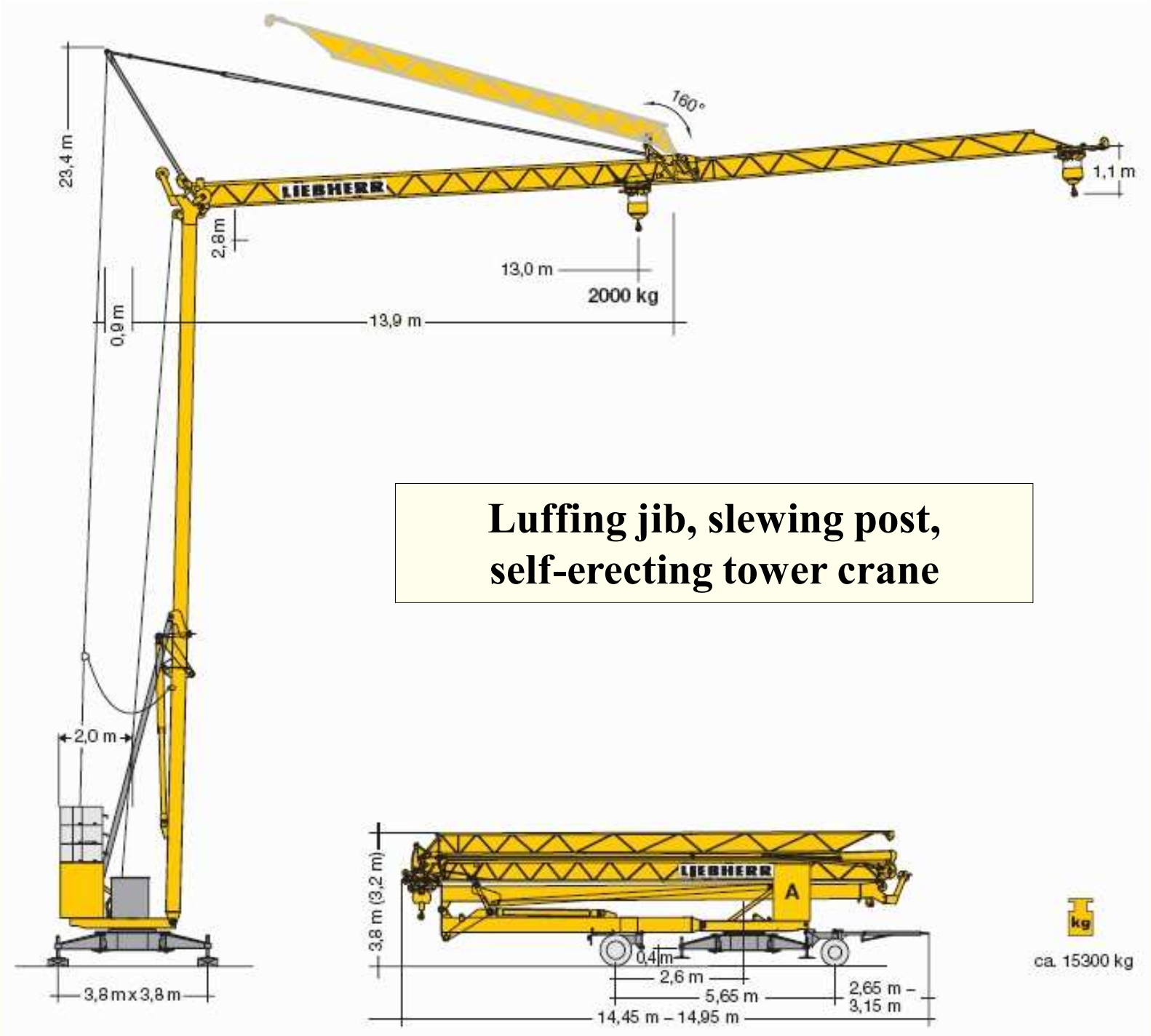
2130
10534
12655



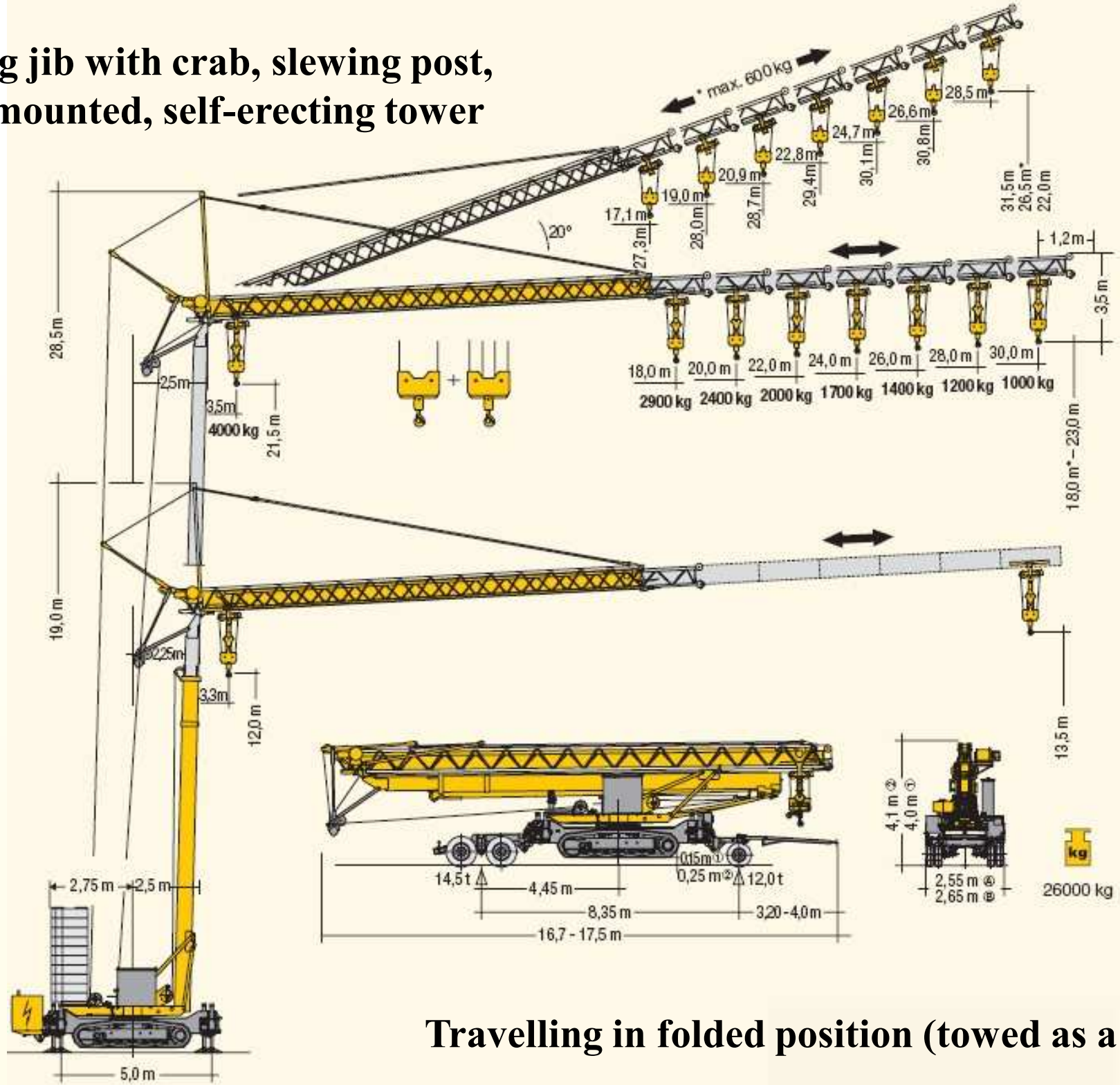

oval cross-section


8480,5
5705
2775,5
R = 3690
R = 4080
R = 3800
C
B
4080
5000
7000
R1 = 8785
R = 10575
R1 = 9790
R = 11445
R1 = 10230
R = 11930
R1 = 3900
R = 5550
□ 500
5455
3102,5
8557,5



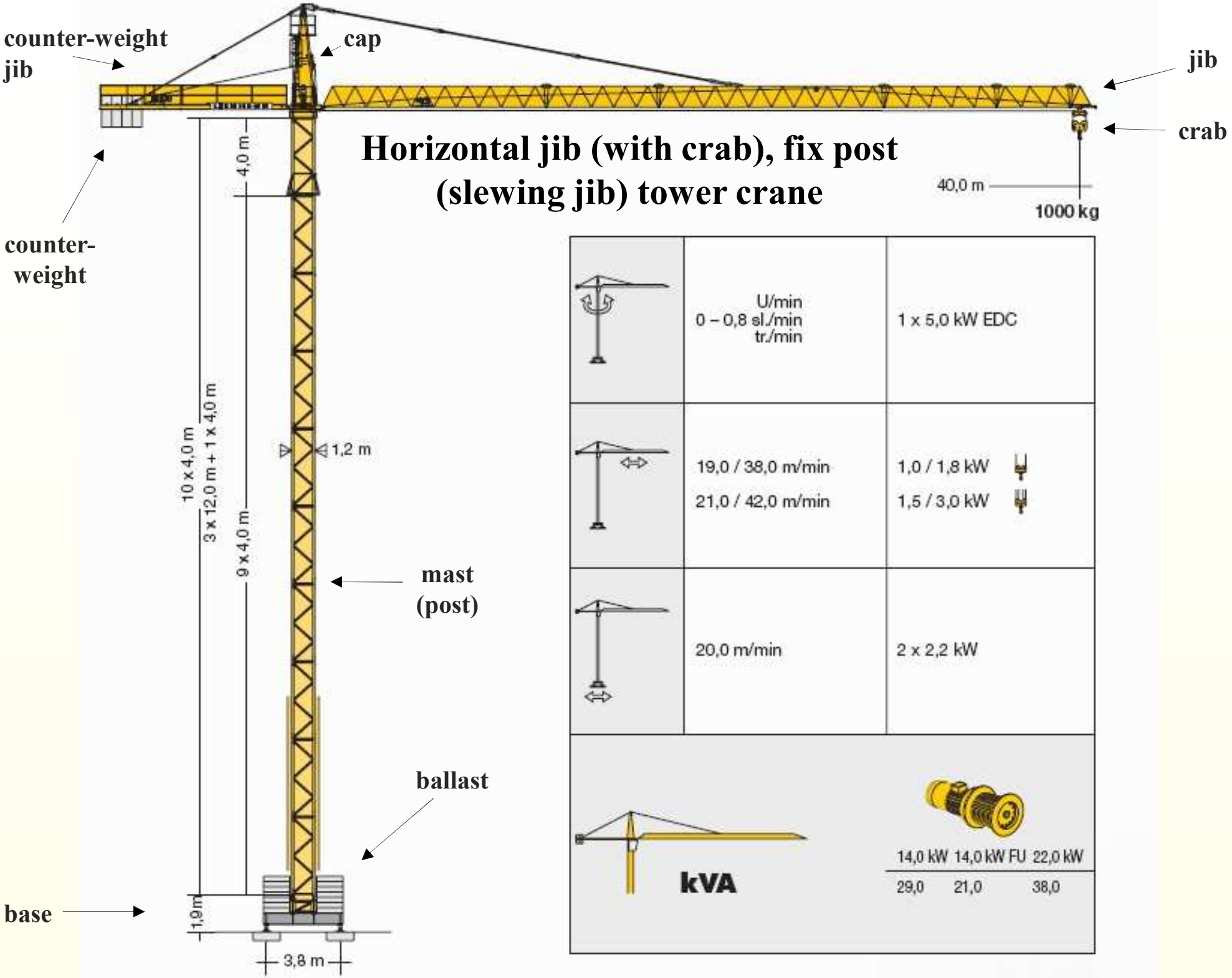

**Luffing jib, slewing post, self-erecting tower crane**

**Luffing jib with crab, slewing post, track mounted, self-erecting tower crane**




**Travelling in folded position (towed as a trailer)**

# Horizontal jib (with crab), fix post (slewing jib) tower crane

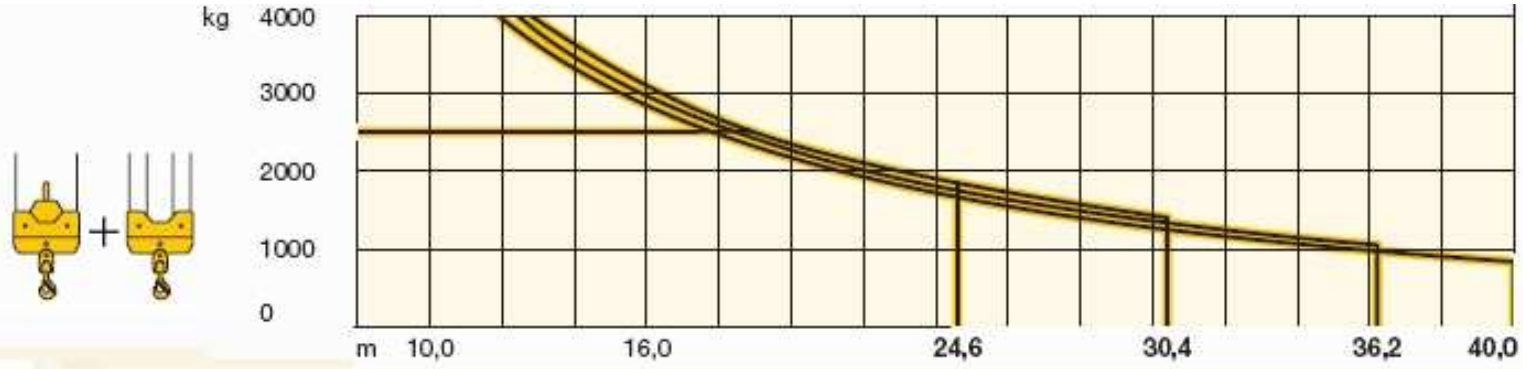



| | | |
|---|---|---|
| | U/min<br>0 – 0,8 sl./min<br>tr./min | 1 x 5,0 kW EDC |
| | 19,0 / 38,0 m/min<br>21,0 / 42,0 m/min | 1,0 / 1,8 kW<br>1,5 / 3,0 kW |
| | 20,0 m/min | 2 x 2,2 kW |

