ENGINEERS' ILLUSTRATED THESAURUS

by
Herbert Herkimer

1952
CHEMICAL PUBLISHING CO., INC.
NEW YORK, N. Y.

CHEMICAL PUBLISHING CO., INC.
212 Fifth Avenue, New York, N. Y.

Printed in the United States of America

FOREWORD

More than thirty years ago, the author began to follow the advice given by William Kent to his students:

"Every young engineer should compile his own pocket-data book, as he proceeds in study and practice, to suit his particular business."

The author went a step farther and began his scrap-book collection of engineering drawings, sketches, diagrams and abstracts from various domestic and foreign patent-office gazettes and trade catalogs.

At the request of the publishers, he started the work of selecting from this accumulated material data pertaining to mechanical engineering and other engineering fields, and arranging them in a form suitable for publication.

The main object has been to present the maximum number of illustrations; this naturally limited descriptive text to a minimum, to keep the book from growing beyond all practical bounds. Engineering science and practice have developed to such an extent that a detailed analysis of the more than 8000 illustrations in this book would fill many volumes.

The graphic method of describing machine parts and their movement by means of diagrams, line drawings and photographs has been generally accepted as the quickest and most satisfactory. Since the purpose of the book is to emphasize underlying principles and not structural details, such as would appear in a textbook of machine design, the sketches and drawings will present a maximum of useful basic information without confusing irrelevant detail, since the practical engineer and inventor need only an outline of an idea for his inspiration and would probably resent elaborate explanations.

While it may be repeated that this work is not a textbook of machine design, nevertheless typical assembly drawings, examples of American and foreign designs are given. It is a well-known fact that most complicated mechanisms consist merely of combinations of the six fundamental machines:

1. Pulley
2. Wheel and axle
3. Inclined plane
4. Wedge
5. Screw
6. Lever

Yet the field of mechanisms and structures seems almost unlimited, according to the patent-office records and the volume of trade catalogs published monthly.

One claim to originality by an author of a book of this type lies in the novel methods of arrangement and indexing for ready, rapid reference.

The author has adopted a classification similar to that of *Roget's Thesaurus of English Words and Phrases* in which a word is classed according to the idea it intends to convey. In addition, there is a detailed alphabetical index in the back of the book. In using the book, the classification should be consulted first and the index afterward.

As all bodies are either in a state of rest or in motion, accordingly two main divisions are used as follows:

PART I — STATICS

Class I — Fasteners
Class II — Adjusting Devices
Class III — Supports and Structures

PART II — DYNAMICS

Class IV — Basic Mechanical Movements
Class V — Elevators, Derricks, Cranes, Conveyors
Class VI — Transmission of Liquids and Gases
Class VII — Combustion
Class VIII — Prime Movers
Class IX — Transportation
Class X — Industrial Processes
Class XI — Electrical Appliances
Class XII — Comfort Heating Cooling and Air Conditioning

Each class is divided into sections and each section is further subdivided into topics. Each topic is illustrated by drawings or photographs.

Invention and engineering design constitute a peculiar art which cannot be acquired but by long and continued practice. There are some engineers more highly gifted than others, but to all there comes a time when ideas stagnate and the solution is far away. Like 'spirits from the vasty deep they come not when we call.'

To engineers struggling with difficulties, this book should prove of great help in solving their problems.

Although with some machine parts, the name of the manufacturer is given, this does not mean that the author recommends the said manufacturer's products. All illustrations are given as examples only and it is left to the reader to select equivalent products of other manufacturers, if he prefers.

The author extends his thanks to many manufacturers who have so courteously supplied drawings and catalogs. If there is any borrowed matter of importance, the source of which is unknown to the author, he will be grateful for pointing it out to him and he will acknowledge it in a later edition.

Grateful acknowledgment is also due to the author's son, Harold Herkimer, for his assistance in the preparation of the illustrations.

TABLE OF CONTENTS

Page

INTRODUCTION

Engineers, designers and draftsmen deal with machines. A machine is defined as a combination of parts which is suitable to transmit and modify energy and motion to do the desired work. Another definition of a machine describes it as a device that overcomes resistance at one point by the application of force at some other point.

