## GLOSSARY OF TERMS

**bearing**—A part on which a pivot, pin, or the like, turns or revolves.

**bevel gears**—Those which have grooves not at right angles to the shaft.

**cam**—Rotating or sliding piece or projection, as on a wheel, for moving or receiving from a roller, pin, or the like, motion against its edge.

**centrifugal force**—Force directed outward from the center when a body is made to move in a curved path.

**clutch**—Mechanical device used to connect a driving and a driven member on the same axis.

**combustion**—The act of burning.

**countershaft**—Intermediate shaft for receiving or transmitting motion, sometimes called a jack shaft.

**crank**—A part or arm at right angles to a shaft to receive or impart motion.

**device**—Refers to an ingenious machine.

**disk**—Flat circular plate.

**drum**—A cylindrical part of a machine resembling the musical instrument of this name.

**dynamometer**—Apparatus for measuring force.

**eccentric**—A revolving disk having the point on which it revolves off the center of the disk.

**elliptic gears**—Those having the form of an ellipse.

**escapement**—A mechanism in which a toothed wheel acts upon two distinct pieces of pallets attached to a reciprocating frame.

**flange**—In this case a rim for a guide to another object.

**force**—A push or pull. Any action between two bodies which changes, or tends to change their relative condition as to rest, motion, or other physical interrelation.

**friction**—A resistance or force which opposes every effort to slide or roll one body over another.

**gear**—A mechanical part by which motion is transmitted in machinery.

**generate**—To produce. Used here in the sense of producing power to do certain work.

**governor**—Automatic attachment to an engine for controlling its speed.

**gravity**—A force or pull which attracts bodies to the center of the earth.

**hydraulic mechanisms**—Those operated or effected by water.

**inclined plane**—A simple machine for overcoming work. One of the basic principles of mechanics.

**inertia**—A property of matter by which it tends to remain in motion if in motion, or at rest if at rest, unless acted upon by some external force.

**intermittent motion**—Periodic; coming and going at intervals; alternate.

**joint**—A connection link for transmitting power between two shafts which are out of line or change position.

**lever**—A simple machine. One of the basic principles of mechanics.

**leverage**—Action of a lever or the mechanical advantage gained by a lever.

**machine**—A combination of mechanical parts which serve to transmit and multiply force and motion so as to do work.

**mechanical advantage**—In a machine it is multiplying power.

**meshing of gears**—Engagement of the teeth of the driving gear with the driven gear.

**miter gears**—Those with grooves at an angle of 45° to the shaft.

**mutilated gears**—Those with an incomplete circle on teeth.

**oscillating motion**—Swinging or moving back and forth over a field.

**pallet**—Teeth on an escapement mechanism which alternately engage with the teeth of the toothed wheel.

**pawl**—An arm which falls into the notches of a ratchet wheel to permit motion in one direction only.

**pendulum**—A body suspended from a fixed point so that it may swing freely to and fro.

**pinion**—Cogwheel with a small number of teeth designed to mesh with a larger wheel or rack.

**piston**—Close-fitting piece which slides within a cylinder.

**piston rod**—Rod which connects the piston with the crank shaft.

**pitman rod**—Rod which connects any driving member in a machine to its driven member.

**platen**—Roller of a typewriter against which the paper rests to be printed.

**power**—The rate of doing work.

**propeller**—A form of screw for pushing or pulling a body through air or water.

**pulley**—A simple machine. A wheel used to transmit power by means of a band, belt, etc.

**pump**—A machine for lifting, compressing, or transferring liquids or gases.

**quadrant**—An area equal to one quarter of a circle.

**radial engine**—An engine with its cylinders diverging from the crank shaft placed in center.

**ratchet**—A mechanism composed of a toothed wheel which is turned in one direction by an arm called a pawl.

**reciprocating motion**—Movement backwards and forwards.

**rectilinear motion**—Motion in a straight line.

**reverse motion**—Opposite, contrary, or turned-back motion.

**rotary motion**—Motion which turns as a wheel on its axis.

**screw**—A simple machine. An inclined plane wrapped around a cylinder.

**scroll gears**—Those which, because of their form, produce a gradual increase and decrease of speed during one revolution.