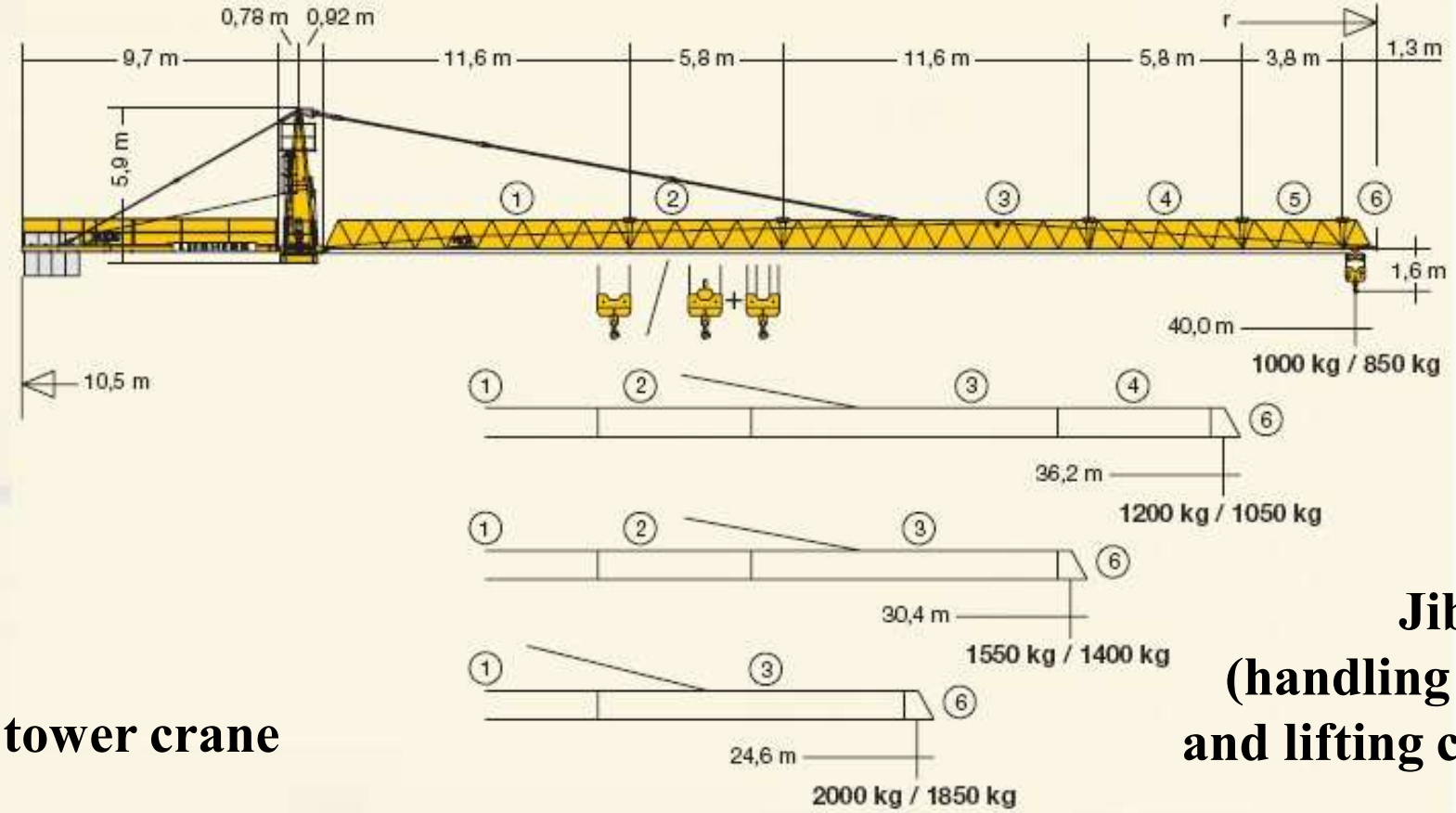
kVA

| 14,0 kW | 14,0 kW FU | 22,0 kW |
|---|---|---|
| 29,0 | 21,0 | 38,0 |

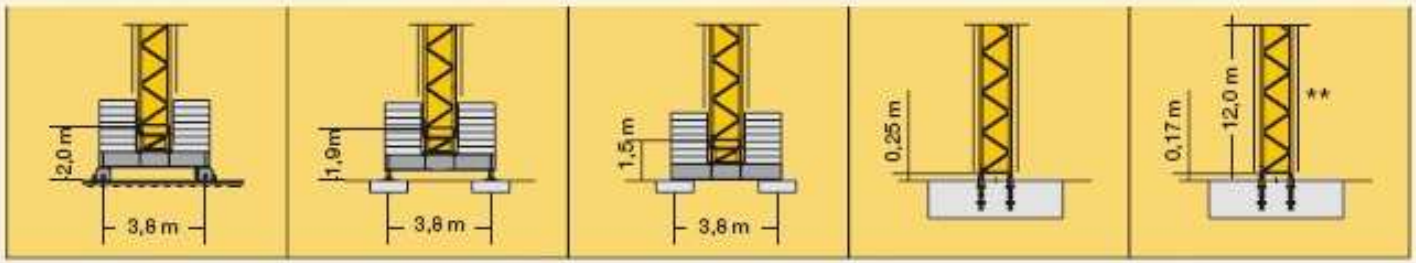
**Hook casing, sheave block**

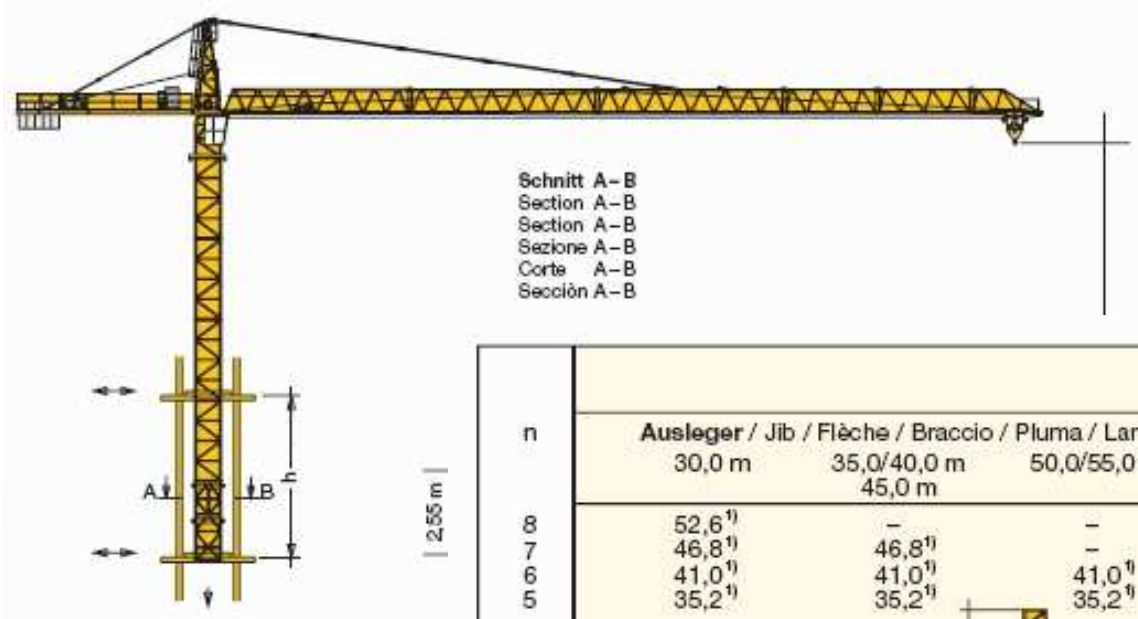



**Jib length (handling radius) and lifting capacity**




**Fix-post tower crane footings**

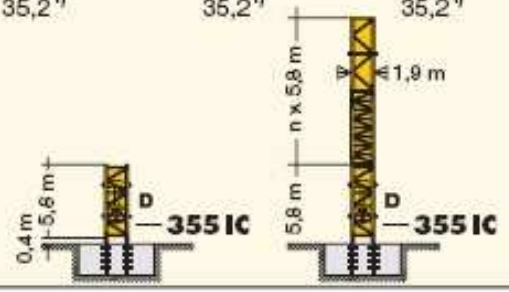


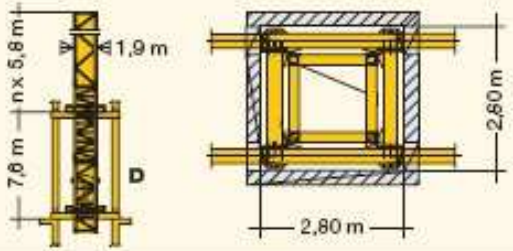



# Climbing crane

## 256 IC

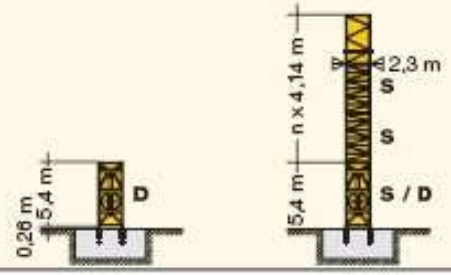
| n | Ausleger / Jib / Flèche / Braccio / Pluma / Lança 30,0 m | 35,0/40,0 m 45,0 m | 50,0/55,0 m | | Ausleger / Jib / Flèche / Braccio / Pluma / Lança 30,0 m | 35,0/40,0 m 45,0 m | 50,0/55,0 m |
|---|---|---|---|---|---|---|---|
| 8 | 52,6[1] | – | – | nx5,8m | 7[1] | – | – |
| 7 | 46,8[1] | 46,8[1] | – | | 6[1] | 6[1] | – |
| 6 | 41,0[1] | 41,0[1] | 41,0[1] | | 5[1] | 5[1] | 5[1] |
| 5 | 35,2[1] | 35,2[1] | 35,2[1] | | 4[1] | 4[1] | 4[1] |

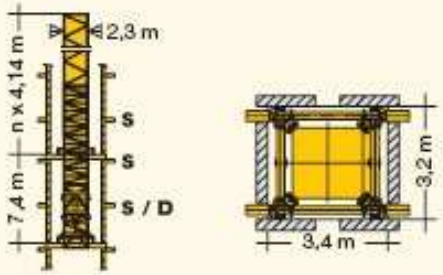



## 256 HC

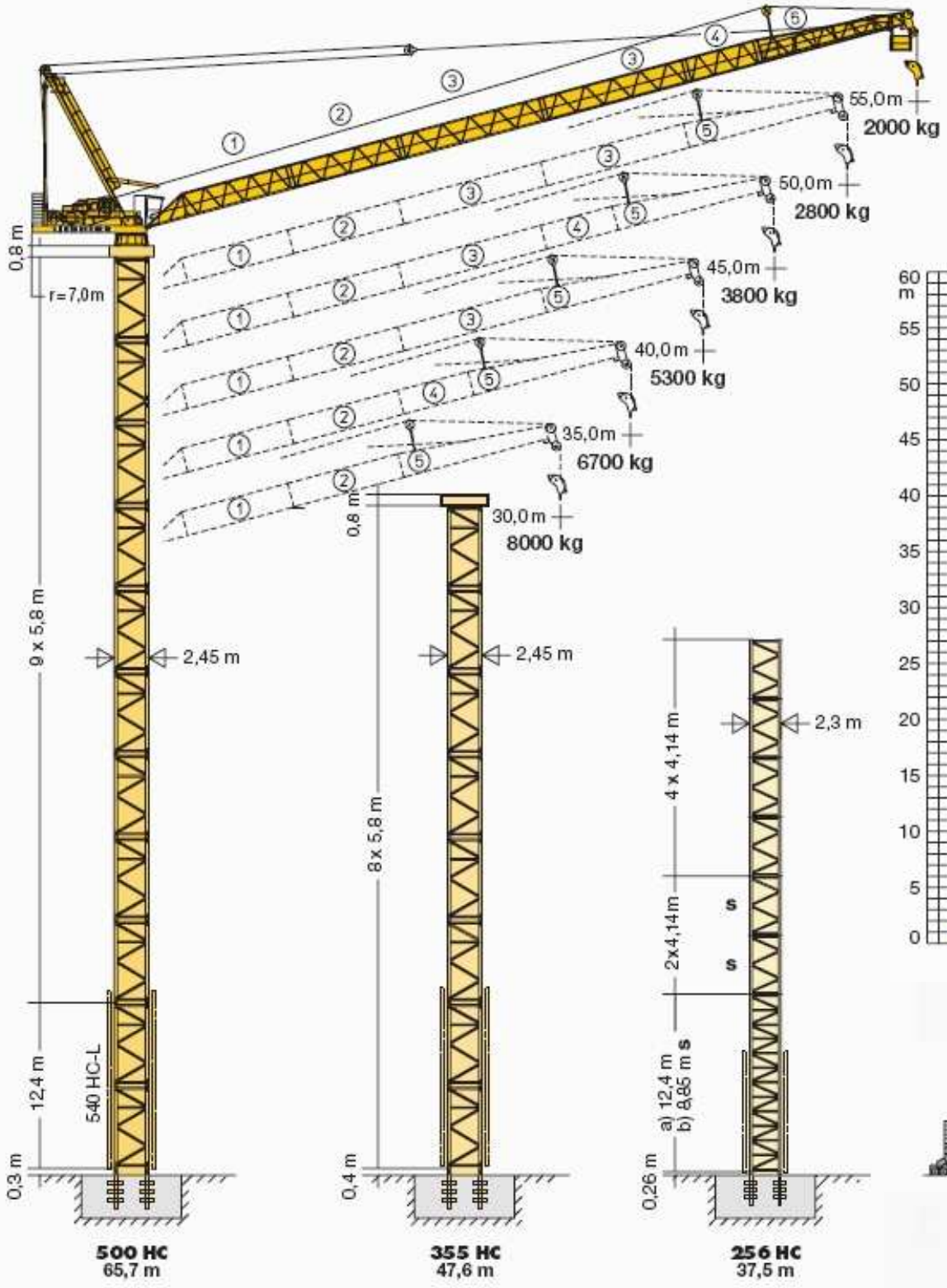
| n | Ausleger / Jib / Flèche / Braccio / Pluma / Lança 30,0/35,0 m | 40,0/45,0 m 50,0 m | 55,0 m | | Ausleger / Jib / Flèche / Braccio / Pluma / Lança 30,0/35,0 m | 40,0/45,0 m | 50,0 m | 55,0 m |
|---|---|---|---|---|---|---|---|---|
| 8 | 38,7[1] | – | – | nx4,14m | 6[1] | – | – | – |
| 7 | 34,6[1] | 34,6[1] | – | | 5[1] | 5[1] | 5[2] | – |
| 6 | 30,5[1] | 30,5[1] | 30,5[1] | | 4[1] | 4[1] | 4[1] | 4[1] |