Energy may be defined as the ability to do work. There are two main types of energy: Potential energy is latent until a change releases it. The energy stored in coal (chemical energy) and changed into heat by burning and the energy of water in a high tank (energy of position) which is released by opening a valve are forms of potential energy. Other examples of potential energy are that of a raised weight, wound spring, and compressed gas. Kinetic energy is the energy of motion. When potential energy is released, it is transformed into kinetic energy. Kinetic energy is sometimes called mechanical energy. Examples of kinetic energy are the electric current, heat, light, energy of expanding gas, working muscles, combining elements, the energy released by atomic fissure, etc.

The law of conservation of energy states that in any isolated system, the total amount of energy is constant. This means that energy can change from one form to another but the total amount of energy will remain the same. This may be expressed mathematically:

Kinetic Energy + Potential Energy = Constant

or

Total Energy Deposited = Work Accomplished +
Energy Lost by Resistance

As the complete energy supplied cannot be converted into useful work, but a certain portion of it is always used to overcome resistance, the idea of a perpetual-motion machine is absurd.

Prime movers are machines which convert energy from a natural source into mechanical power. Oil engines, gas engines, wind mills, water wheels and turbines, steam engines and internal-combustion engines are examples of prime movers.

Power is the rate of doing work. The standard unit of power is one horse power which is equal to 33,000 pounds lifted 1 foot high in 1 minute.

If the number of foot-pounds done per minute is known, we can express the work in horse-power units by dividing by 33,000. For example:

	Foot-pounds	Horse power
A man raising his own weight vertically during a day of eight hours	4,350	0.1318
A man pushing and pulling at capstan	3,180	0.0963
A man turning a winch	2,700	0.0818
A horse pulling a cart	26,150	0.7924

This shows that a man performs 1/10 to 1/8 of a horse power and a real horse 8/10 of a horse power.

Force is the cause of the acceleration of a body free to move. Its unit is the poundal or the dyne.

Velocity is the rate of movement and is measured in feet or centimeters per second. For velocity, both the direction and magnitude must be specified as it is a vector quantity.

Acceleration is the increase of velocity expressed in feet or centimeters per second per second.

All machines—however complicated—can be reduced to six simple forms:

1. The *lever* consists of a bar free to turn around a point, called the fulcrum.
2. The *wheel and axle* may be considered a rotating or continuous lever; it may consist of a large wheel and a small wheel attached together; or of a wheel attached to an axle; or of a handle attached to an axle.
3. The pulley or block and tackle is also a modified form of lever. In its simplest form, it consists of a disc and of a rope placed in a groove on its circumference. It

may be considered as a continuously acting lever whose fulcrum is in the middle.

4. The inclined plane is an oblique surface which forms an angle with the base.

two basic machine forms: the lever and the inclined plane.

6. The screw is a spiral or continuous inclined plane.

From this, it is obvious that, in final analysis, there are only two basic machine forms; the lever and the inclined plane.

In any machine, there is a point P where the force is applied and a point W where work is accomplished. Neglecting the resistance, the work done is equal to the applied force.

In a machine, the ratio of the resistance, or load, to the applied force, or effort, is called mechanical advantage. In constructing a machine one of the aims is to obtain the highest possible mechanical advantage.

Figures A and J show various forms of levers. Figure B illustrates a wheel and axle. Figures C and G are gear trains. Figure D shows the pulley, or block and tackle. Figure E illustrates the principles of the inclined plane, and figure F shows a screw combined with a lever.

A compound machine is the combination of simple machines to give greater mechanical advantage. The mechanical advantage of a compound machine is the product of the mechanical advantages of the individual machines that make up the compound machine. Figure H shows a combination of a crank, axle, and inclined plane.

Every machine performs at least one of the following functions:

1. It changes the applied force or effort
2. It changes the direction of the applied force
3. It changes the speed
4. It transmits the force from one point to another.

There is no machine that could deliver work without work being spent on it. Moreover, the work delivered by a machine is always less than the work supplied, since some work is lost by overcoming resistance, which is usually friction. Nevertheless, machines are powerful tools of human progress and our modern age would not be possible without them.

