Crane Building

2001 - Initial research into Great Crane of Bruges
2002 - Built a Perronet Crane Norwell MA
2003 - Built a Diderot T-crane MassArt
2003 - Crane Exhibit MassArt
2006 - Prague Castle Crane Czech Republic
Castle Tocnik
Castle Tocnik - aerial view
Existing 19c. Truss Reconstruction is incorrect structure.
Transport of the Materials using the Contemporary crane and equipment
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Crane possibilities at Castel Karlstejn
Lifting by hand with a come-along.
Heliocopter crane technique at Castle Tocnik
Great Palace 1992
Objectives of the Tocnik Crane experiment:

1. Verify the historic art sources

2. Demonstrate a forgotten construction skill of our ancestors
   - applied on a real functional object
   - create public interest in cultural heritage.

3. Check the technical parameters of the machine

4. Compare this machine with modern cranes
   - Productivity
   - Production and energy costs
   - Ecological impacts
Researching Human Powered Cranes through Art

Crane with hand wheel and without rotation.

Stavba v__e babylonské, Rudolf von Ems, Weltchronik
Lifting Arm with Windlass

Stavba velkého kostela v Bernu z r. 1420, Diebold Schilling, Bern Chronicle, 1484-5.
Wheel is independent of post and causes difficulty with rotation.
Drawing of the interior of the crane workings with offset wheel and post. All parts can rotate 360 degrees.
Bible of Vaclav IV
14th c.
Red is crane

Orange is cage

Yellow is Foundation for Cage set into existing window.
Construction of the Tocnik Crane at the Castle Prague using Medieval tool and techniques  2007
Art as a resource of early tools and techniques

Bible Václava IV. ze 14. C.
Felling the trees with axes

Cologne, St Heribert Church, Medallion, 1160-70
Cutting Logs with a two handled saw
Hewing timber square with a broad ax

Woodcut by Hans Schaufflein, Nuremberg, c. 1500
Hewing - long handled ax low position
Hewing
short handle ax on trestles
Cutting boards with pit saw.

Building Noah's Ark, tracing from fresco by Christofano Buffalmacco, , Pisa, 1350
The Chalk Line

Brussels, Bibliotheque Royale
Illumination, Raoulet D’Orleans, 1376
Dual Tread Wheels
Axel
Post and Lifting Arm

Designers Vít Mlázovsky and Petr Ruzicka, 2005

Crane - Munich, Bayer Staatsbibl., 1430
Design and layout of the crane using circle geometry

Drawing by Petr Ruzicka, 2006
Building the Tread Wheels

Cutting the arcs of the rim with axes.

From Czech bible, 1411
The rim arcs are joined on a wooden template for consistent wheel construction.
Two overlapped layered rims

drilled, pegged and glued.
Rope and tourniquet clamps

Chalk and cheese glue
Wheel glued, pegged and clamped
Wheel assembled on axel
Wheel rims aligned with spacers

secured by rope and tourniquet clamps.
Measuring and marking tread spacing
Treads scribed, trimmed and installed
Completed wheel

waiting in the shadow of the cathedral.
Intersection of time culture and technologies.
Building the axel and wheel frame stirrup.

Bridge building Diebold Schilling, Bern Chronicle, 1484-5.
Axel and wheel frame stirrup with offset main post.
Axel and Wheel Frame Stirrup Connection -

sliding dove tail joint, pinned and secured with iron straps.

Sealing axel and frame with traditional pig fat and soap formula.
Iron banded and wedged

Greased and ready
Example of Cage Crane - Strasbourg 1482.

The Crane Cage
Medieval Mortising Machines

Spiefel Van Het Mense’yk Bedryf, Van Kornelis Van Der Lyn and J & K Luyken, 1718
Fitting joints and squaring
Cutting brace joints with axes
Fitting and pegging
Raising the cage
Raising the cage
The post and lifting art

482  14. Jh.
Prag, Archiv Pražského hradu, Cod.
A 10, fol. 166v
Handschrift
Buchmalerei
*Hammer, Lastkran mit Tretrad, Mörtelbottich*
Neuwirth, Josef: Geschichte der bildenden Kunst in Böhmen.
Prag 1893, Bd. I, Taf. III.
The Post
Sheeve at top of post used for raising the crane.

Setting iron band on post
The Lifting Arm
Inlaying iron sisters
Setting in brass bushings in arm

these provide the ability for height and angle adjustment.
Connecting the lifting arm with the post.
Lower and upper arms connected with spacers
Setting the Sheeve in the Lifting Arm
Setting post in crane cage
Post to Cage connection

Groove in post for rope to allow 360 degree rotation of post and axel frame.
Post and Axel Frame Connection
Raising and attaching the Lifting Arm to the Post
Lifting Arm in place
The Team
Crane Technical Statistics

- Ground plan of the cage 3.50 m _ 3.50 m
- Pole length 8.0 m (with footstall 9.0 m)
- Radius of the lever arm 2.90 m – 4.70 m
- Crane weight without operators and ballast 3000 kg
- Max. weight of burden 700 kg