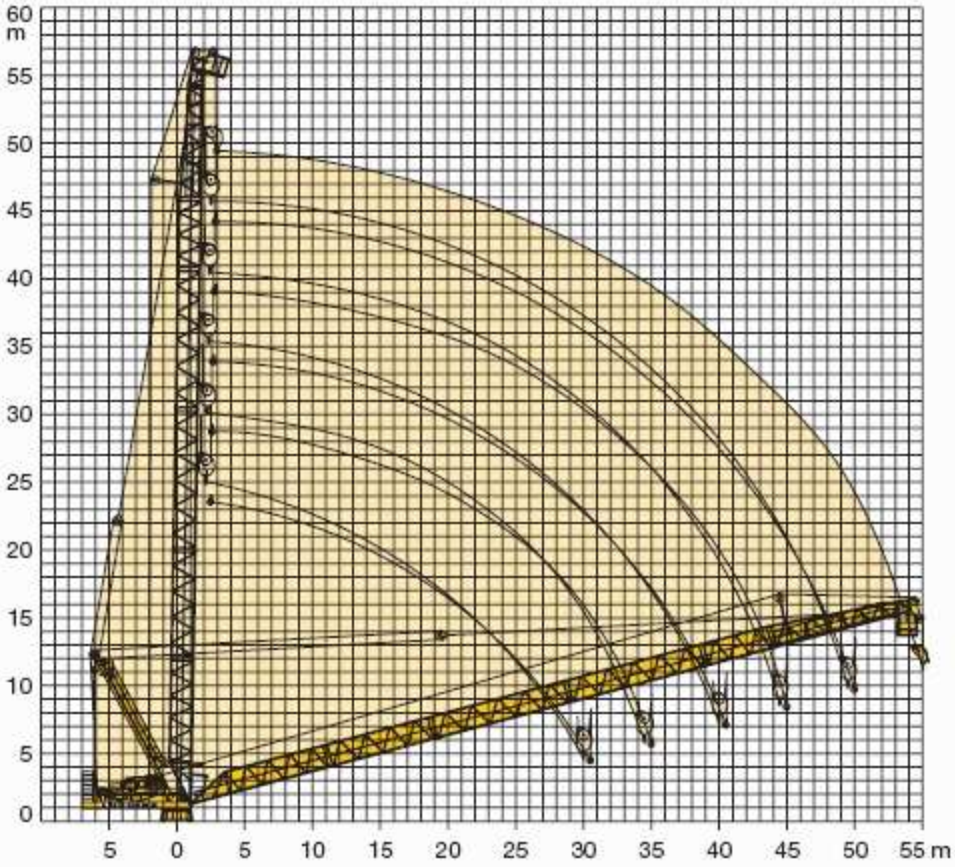


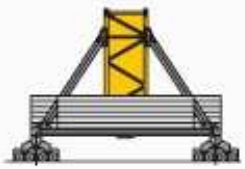




# Fix-post (mast) tower crane

# Luffing jib, fix post, tower crane

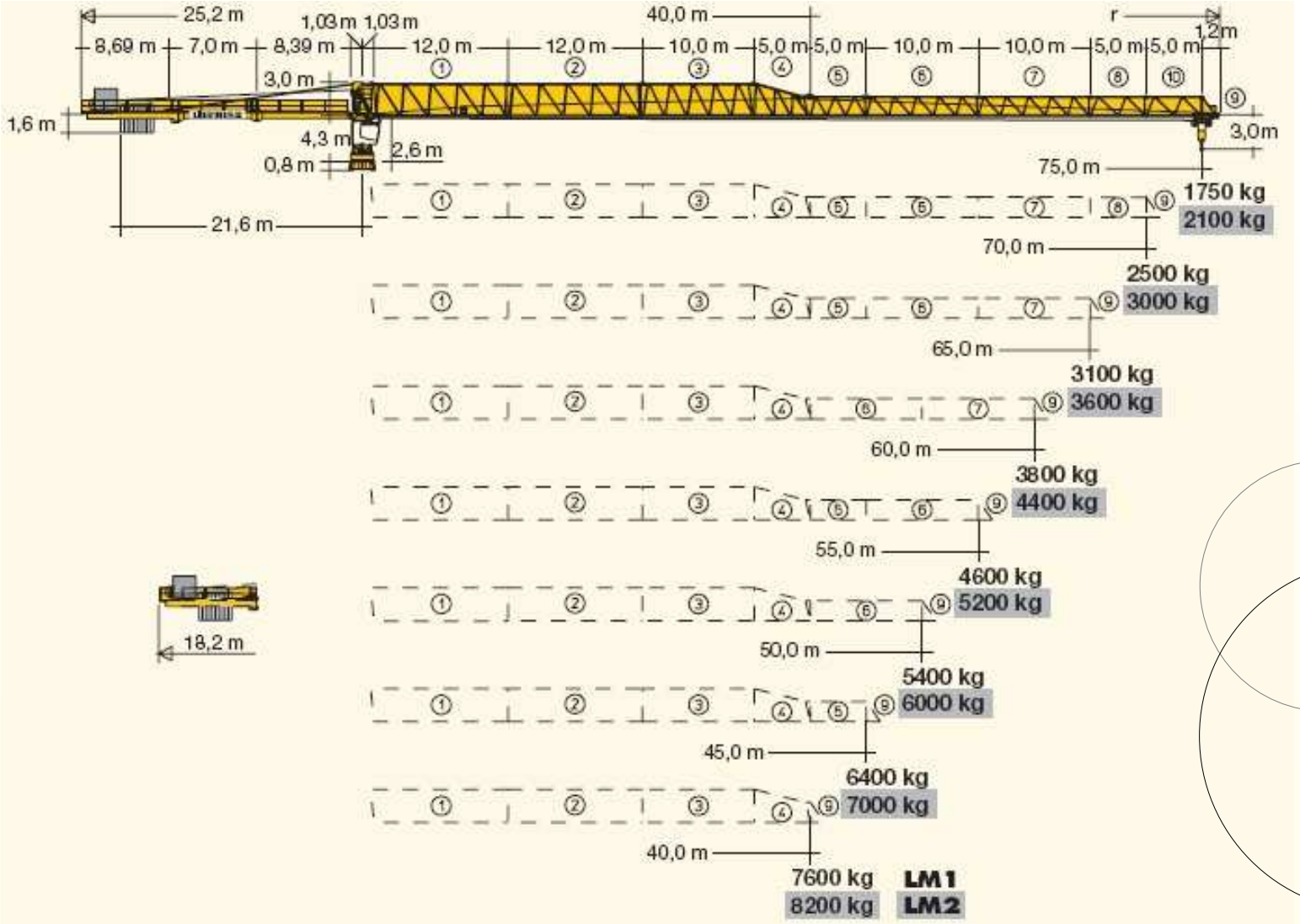


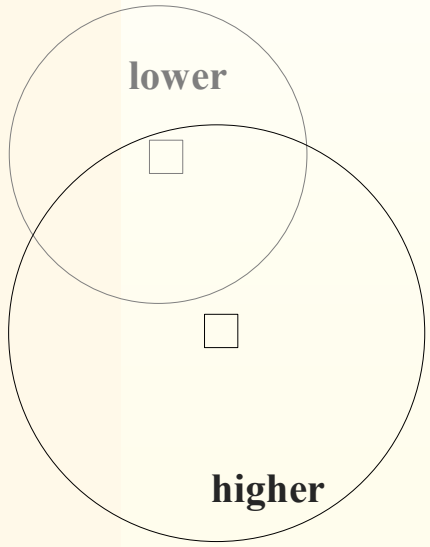



# Luffing- and handling capabilities

# Flat-top (with no cap), horizontal slewing jib (with crab) fix-post tower crane



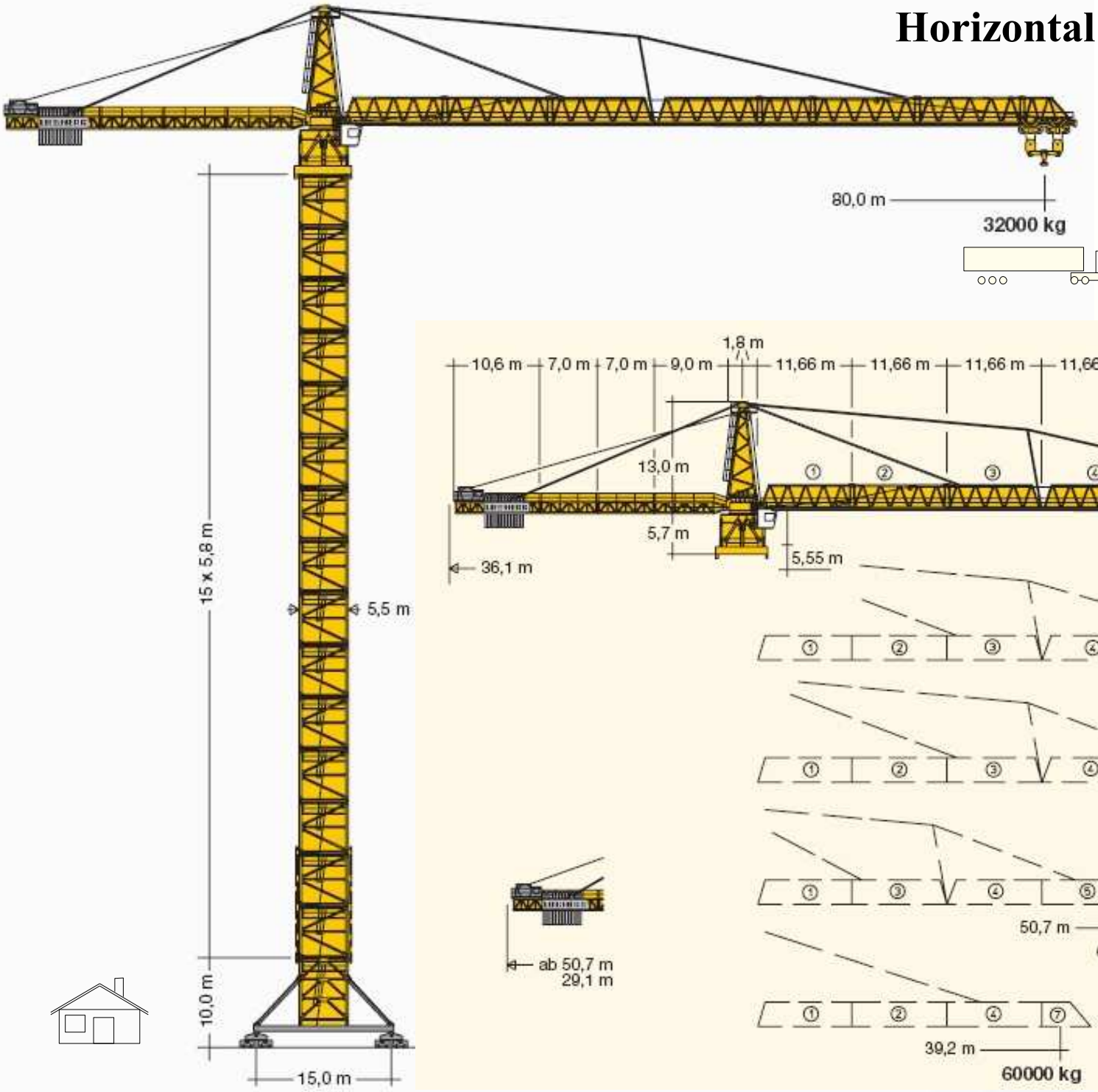




**Typical where more tower cranes have to co-operate within reach**

(as the lower crane – the higher can mount and dismount the lower one)

# Horizontal slewing jib, fix post, tower crane

Not the smallest one
(Consider its sizes!)



# The compact tower head. EC-B Flat-Top tower cranes.

## New technology. New ideas.

### Complete unit including:

Cabin, slewing gears, switchgear, slewing ring support, slewing ring, guy frame and current collector

### Compact tower head.

- Transport in upright position possible
- Completely pre-assembled
- A single transport unit
- Erection in a single lift
- Plug-in connections for the entire electrical installation
- Slewing possible immediately after erection
- Only one switch cabinet including S1 and S2
- Folding guy frame for low transport height
- Interchangeable deluxe cabin
  - can be removed
  - can be retracted for transport


LIEBHERR

# Basic Standard Hand Signals for Cranes and Hoisting Equipment

**HOIST:** With forearm vertical, and forefinger pointing up, move hand in small horizontal circle.

**LOWER:** With arm extended downward, forefinger pointing down, move hand in a small horizontal circle.

**RAISE BOOM:** Arm extended, fingers closed, thumb pointing upward.

**LOWER BOOM:** Arm extended, fingers closed, thumb pointing downward.

**EXTEND BOOM:** Both fists in front of body with thumbs pointing outward.

**RETRACT BOOM:** Both fists in front of body with thumbs pointing toward each other.

**SWING:** Arm extended, point with finger in direction of desired boom swing.

**STOP DOG EVERYTHING:** Clasp hands in front of body.

**MOVE SLOWLY:** Use one hand to give any motion signal and place the other hand motionless in front of the hand giving the signal.

**TRAVEL:** Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

**USE MAIN HOIST:** Tap fist on head; then use regular signals.

**USE WHIP LINE (AUXILIARY HOIST):** Tap elbow with one hand; then use regular signals.

**STOP:** Arm extended, palm down, move arm back and forth horizontally.

**RAISE THE BOOM AND LOWER THE LOAD:** With arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.

**LOWER THE BOOM AND RAISE THE LOAD:** With arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

**EMERGENCY STOP:** Both arms extended, palms down, move arms back and forth horizontally.

☛ *Basic Standard Hand Signals* (PDF file).

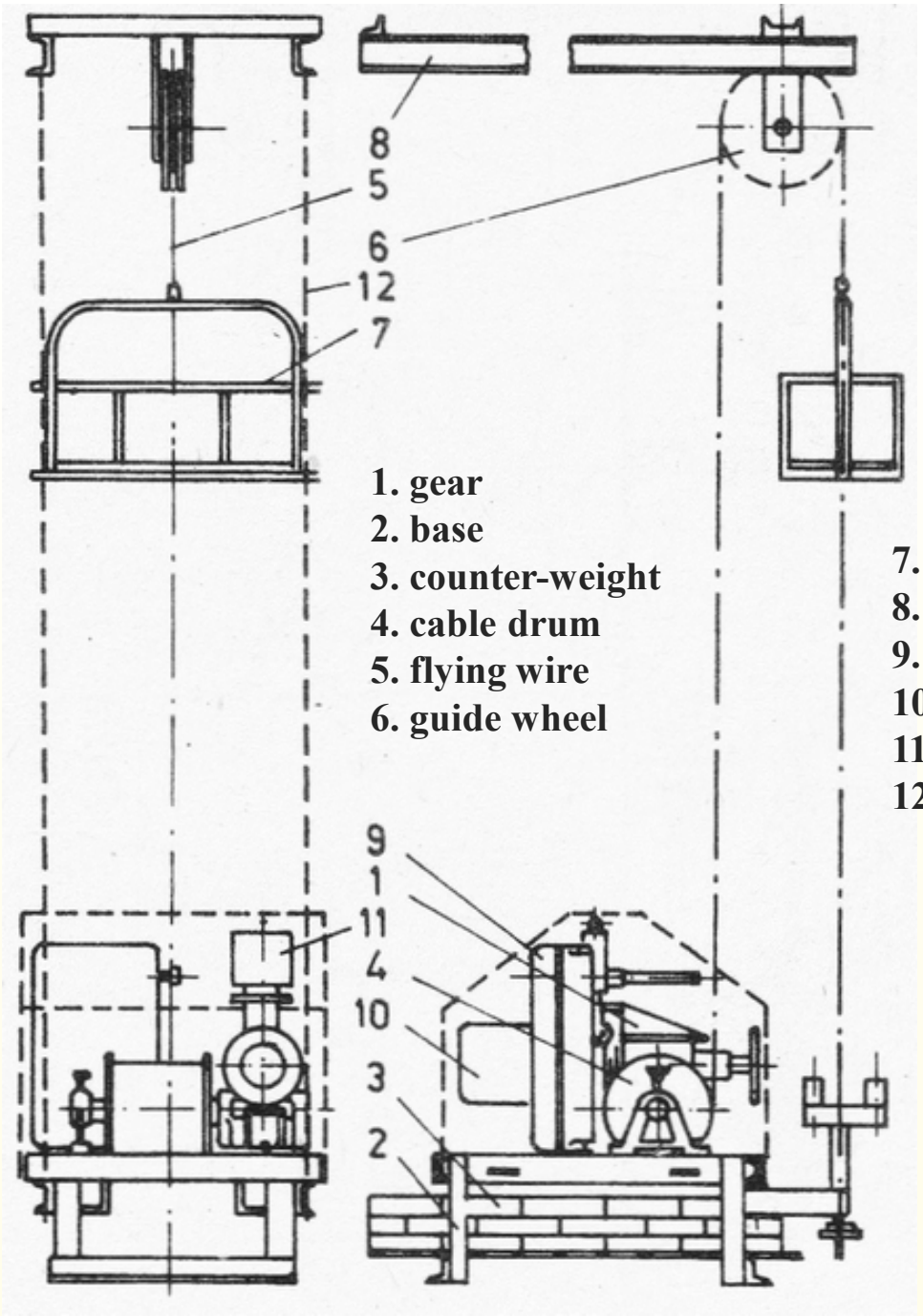
| | |
|---|---|
| Issued: | 04/08/2003 |
| Tag # | AP2003-M061 |

U.S. Department of Labor
MSHA
Mine Safety and Health Administration

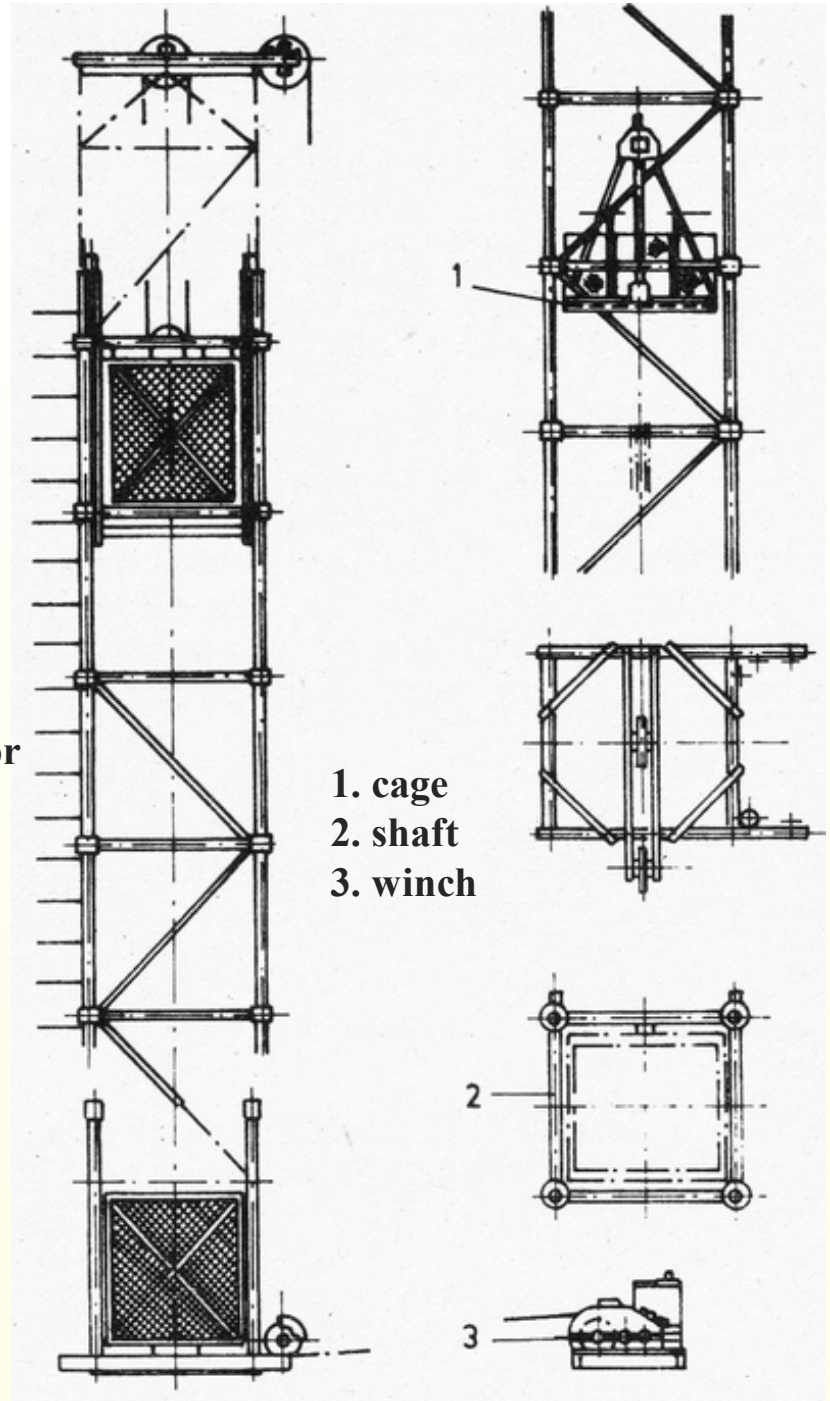
# Cage lift

# Exterior (Contractor's) Hoist

# Shaft lift

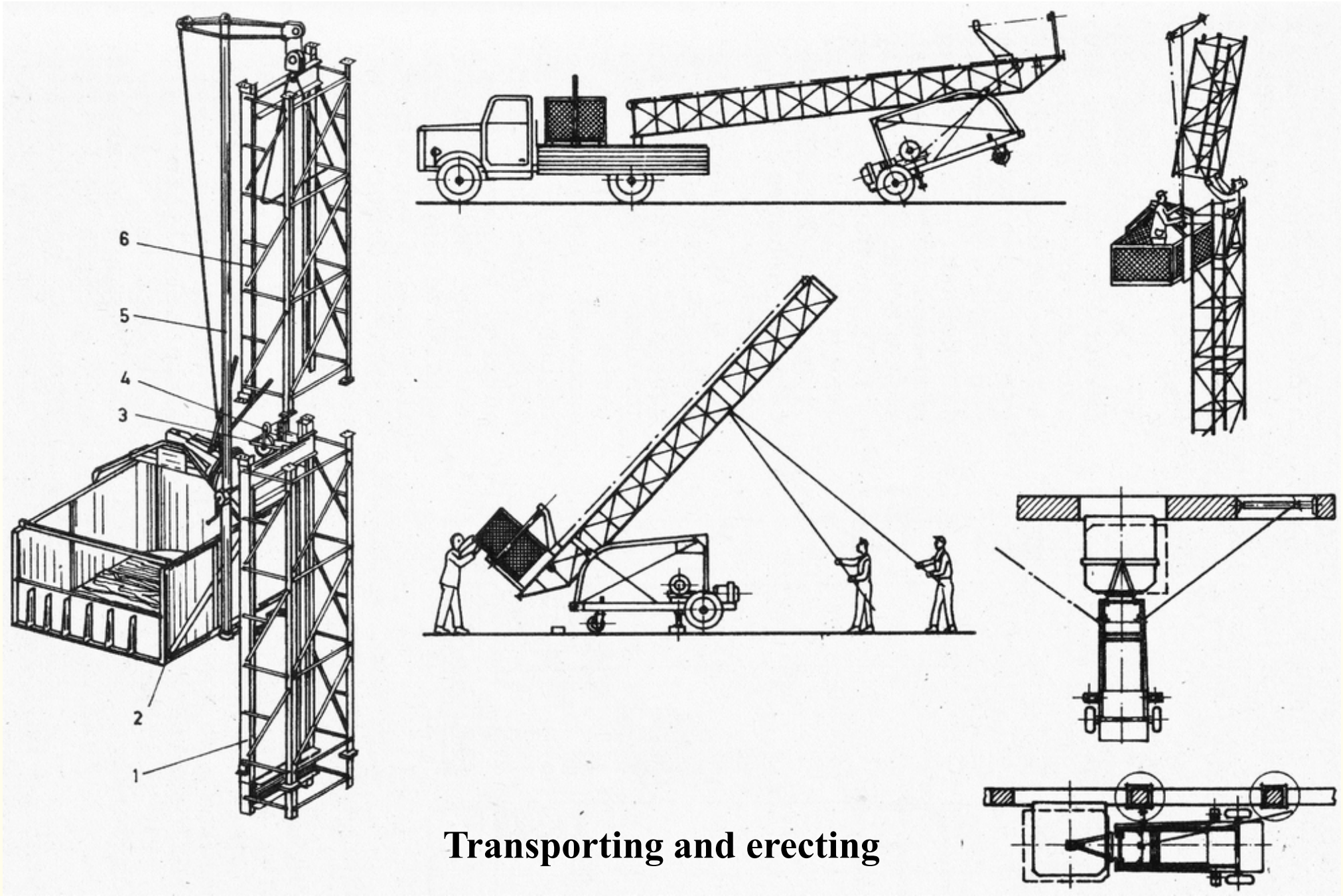



1. gear
2. base
3. counter-weight
4. cable drum
5. flying wire
6. guide wheel
7. cage
8. guide rail
9. control box
10. electromotor
11. break
12. guide rope