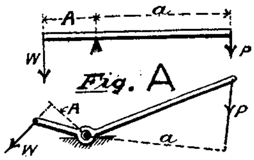


Fig. A

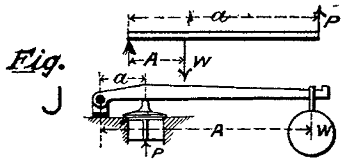


Fig. J

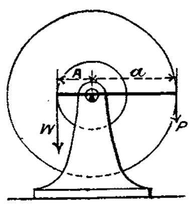


Fig. B

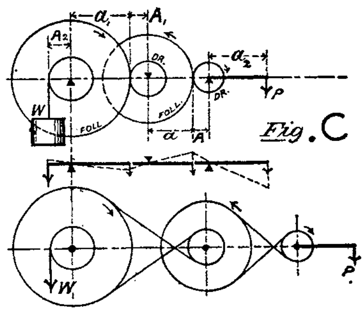


Fig. C

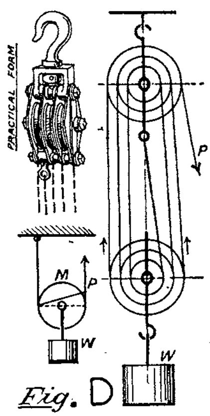


Fig. D

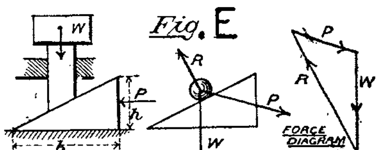


Fig. E

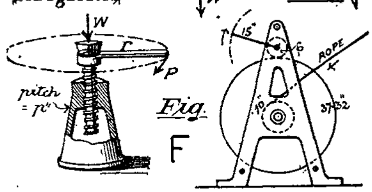


Fig. F

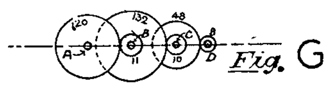


Fig. G

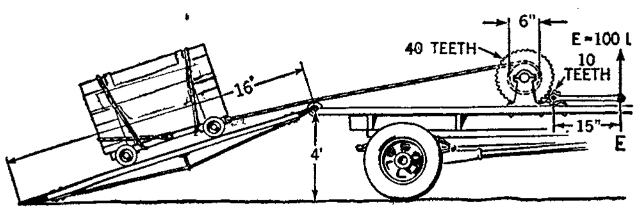


Fig. H

PART I—STATICS

CLASS I. FASTENERS

Section 1a. Marine and Masonry Anchors

A—Mushroom anchor.

B—Trawl or sand anchor; fast stock, double fluke.

C—Trawl or sand anchor; loose folding stock.

D—Grapnel.

E—Navy-type swivelling fluke.

F—Denforth anchor.

G—Northill utility anchor.

H—Fisherman's anchor.

J—Laughlin C.Q.R. plow anchor.

K—Anchor trip hook.

L—Rock anchor for guy or suspension bridge.

M—Concrete, sunk in ground with plate and rod reenforcing.

N—Mooring screws, sunk in ground for buoys.

O—Anchor plate, sunk in ground for attaching tie rods and guys.

P—Wall eye, cast to form brick.

Q—Wall eye, built in.

R—Foundation-bolt head, jagged.

S—Foundation bolt with key.

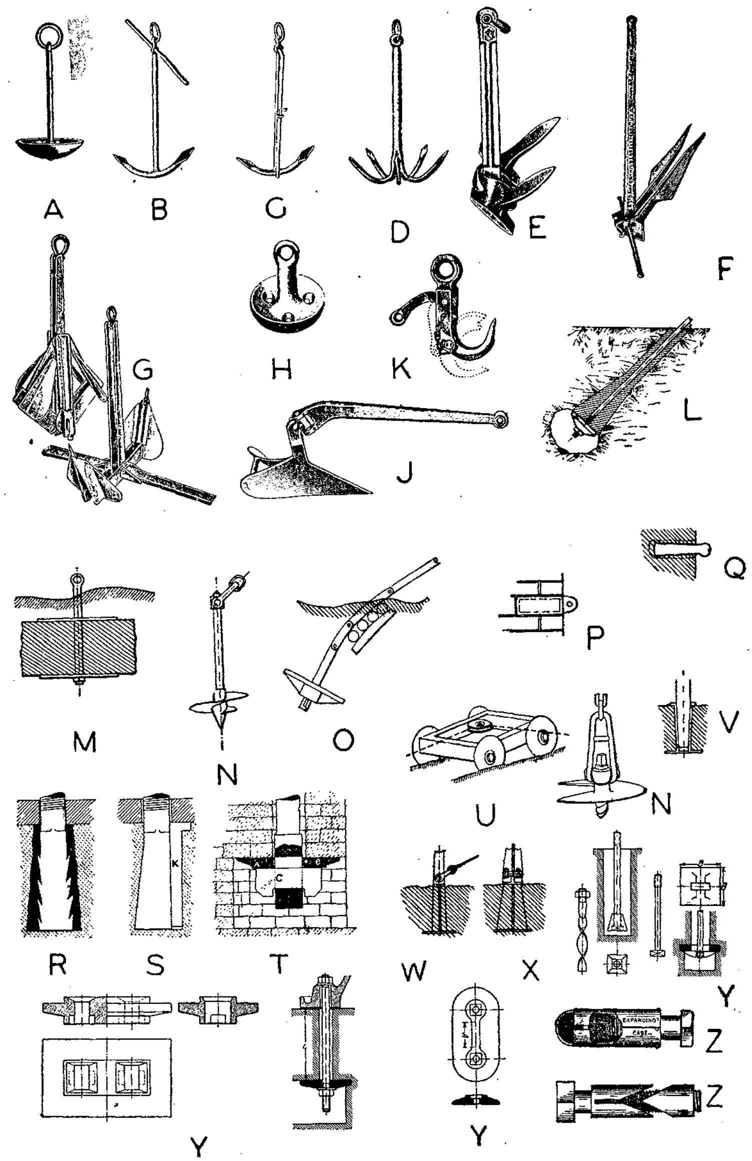
T—Foundation bolt, standard.