**shaft**—A bar to support rotating parts or to transmit power by turning.

**sheave**—Grooved wheel of a pulley.

**spring**—Elastic body or device which recovers its original shape when released after being distorted.

**sprocket wheel**—A toothed wheel shaped to engage with a chain.

**spur gears**—Those having grooves parallel to the shaft.

**steam engine**—An engine driven or worked by steam.

**stud**—Short projecting rod or pin on a mechanism for giving or receiving motion against its edge.

**train of mechanisms**—Series of connected mechanisms.

**transmission of motion**—Act of passing on motion from the driver to the driven member of a machine.

**treadle**—A lever device pressed by the foot to operate a machine.

**turbine**—Rotary motor, operated by the force of water or steam against its curved veins.

**universal joint**—Flexible joint which allows variation in the angle between the two shafts.

**vacuum**—Space where there is literally nothing.

**valve**—A device which regulates the direction of the flow of a liquid or gas.

**wedge**—A simple machine. Another form of the inclined plane.

**work**—The act of a force upon a body causing it to move.

**worm**—A continuous screw.

**yoke**—Frame in which a particular part of a machine works.

## SOME OF THE BOOKS CONSULTED

The following books were found most helpful in preparing the exhibit and the text for this pamphlet:


Andrews, E. S. Mechanisms. Lond., Clive, 1926.

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Bradford, L. J. and Eaton, P. B. Machine Design. Wiley, 1926.

Brown, H. T. Five Hundred and Seven Mechanical Movements. Baird, 1908.

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Dull, C. E. Essentials of Modern Physics. Holt, 1922.

Dunkerley, S. Mechanism. Longmans, 1919.

Dyke, A. L. Dyke's Automobile and Gasoline Engine Encyclopaedia. Dyke, 1928–1930.

Encyclopaedia Britannica, 14th Edition. Vol. 18. Article on "Power Transmission." 1929.

Ham, C. W. and Crane, E. J. Mechanics of Machinery. McGraw, 1927.

Hiscox, G. D. Mechanical Appliances, Mechanical Movements and Novelties of Construction. Henley, 1927.

Hiscox, G. D. Mechanical Movements, Powers and Devices. Henley, 1927.

Keown, R. M. Mechanism. McGraw, 1921.

Kuns, R. F. Automotive Essentials. Bruce, 1928.

Ortman, O. R. Physical Basis of Piano Touch and Tone. Dutton, 1925.

Page, V. W. Everybody's Aviation Guide. Henley, 1928.

Page, V. W. Modern Gasoline Automobile. Henley, 1928.

Usher, A. P. History of Mechanical Inventions. McGraw, 1929.

A special book list on Machine Shop Practice was prepared and distributed by the Newark Free Public Library.

## PATTERN MAKING AND IRON CASTING

The metal parts of the models in the exhibit of Mechanical Models explained in the first part of this pamphlet were cast in aluminum because of its lightness. The patterns were made by Benjamin E. Jarvis, Inc., of Newark, and the castings by the American Aluminum Casting Co., of Irvington, N. J., and J. Redlinghouse, Inc., of Newark.

Through the courtesy of Benjamin E. Jarvis, Inc., and Sacks-Barlow Foundries, Inc., Newark, process exhibits illustrating the steps in pattern making and iron casting are illustrated.

# EXHIBIT OF PATTERN MAKING

*Gift of Benjamin E. Jarvis, Inc., Newark, N. J.*

DOUBLE GROOVED PULLEY

*As used in the operation of Mechanical Models*

Processes shown in the exhibit include:

Tracing of working drawing

Blueprint

Photograph of back of Section No. 1, Mechanical Models, showing single and double grooved pulleys.

Iron Casting of a double grooved pulley.

Scale. This is one eighth of an inch longer than standard. Cast iron, in cooling from liquid to solid state, shrinks approximately one eighth of an inch per foot. Pattern-maker allows for this shrinkage by using a scale one eighth of an inch longer than standard.

Pattern consisting of two separate parts, pattern and core box.