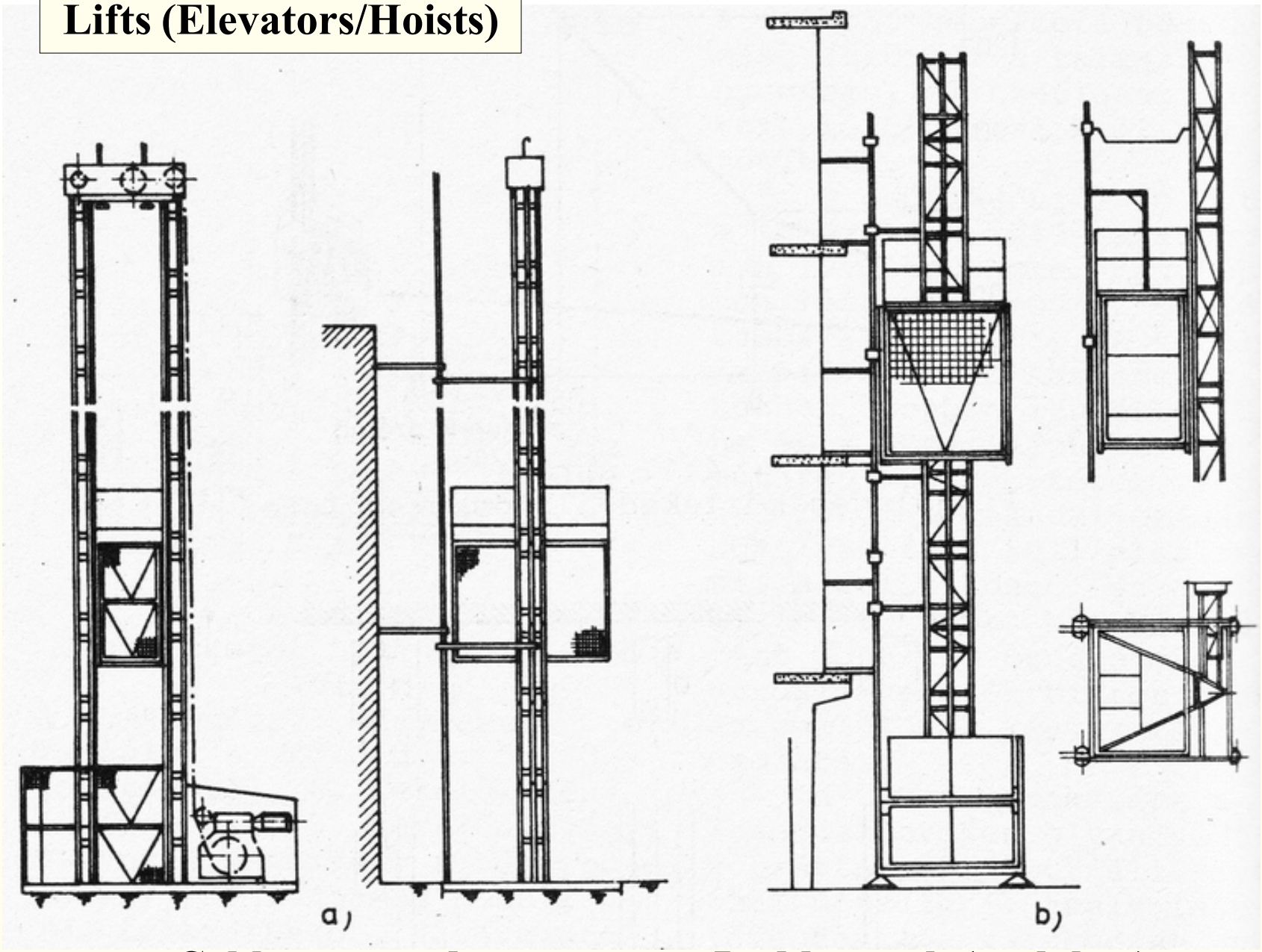

1. cage
2. shaft
3. winch

# Elevator Tower Hoist



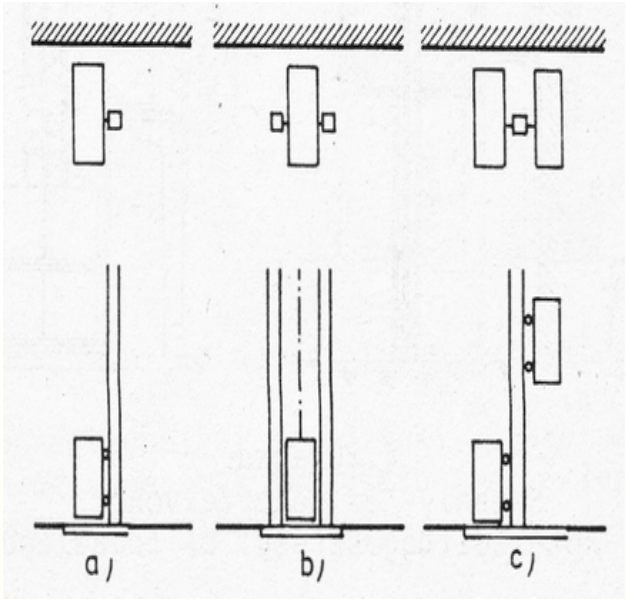

Transporting and erecting

# Freight- and Passanger Lifts (Elevators/Hoists)

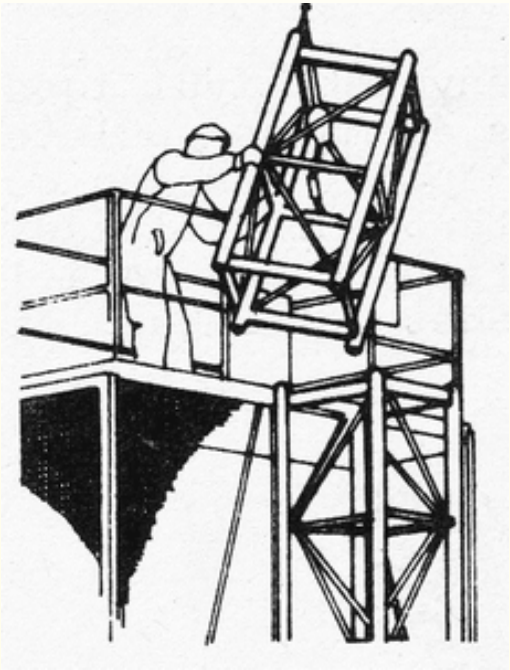



Cable operated

Ladder rack (rack bar) operated

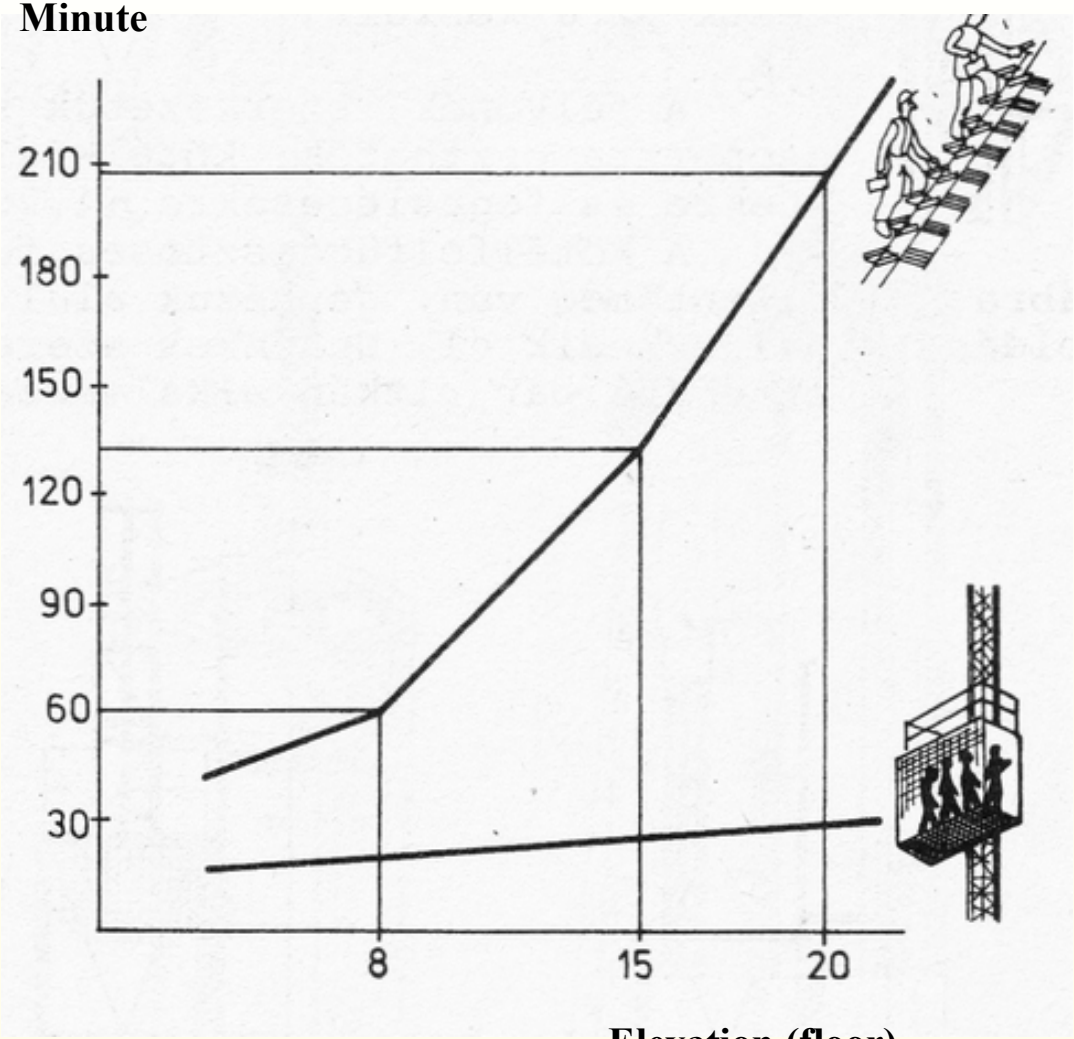



**a. single mast; b. twinmast;**
**c. single mast two cages**



**Extending the lift tower**

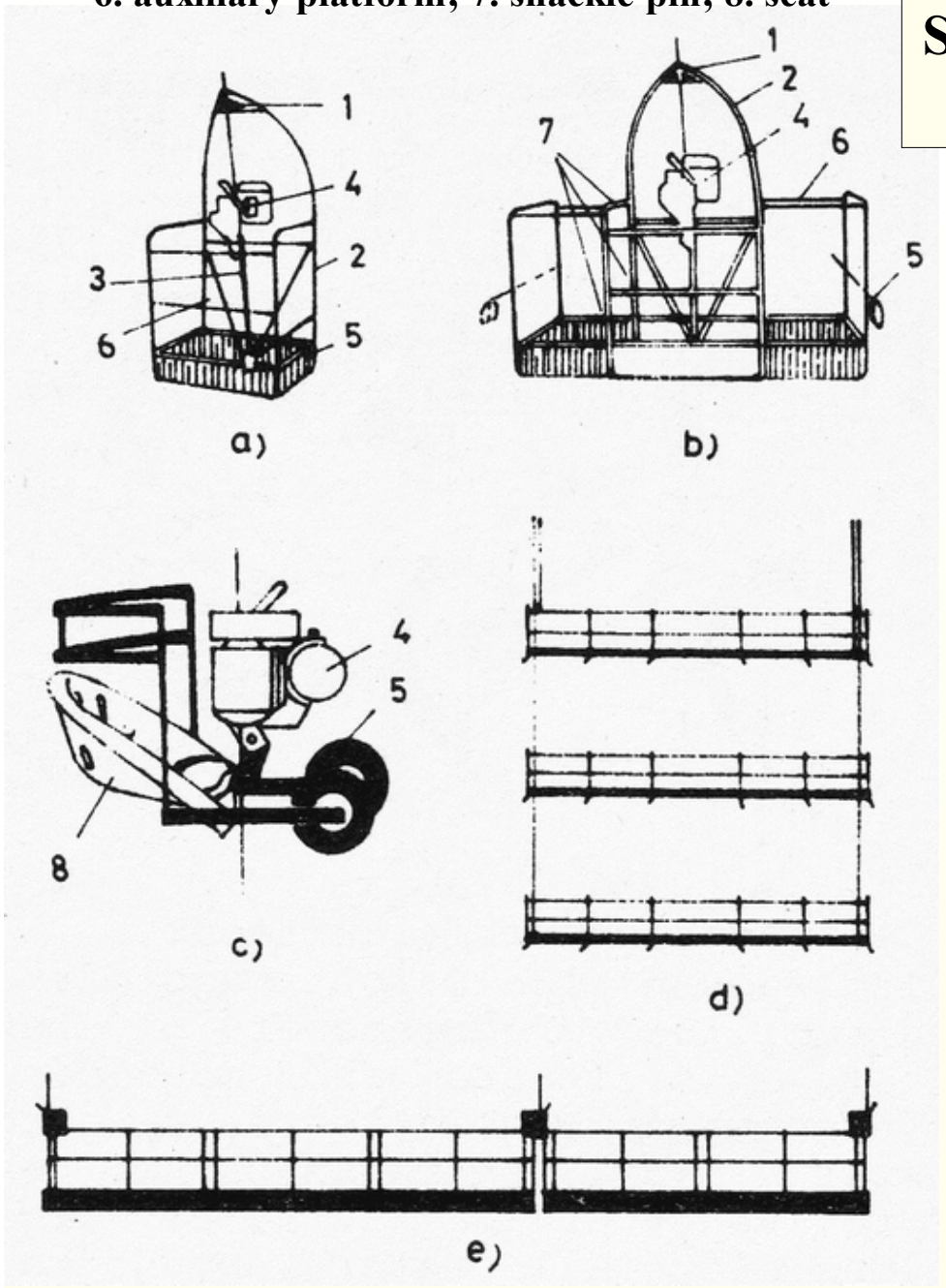
# Time-consumption of on-site vertical traffic



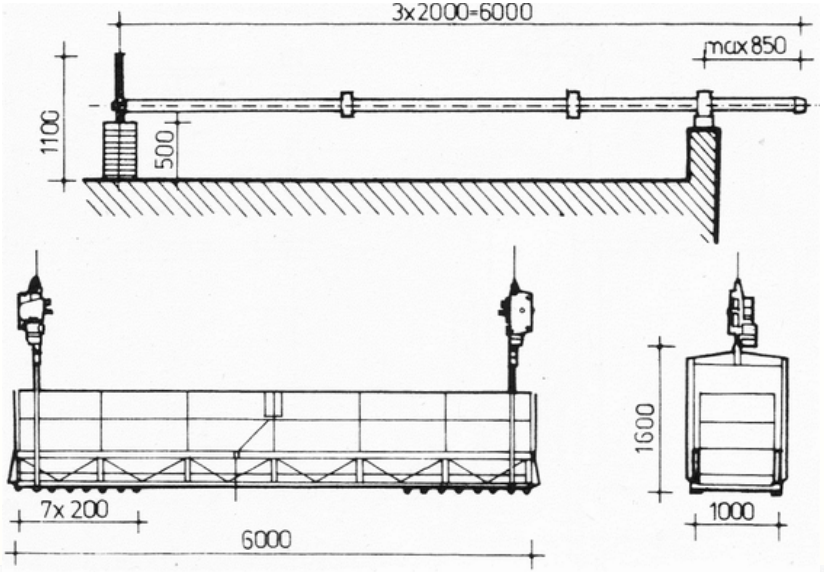

**Elevation (floor)**

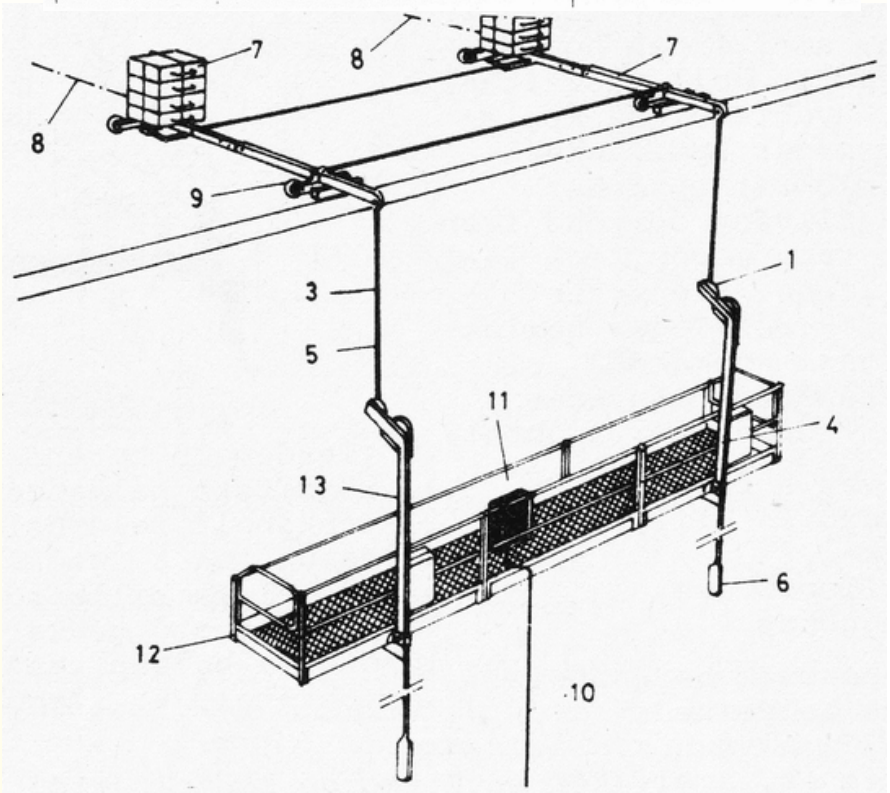
# Suspended scaffolds

1. guide sheave; 2. cage frame; 3. frame post;
4. climbing unit; 5. guide wheels;
6. auxiliary platform; 7. shackle pin; 8. seat