U—Rope-pulley leader anchor, knife-wheel grip in ground.

V, W, X—Fencing posts in ground.

Y—Miscellaneous foundation-bolt anchors.

Z—Expansion bolts.


A
B
C
D
E
F
G
H
K
L
J
Q
P
M
N
O
V
U
N
R
S
T
W
X
Y
Y
Y
Z
Z
EXPANDING CASE

CLASS I. FASTENERS

Section 1b. Expansion Shields and Anchors

A–Spring-wing toggle bolt, shown open and closed.

B–Spring-wing toggle bolt: *A* with round head; *B* with square nut; *C* with flat-head screw.

C, D–Spring-wing toggle bolt inserted into a drilled hole in tile or gypsum walls.

E–One-piece toggle, without springs.

F–Paine lead expansion anchors for use in concrete, stone, marble, tile, slate, etc.

G–F in position.

H–Single machine-bolt shield with two-side expansion for use in concrete, etc., installed without a setting tool.

J–Double machine-bolt shield; installed without a setting tool.

K–Fiber or rawhide wood and lag screw anchor for use in brick, plaster, concrete, etc.; the hole need not be plumb; no setting tool required; the fiber anchor should be as long as the threaded part of the wood or lag screw and have the same diameter as the screw.

L, M–Paine steel expansion shells; may be used with two cups; no setting tool required; the hole need not be plumb.

N–Four-point star drill for making expansion-anchor holes in masonry.

O–Paine pipe hook, snug-fit type.

P–Paine adjustable combination pipe hanger; consists of a six-inch length of perforated hanger iron with a gimlet-pointed lag screw at one end and a pipe ring at the other end.

Q–BX staple.

R–Flattened-end lag screw with bolt for use with a malleable expansion shield.

S, T, U–Rawl drive expansion plugs.

V, W–Two-hole and one-hole straps for supporting wall pipe conduit and armored cable.

X–Gimlet-point lag screw; commercial sizes vary in length from 1½ inches to 12 inches and in diameter from ¼ inch to ⅞ inch; lag screws are measured from under the head to the extreme point.

Y–Seebco Scruin patented expansion shield.

INDEX

Q

R

S

T

9 780820 603797

The engineering collection grew from the holdings of the Astor Library, which focused on practical knowledge and included a significant number of useful works such as trade catalogs and business journals not collected by academic institutions.Â Herkimer, Herbert. Engineers' Illustrated Thesaurus. (1952). Hubert, Paur, ed. Engineers' Illustrated Thesaurus Paperback â€“ April 28, 2012. by Herbert Herkimer (Author). 3.1 out of 5 stars 2 customer reviews.Â Amazon Giveaway allows you to run promotional giveaways in order to create buzz, reward your audience, and attract new followers and customers. Learn more about Amazon Giveaway. This item: Engineers' Illustrated Thesaurus. Set up a giveaway. There's a problem loading this menu right now.