Pattern

A Plate

a. Board in rough

b. Board after running through Jointer and Thickness Planer, with diameter of plate indicated

B Hub

a. Board with diameters of hubs indicated

b. Hubs after cutting out on Band Saw

C Photograph showing man operating Band Saw

D Plate after cutting out on Band Saw with one hub glued on (ready for Lathe)

E Chuck to which Pattern is attached for turning on Lathe

F Photograph showing man turning pattern on Lathe

G Finished pattern

Core Box

A Box

a. Board in rough

b. Board after running through Jointer and Thickness Planer, with diameter of core box indicated

c. Core box after cutting out on Band Saw (ready for Lathe)

d. Finished core box

B Loose Piece

a. Board in rough

b. Board after running through Jointer and Thickness Planer, with diameter of piece indicated

c. Piece cut out on Band Saw (ready for Lathe)

d. Finished loose piece

C Sweep

CAM WHEEL

*As shown on Panel No. 55*

Tracing of working drawing

Blueprint

Photograph of Panel No. 55 Mechanical Models showing Cam Wheel for Intermittent Motion

I Pattern

- A Plate
  - a. Board in rough
  - b. Board after running through Jointer and Thickness Planer, with diameter of plate indicated
  - c. Plate after cutting out on Band Saw
- B Hubs
  - a. Boards with diameter of hubs indicated
  - b. Hubs after cutting out on Band Saw
- C Rim
  - a. 4 segments of rim laid out on piece of wood
  - b. 4 segments after cutting out on Band Saw
- D Parts B and C assembled and glued to plate A (ready for Lathe)
- E Pattern after turned on Lathe, with teeth laid out on rim showing four stages in the process of cutting and finishing teeth
- F Finished pattern

A good description of the process of making a pattern may be found in Pattern-Making by Edward M. McCracken and Charles H. Sampson, published by Van Nostrand, 1921 and in Wood Pattern Making by Edmund C. Hanley, published by Bruce, 1922–24.

# EXHIBIT OF IRON CASTING

*Lent by Sacks-Barlow Foundries, Inc., Newark, N. J.*

DOUBLE GROOVED PULLEY AND CAM WHEEL

Processes shown in the exhibit include:

1. Ingredients for Match
   a. Samples of sand
   b. Samples of litharge
   c. Samples of boiled linseed oil
2. Match
3. Bench rammers (2)
4. Match with drag placed on top
5. Sample of parting powder and bag
6. Sample of molding sand
7. Drag filled up with sand
8. Iron striker to smooth off sand
9. Match part removed and cope placed on drag
   Sprue put in place
10. Mold filled with sand and sprue removed
11. Bellows
12. Ingredients for core
    a. Core sand
    b. Binder
13. Core in core box with sweep
14. Baked core on iron plate
15. Flasks with cope separated from drag with patterns still in place
16. Feeders cut in sand. Patterns removed. Core put in place
17. Sample of graphite facing

18. Molders tools
    a. Finishing (5)
    b. Draw pin
    c. Screw draw pin
    d. Trowel
    e. Swab
19. Cope on drag with weight on top (ready for pouring)
20. Materials put in cupola
    a. Samples of coke
    b. Samples of pig iron
21. Picture of cupola
22. Hand ladle
23. Samples of fire clay and fire sand
24. Mold filled with iron
25. Quarter cross section of mold showing castings in sand mold
26. Castings as taken from sand
27. Castings broken off from gate

A good description of the process of making a simple casting may be found in Foundry Practice by R. H. Palmer, 3rd edition, Wiley, 1926.

## OTHER REFERENCES

Gray, B. L. Foundry Work. American Technical Society, 1927.

Hartley, L. A. Elementary Foundry Technology. McGraw, 1928.

Rawlinson, William. Modern Foundry Operations and Equipment. Chapman & Hall, 1928.

Ritchey, James. Pattern Making. American Technical Society, 1930.

(Modern Shop Practice, ed. by H. M. Raymond, Vol. VII, p. 11–223).

Wendt, R. E. Foundry Work. McGraw, 1928.