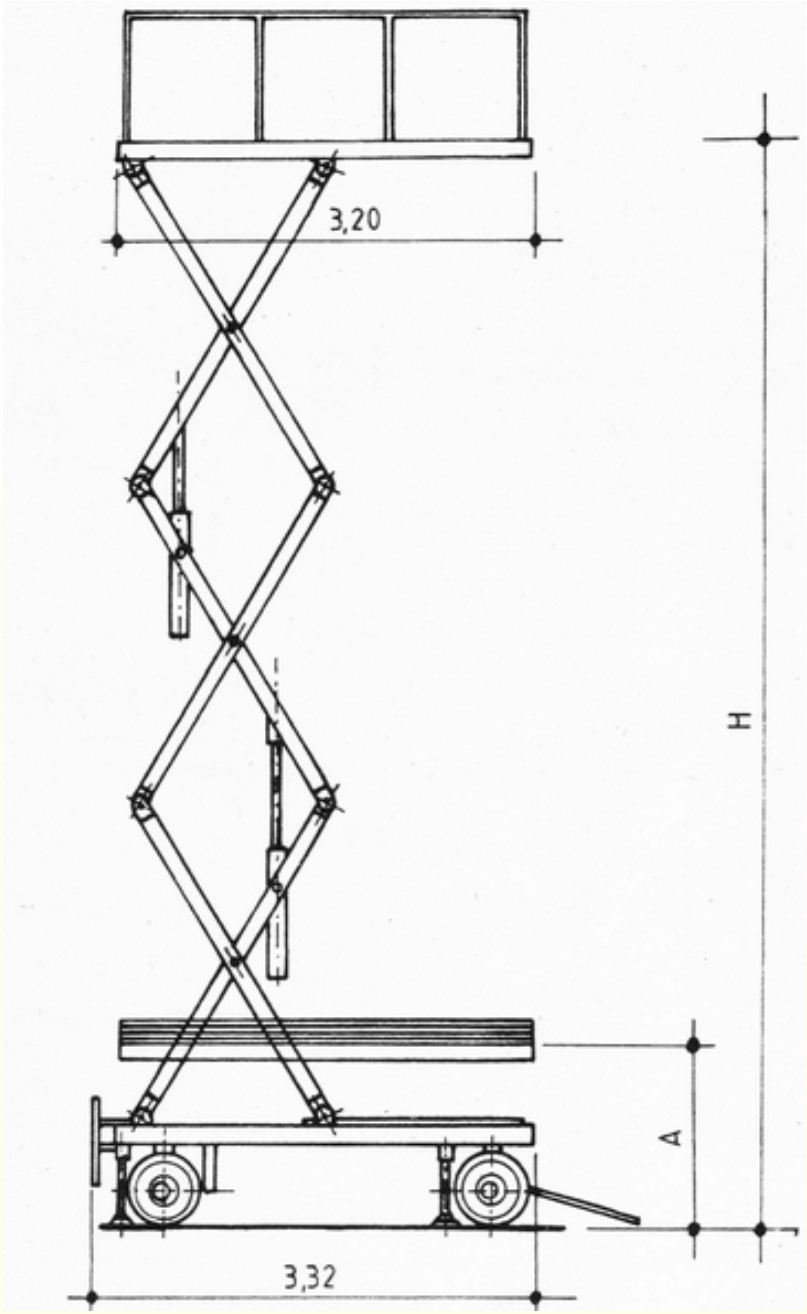

a. single-; b. extended-; c. one-man-;
d. multistorey-; e. extensible cages



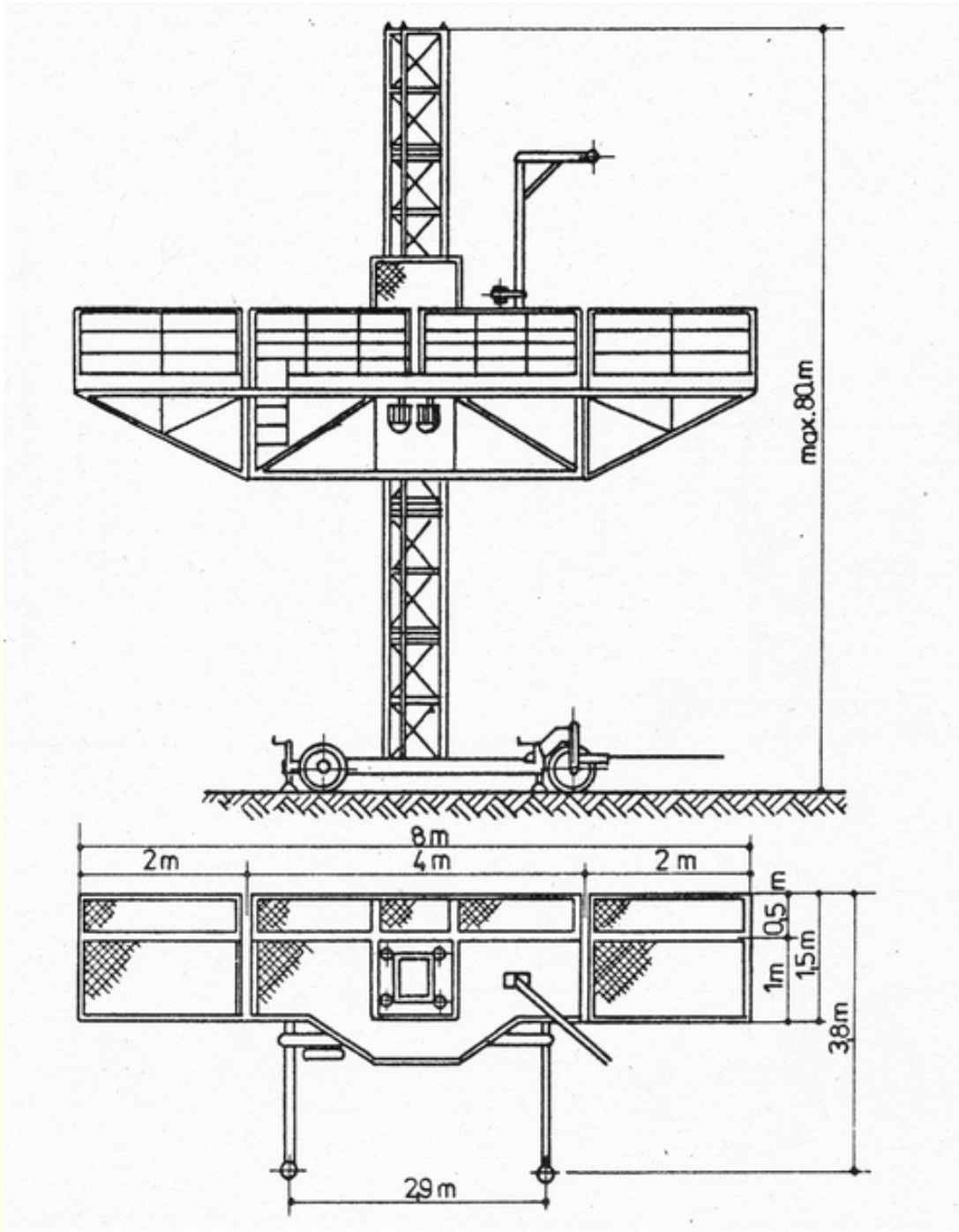



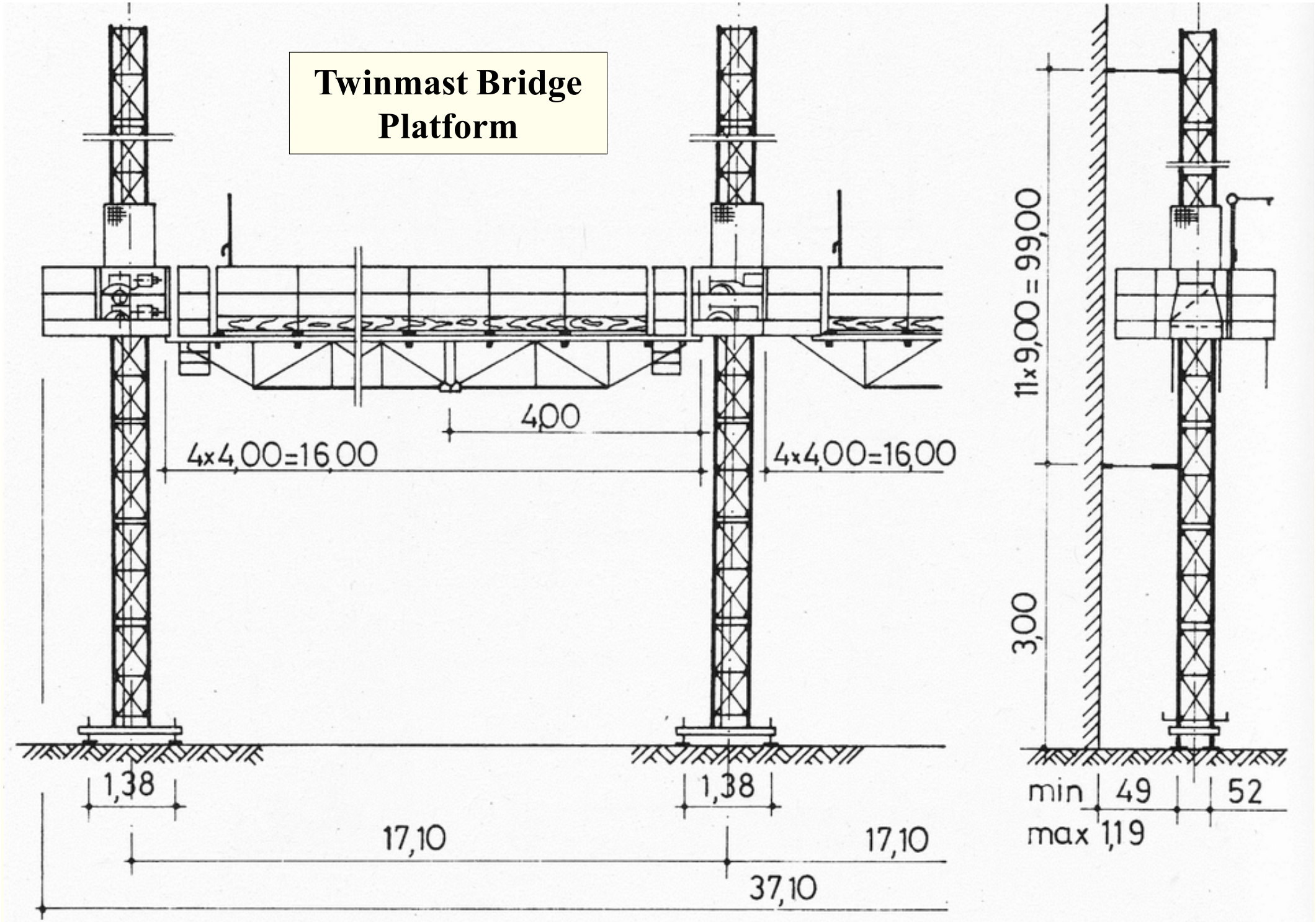
1. sheaves; 2. console; 3. lifting cable; 4. drive;
5. stay line; 6. tension weight; 7. counter-weight;
8. safety line; 9. idler; 10. floating line; 11. control;
12. suspended bridge; 13. stabilizer frame post

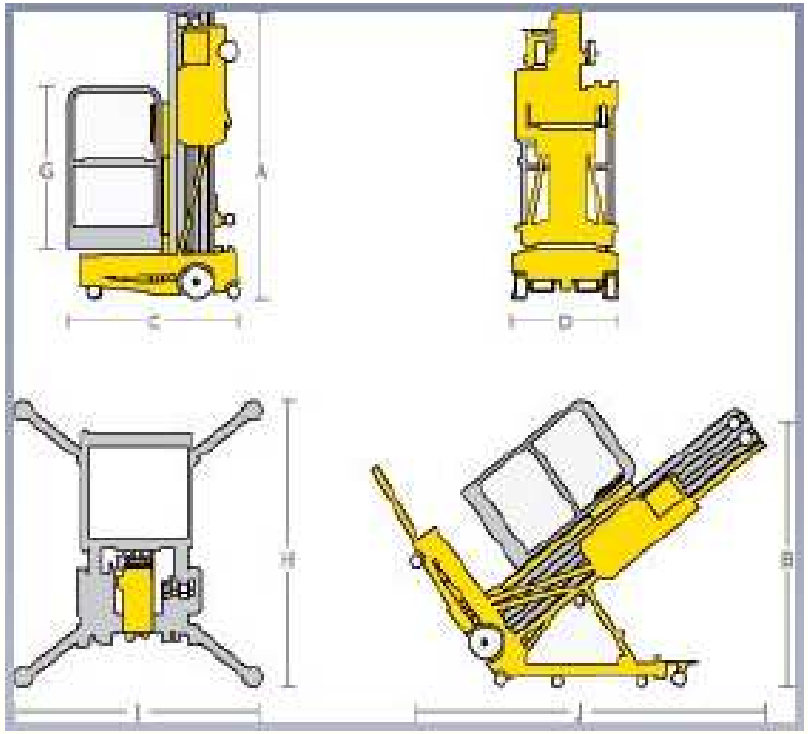
## Scissor Lift

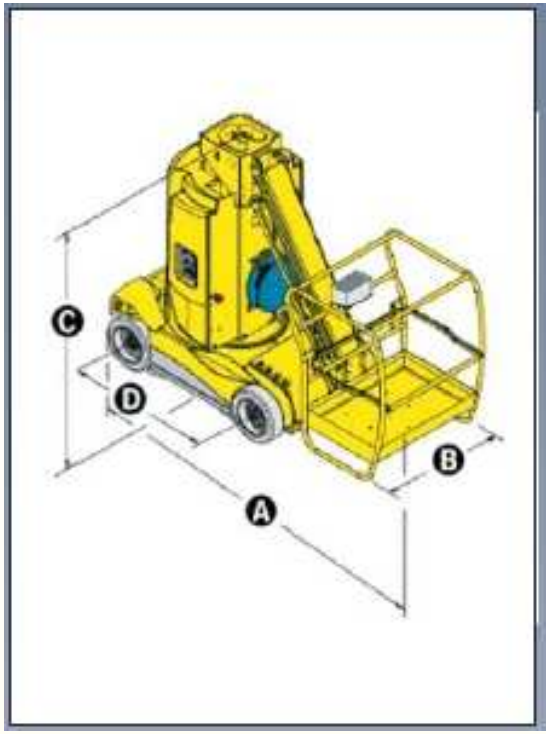


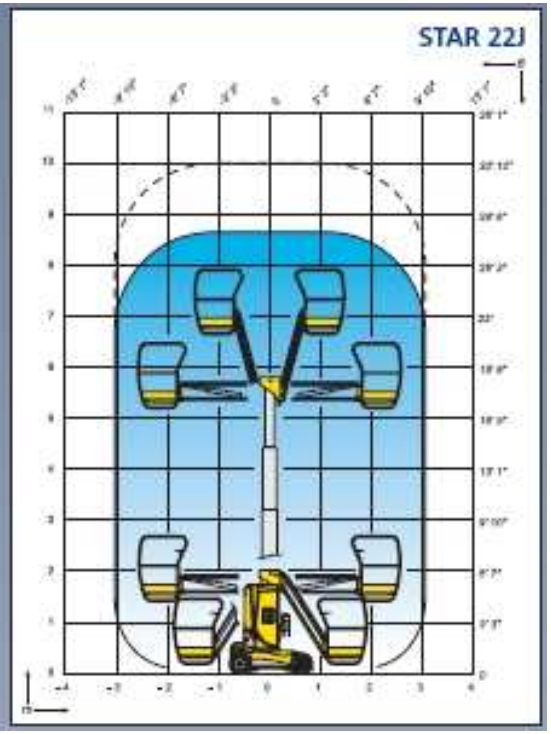

## Assembly Platform



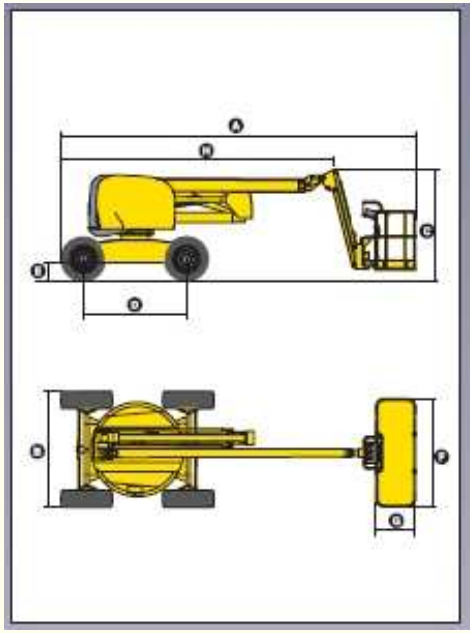

Twinmast Bridge Platform
4,00
4x4,00=16,00
4x4,00=16,00
1,38
1,38
17,10
17,10
37,10
11x9,00=99,00
3,00
min
49
52
max 1,19

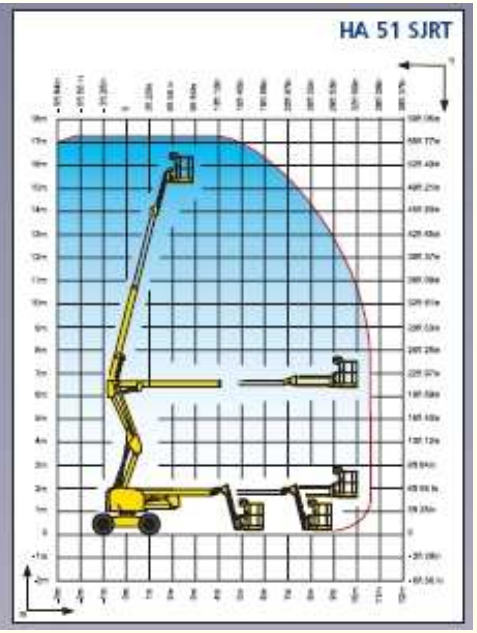


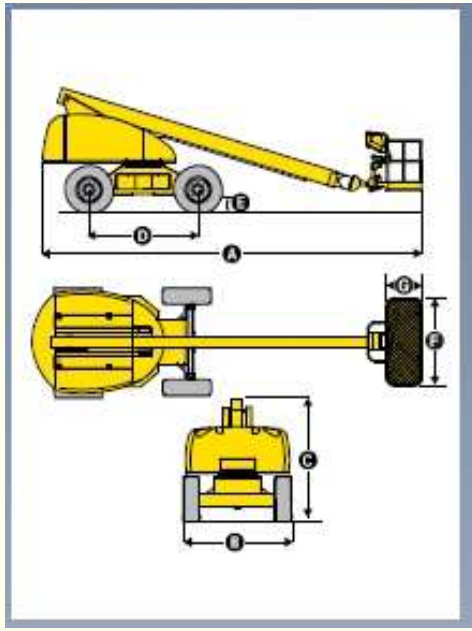



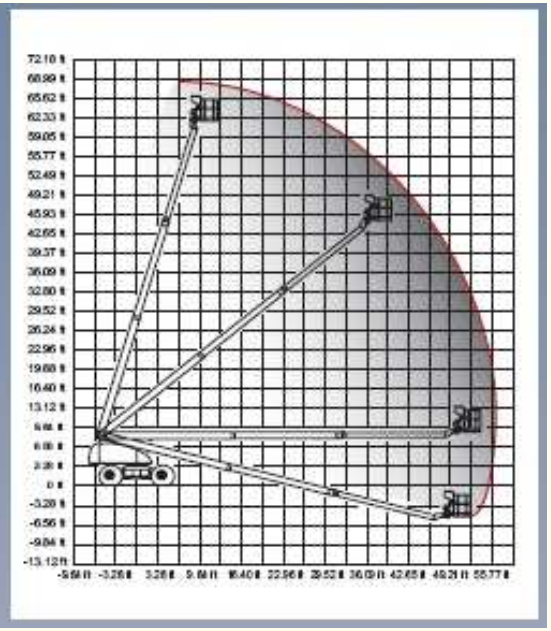




# Cage-operated Working Platforms

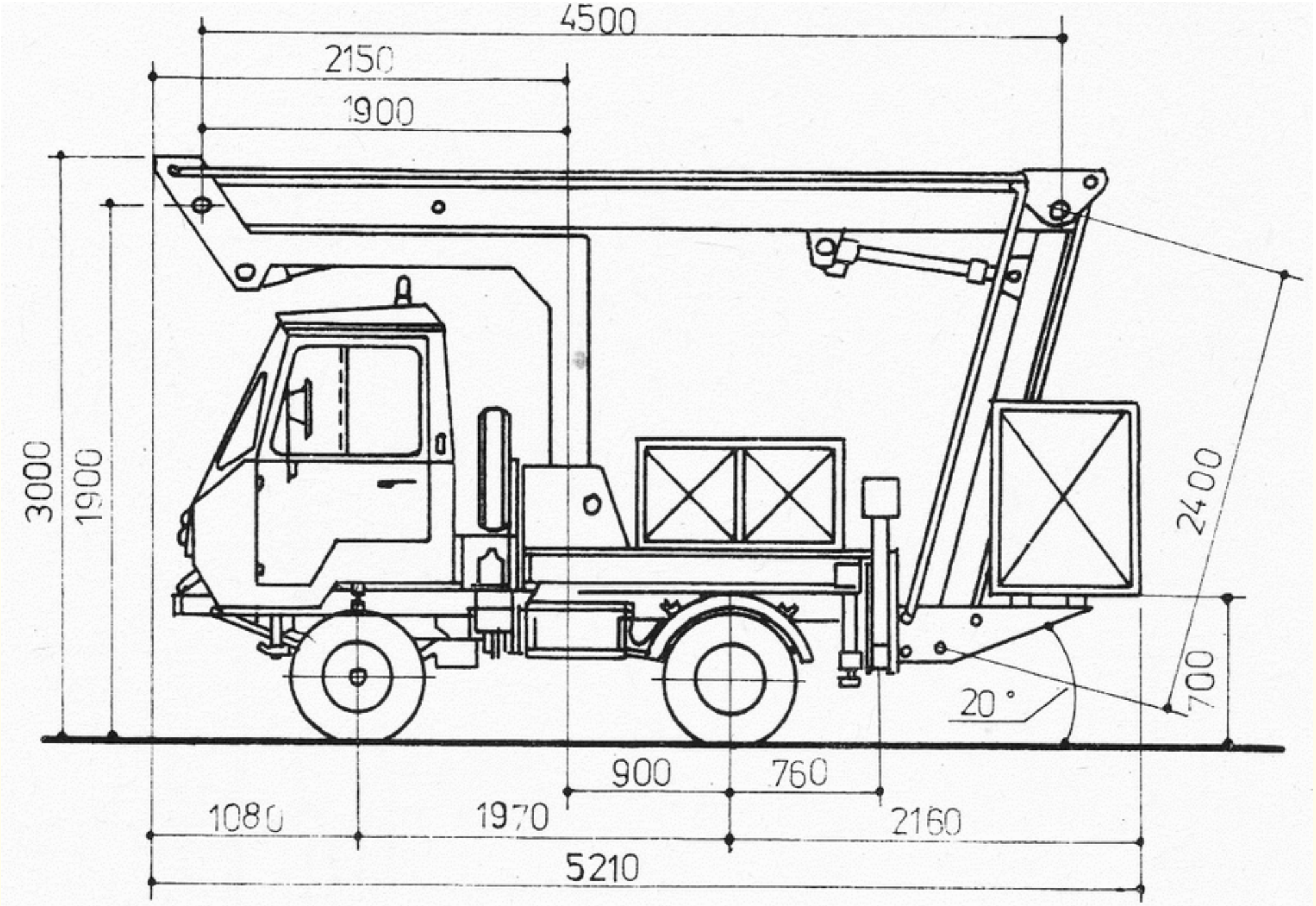


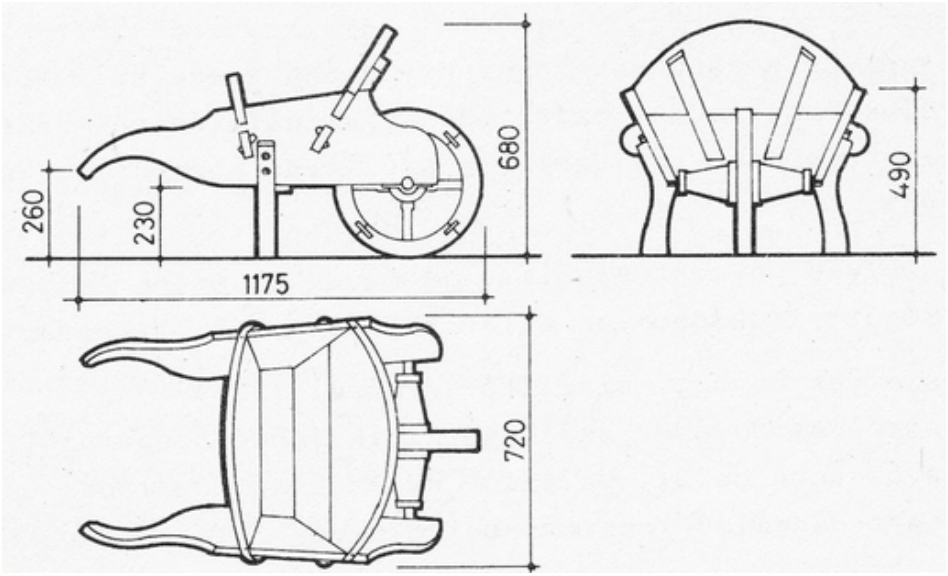



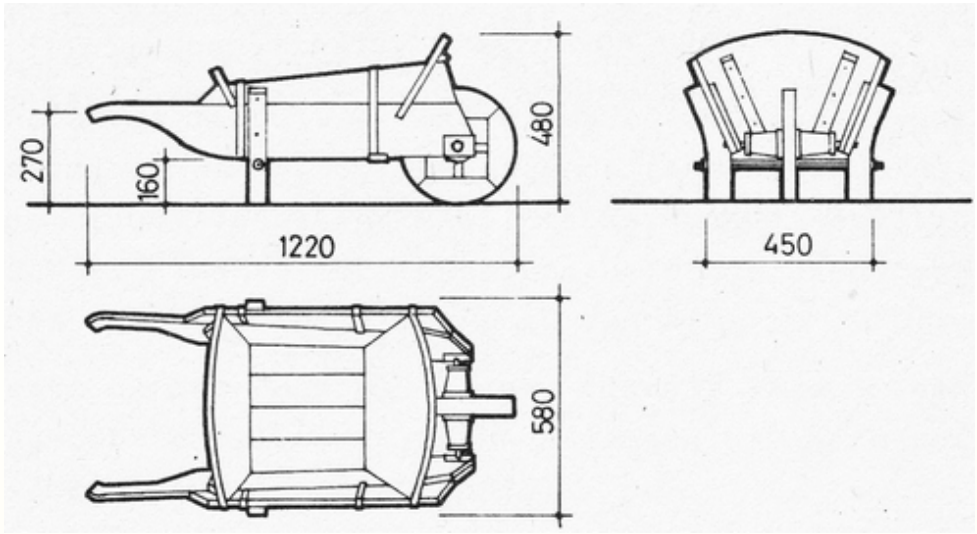



# „Multicar” (Articulated, Vehicle-Mounted) Work Deck



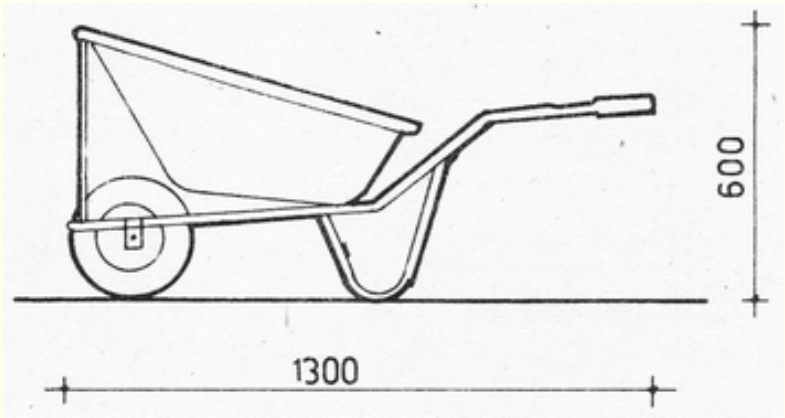


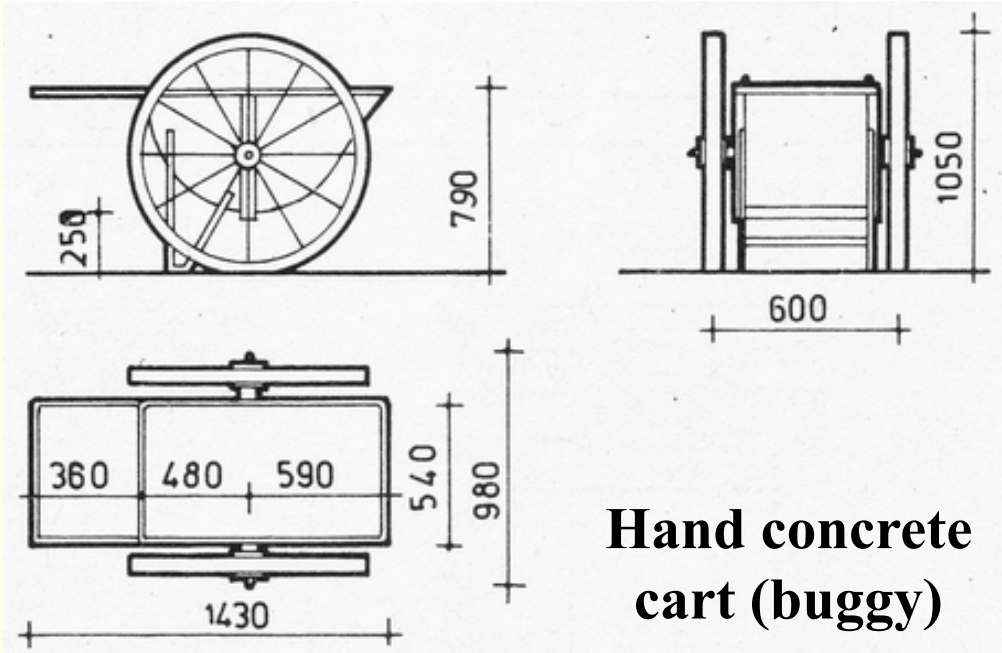

**Navvy's wheel-barrow**



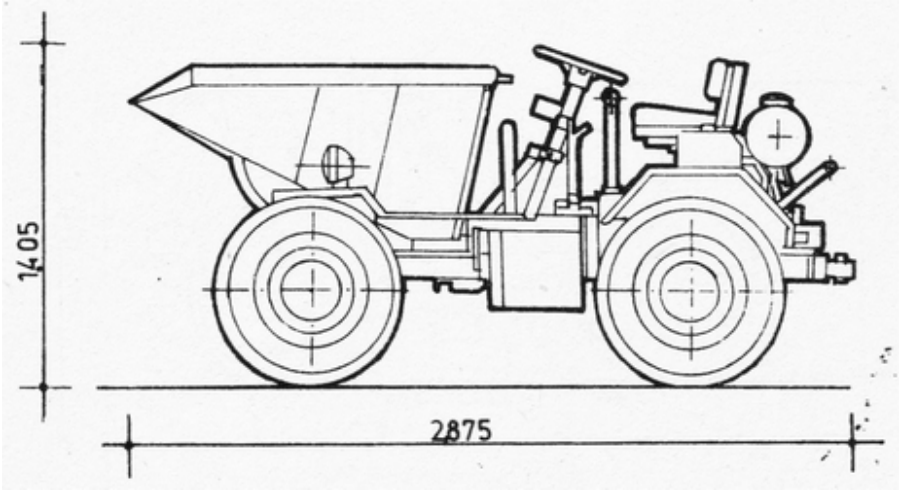

**Builder's wheel-barrow**

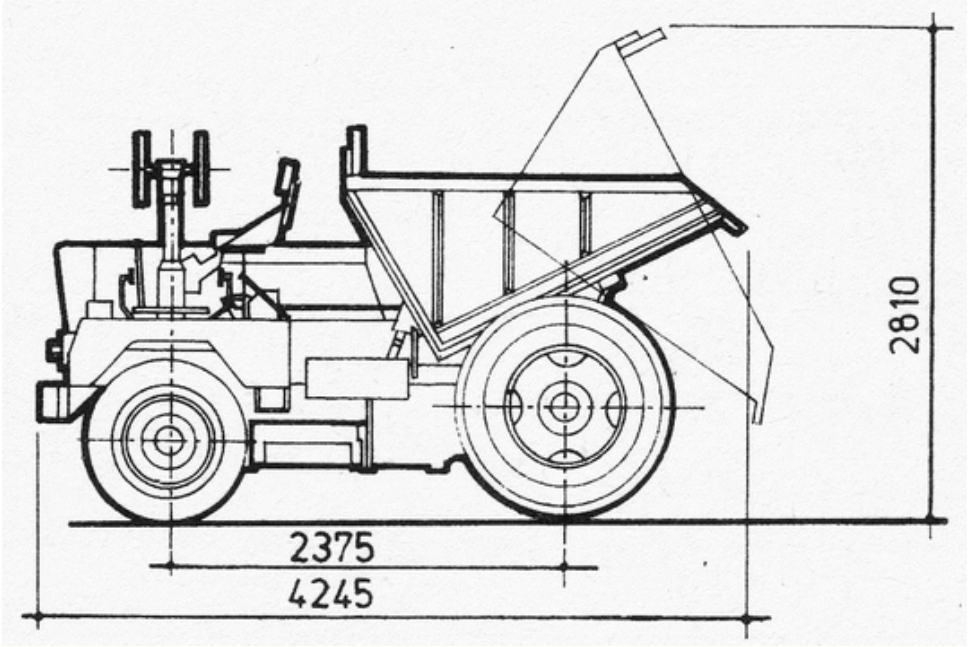
**Steel wheel-barrow (general-purpose)**



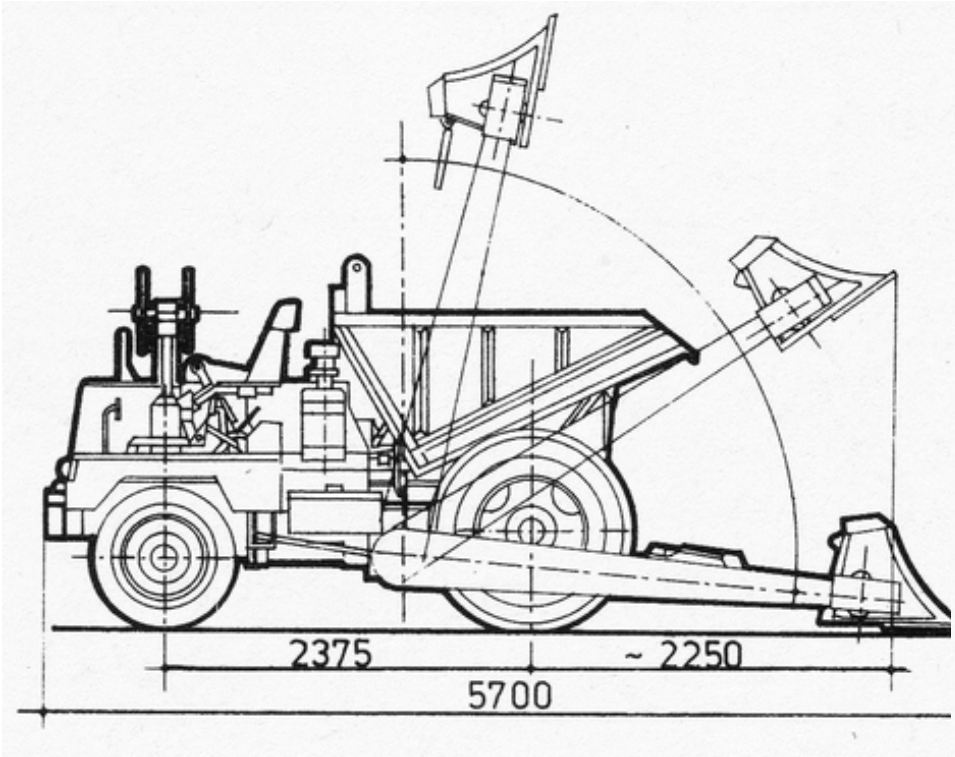




**Hand concrete cart (buggy)**

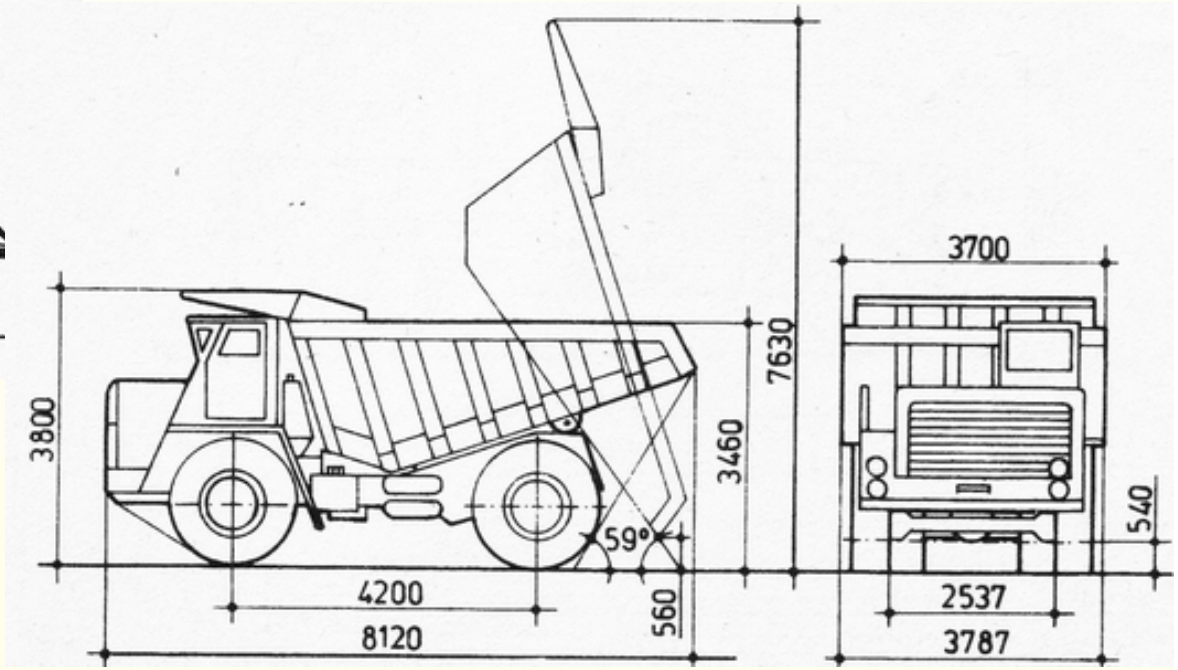


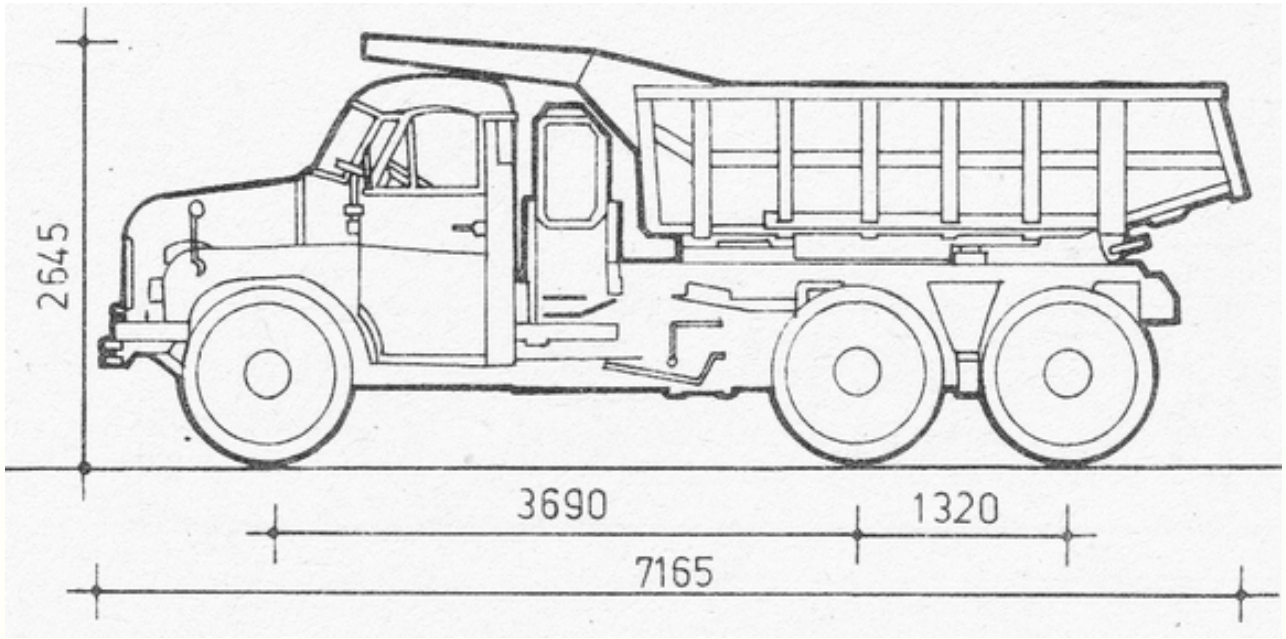

**From wheel-barrows through motobugs (dumpers) to offroad trucks**




Self-loading shovel-motobug („DUTRA")

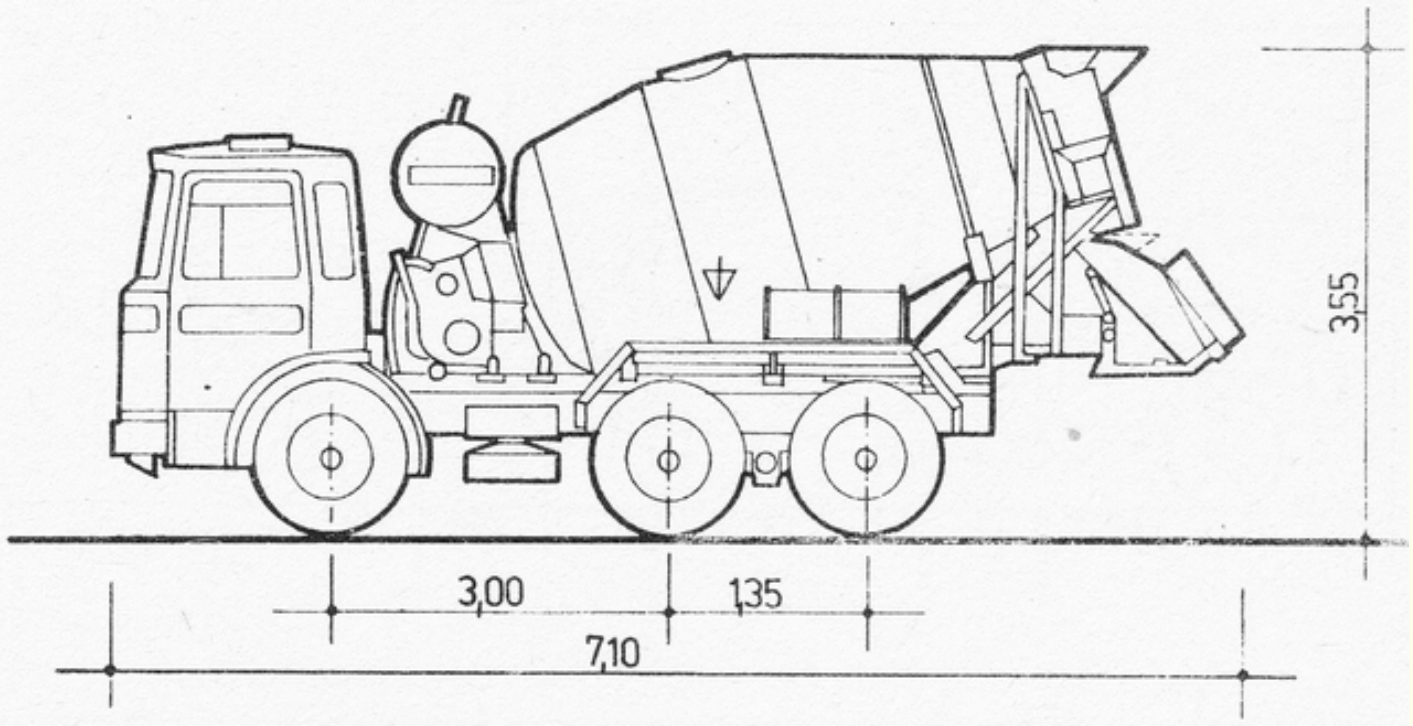


# Special-purpose lorries (trucks)

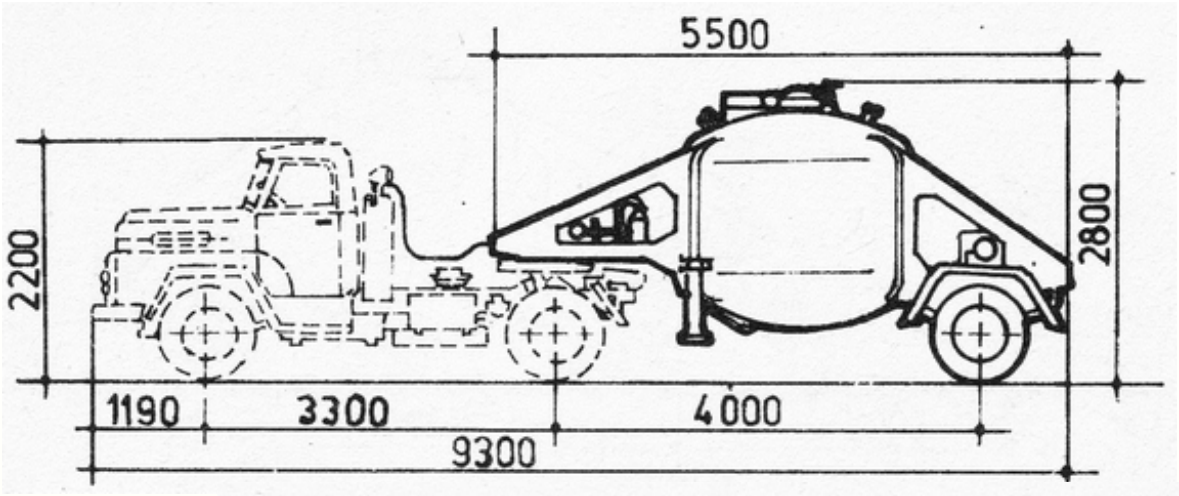


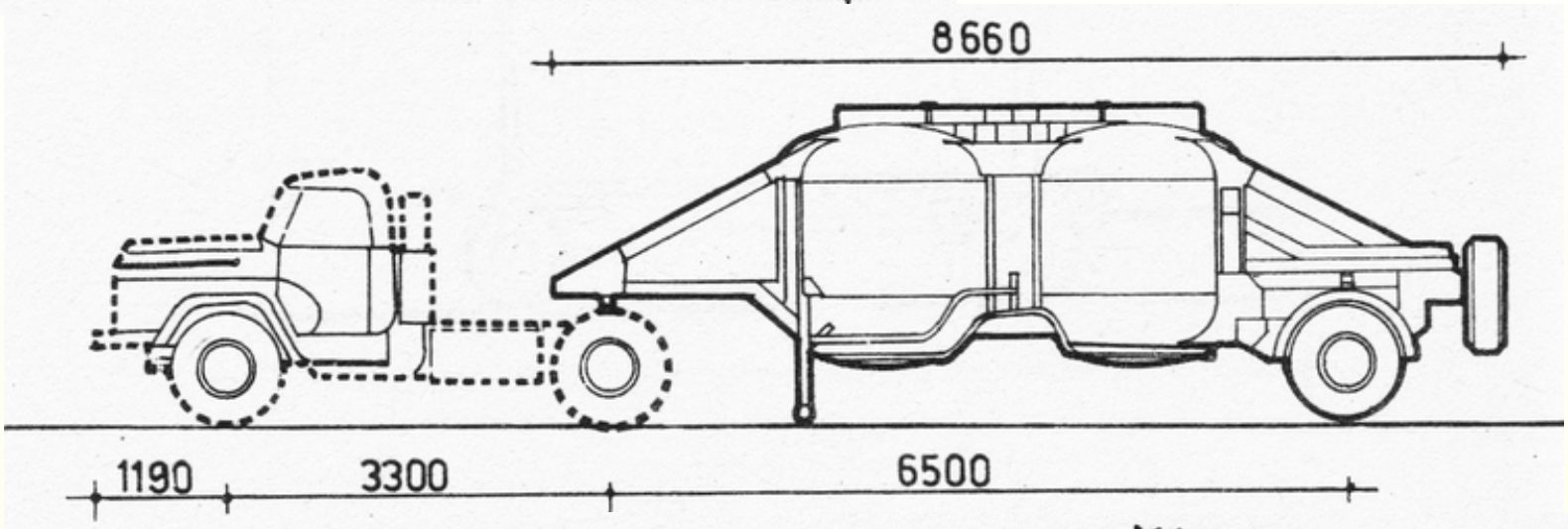

**Dumper truck**

**Mixer truck**

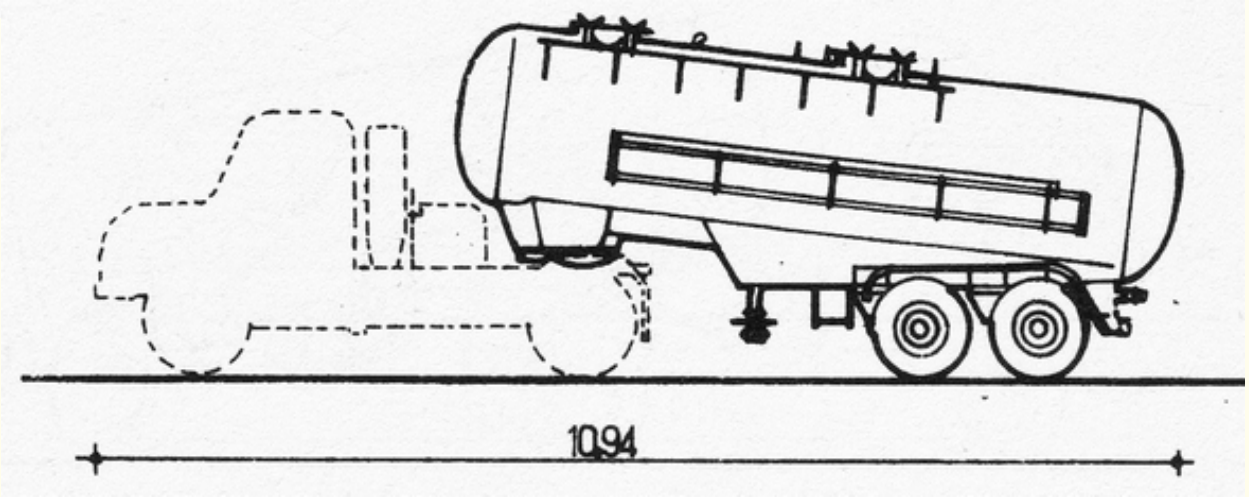


# Special-purpose semi-trailers

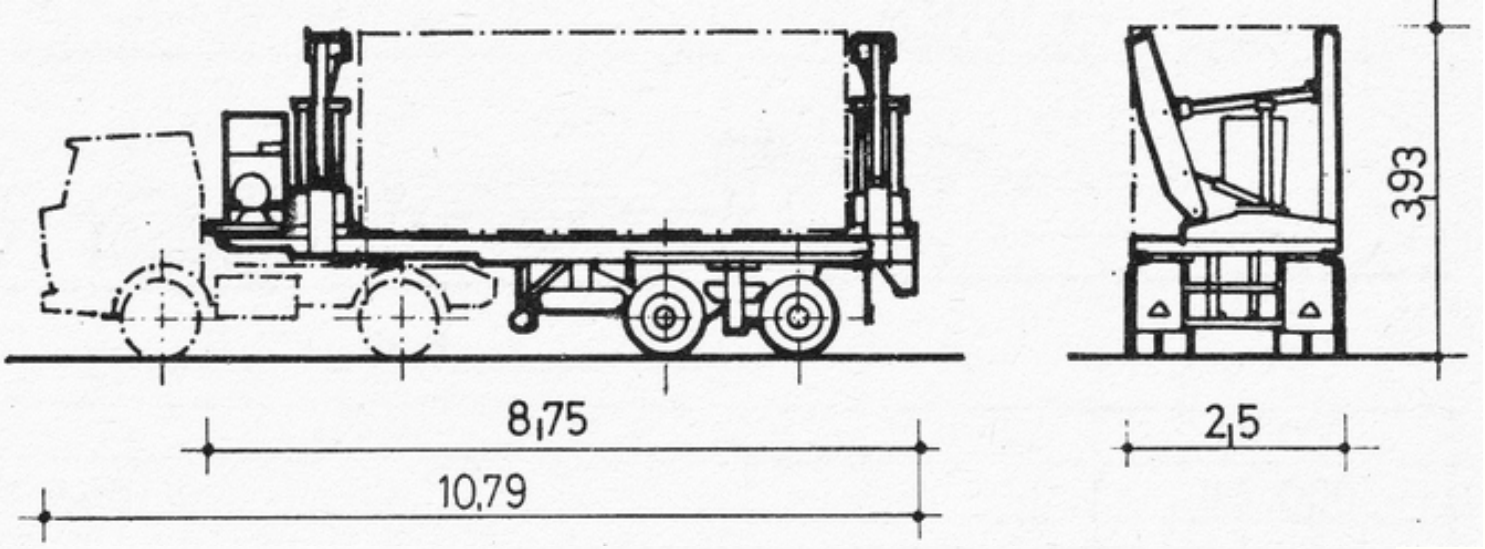


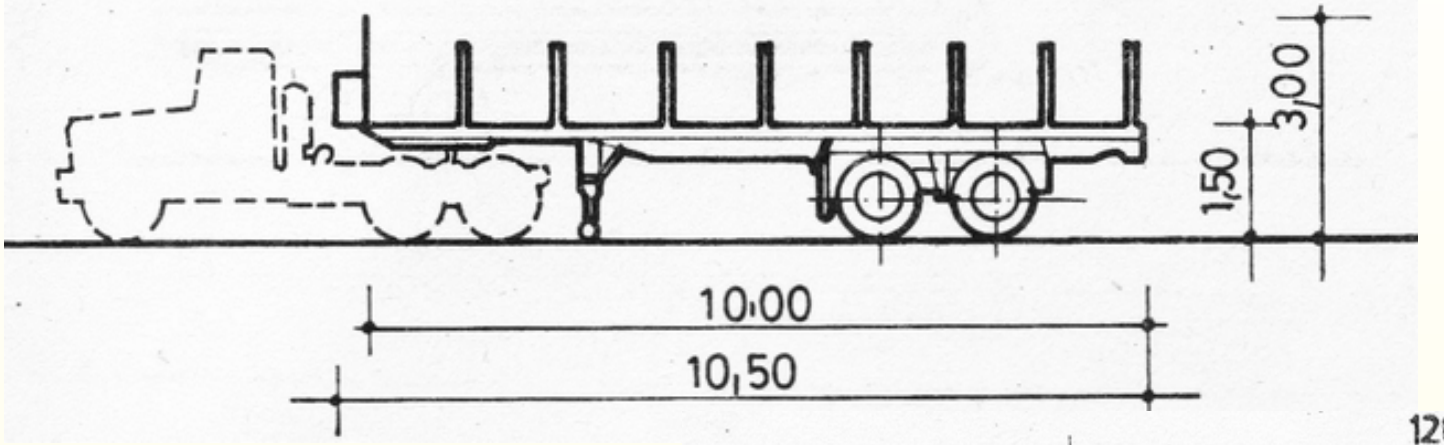

**Cement transporters**



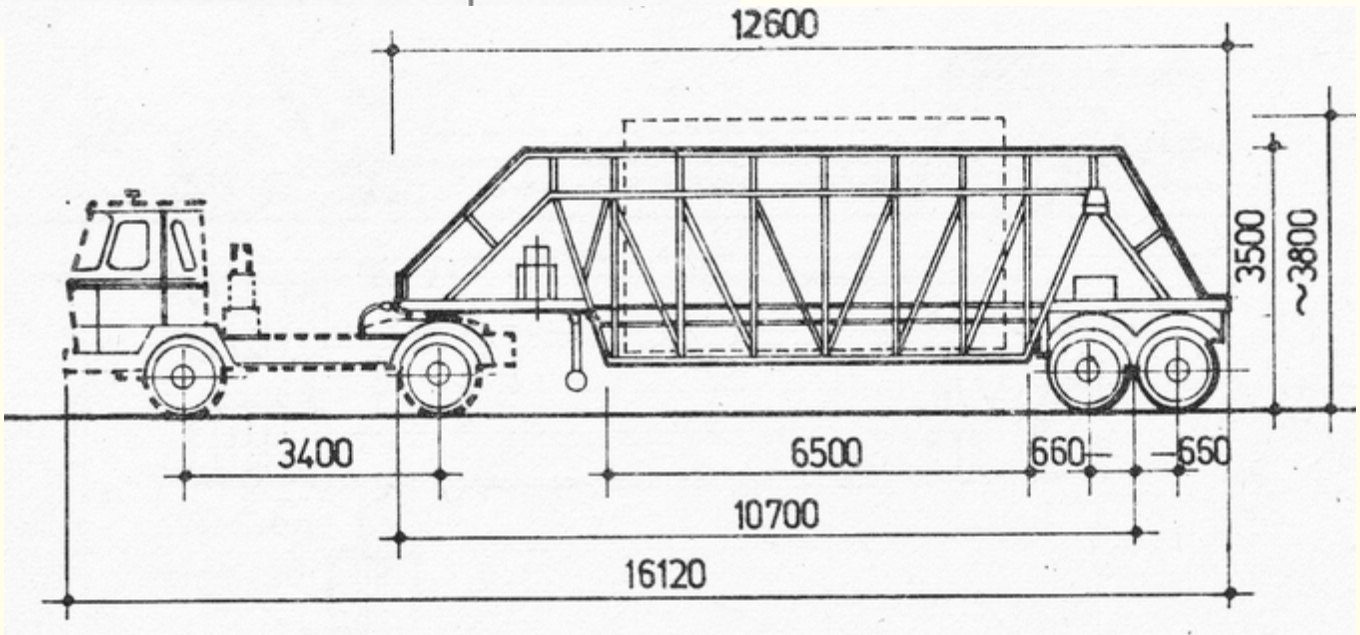
**(Selft-loading) Container transporter**




**Beam- and pipe (log) transporter**




**Wall-panel transporter**




**Special-purpose semi-trailers**

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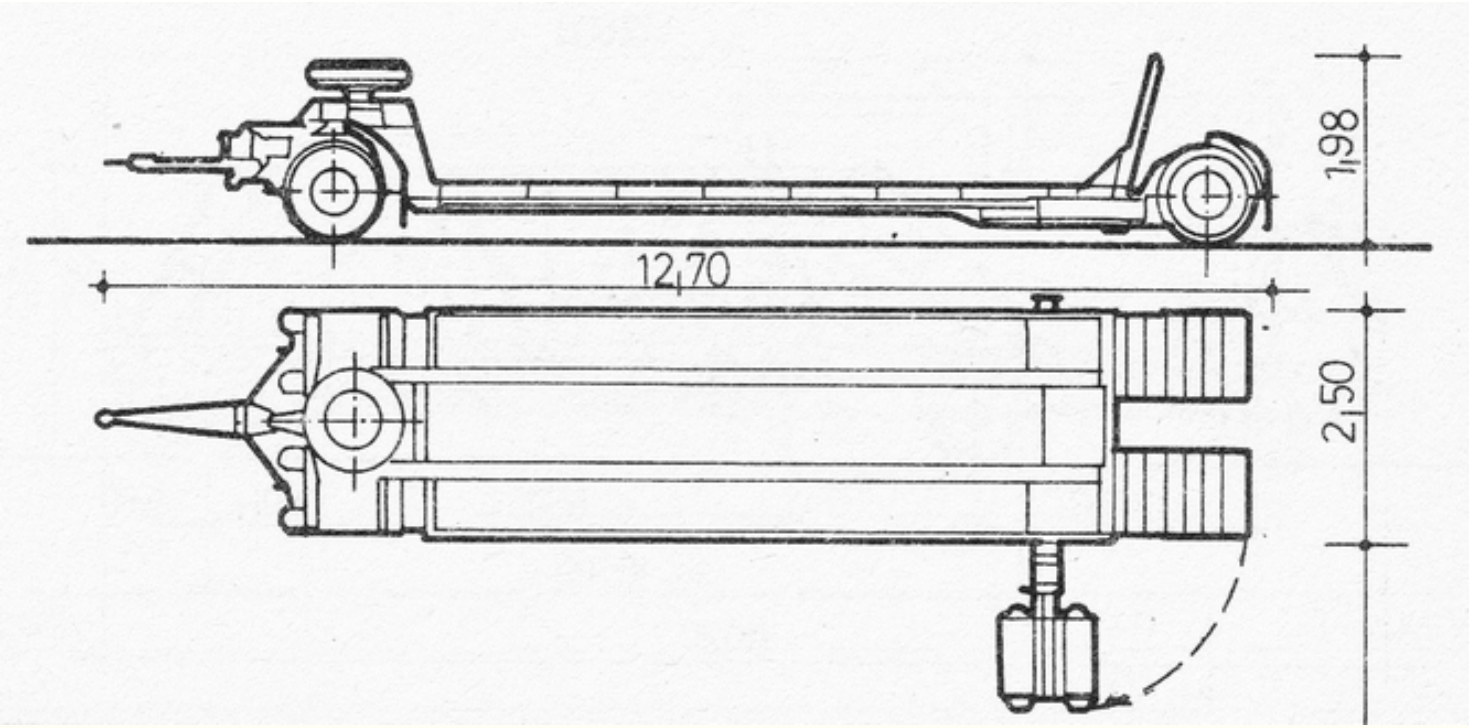
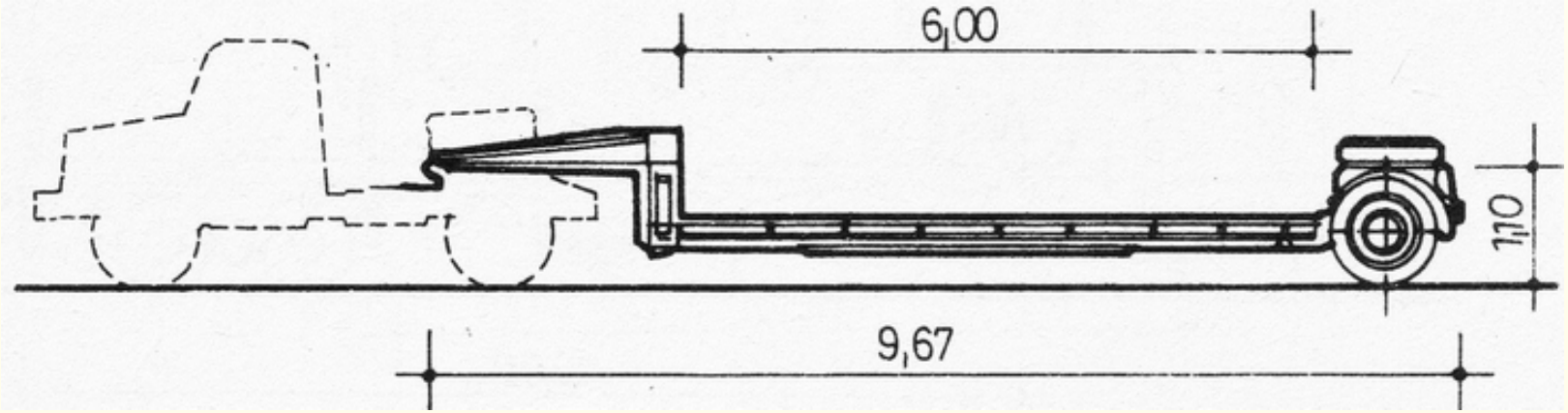
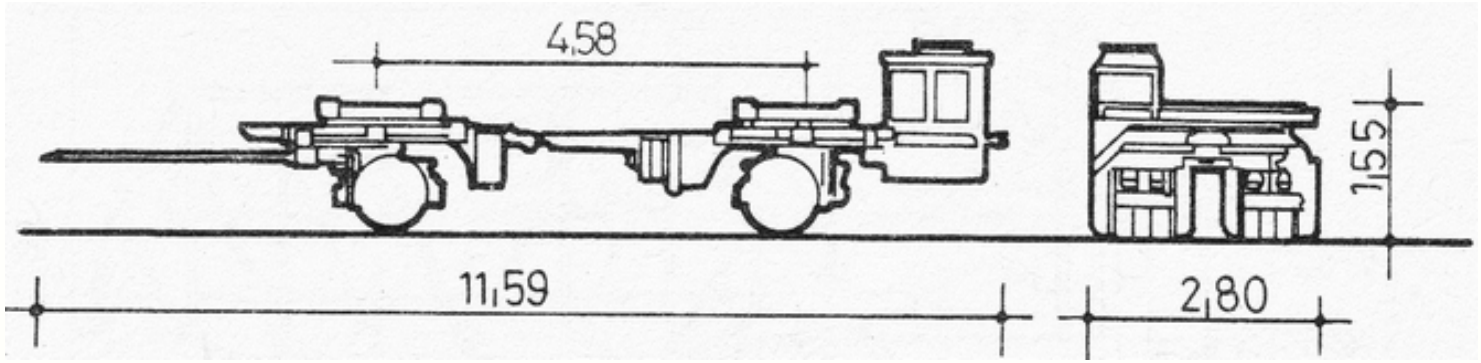
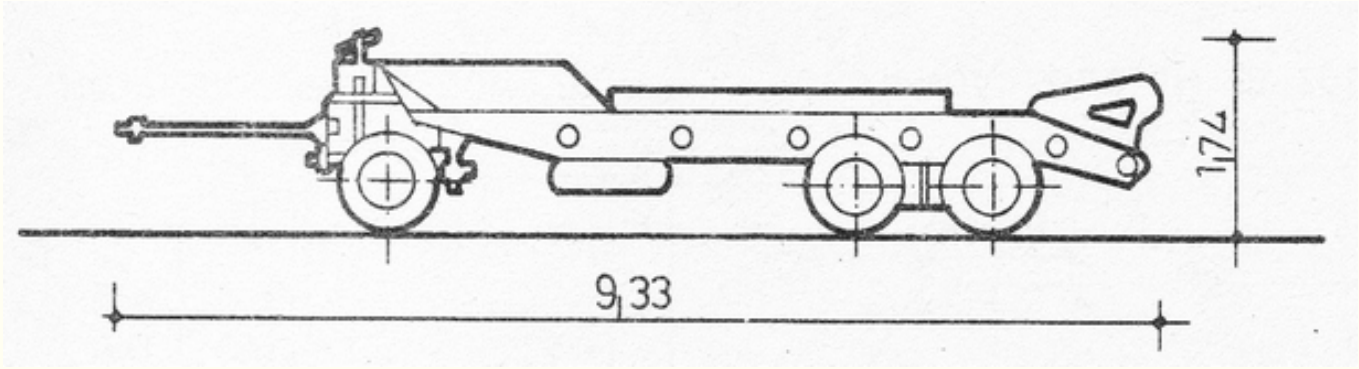



## Equipment transporters

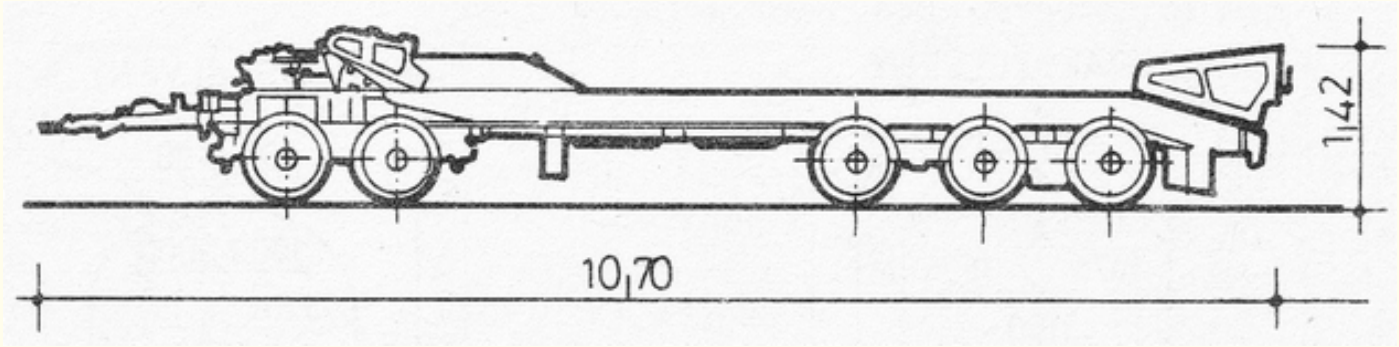





**Long freight transporter (with steered rear wheels)**

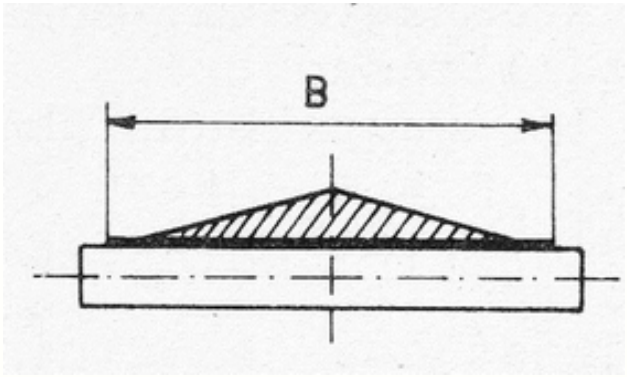



**Heavy equipment transporters**

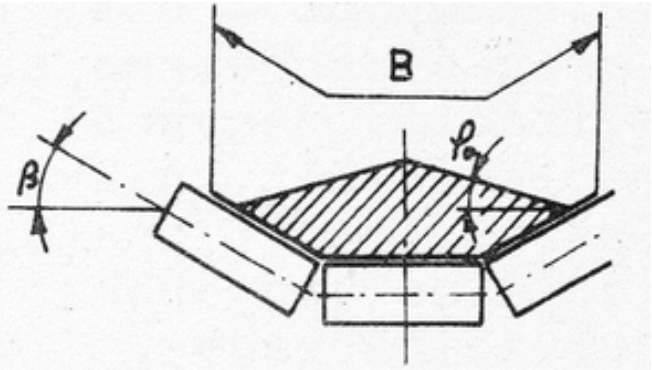



**Special-purpose (semi-) trailers**

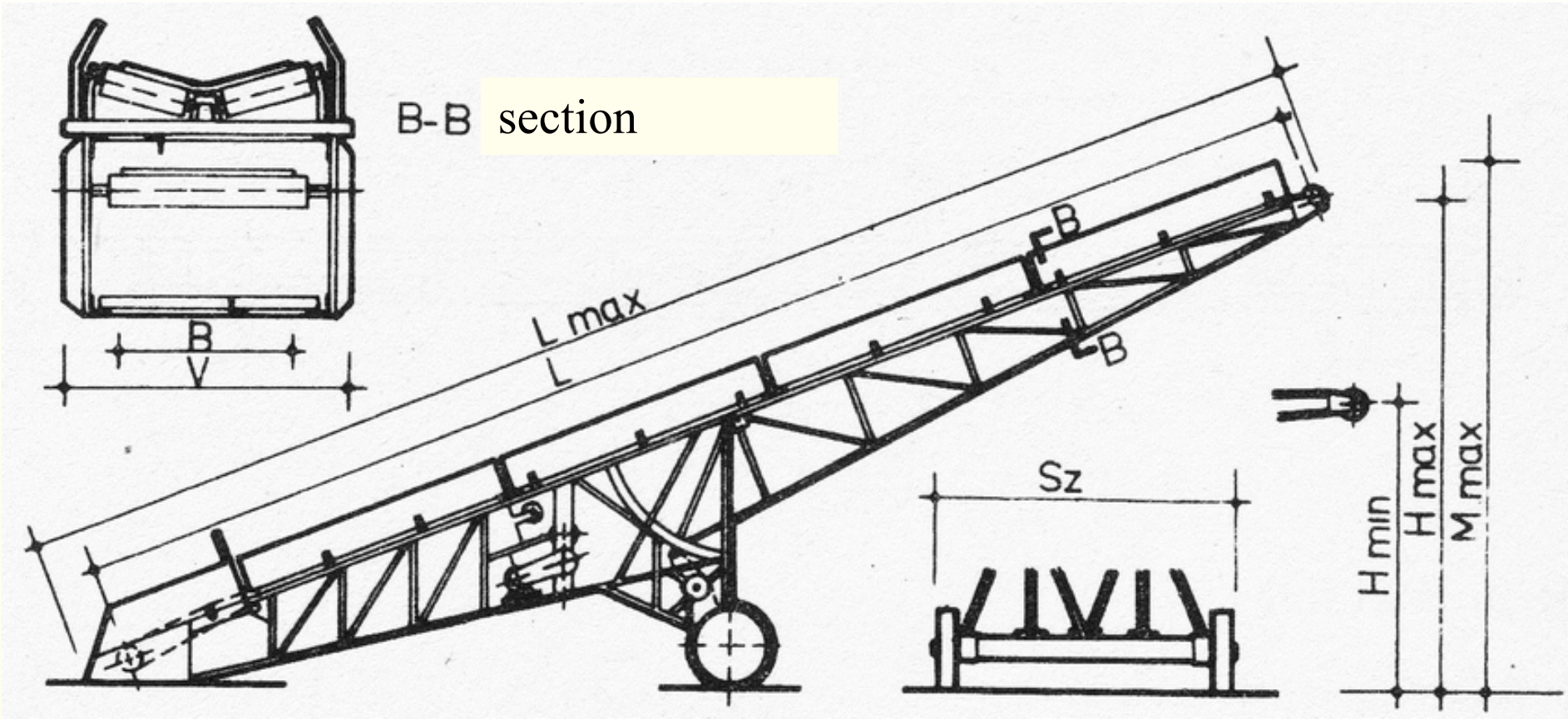
# Builder's Conveyor Belt




**Flat conveyor**




**Trough conveyor**



Sources of B&W pictures and drawings:

- Bacher Károly, Dr. Lánczos Pál, Dr. Soós László, Építésgépesítés I., Tankönyvkiadó, Budapest, 1985
- Dr. Nagy Pál, Építéstechnológia I, Alaptechnológiák, Tankönyvkiadó, Budapest, 1990
- Soós László, Építőipari gépek I., Tervezési segédlet, Tankönyvkiadó, Budapest, 1987
- Soós László, Építőipari gépek II, Tervezési segédlet, Tankönyvkiadó, Budapest, 1987
- Dr. Soós László, Építőipari emelőgépek, Tervezési segédlet, Tankönyvkiadó, Budapest, 1990