**TRANSFER** (from Lat. *transferre,* to bear across, carry over), the handing over, removal or conveyance of anything from one person or place to another; also the subject of this transference or the form or method by which it is effected. The term is particularly used in law of the conveyance of property from one person to another, especially of the conveyance of real property (see Conveyancing). For the simplification of this process by means of registration of title, see Land Registration. For the transference of designs, drawings, &c., by means of transfer­paper to the surface of pottery and porcelain, see Ceramics; for their transfer to stones for printing, see Lithography.

**TRANSFORMERS.** An electrical transformer is the name given to any device for producing by means of one electric current another of a different character. The working of such an appliance is, of course, subject to the law of conservation of energy. The resulting current represents less power than the applied current, the difference being represented by the power dissipated in the translating process. Hence an electrical transformer corresponds to a simple machine in mechanics, both transforming power from one form into another with a certain energy-dissipation depending upon frictional losses, or something equivalent to them. Electrical transformers may be divided into several classes, according to the nature of the transformation effected. The first division comprises those which change the form of the power, but keep the type of the current the same; the second those that change the type of the current as well as the form of power. The power given up electrically to any circuit is measured by the product of the *effective value* of the current, the *effective value* of the difference of potential between the ends of the circuit and a factor called the *power factor.* In dealing with periodic currents, the effective value is that called the root-mean-square value (R.M.S.), that is to say, the square root of the mean of the squares of the time equidistant instantaneous values during one complete period (see Electrokinetics). In the case of continuous current, the power factor is unity, and the effective value of the current or voltage is the true mean value. As the electrical measure of a power is always a product involving current and voltage, we may transform the character of the power by increasing or diminishing the current with a corresponding decrease or increase of the voltage. A transformer which raises voltage is generally called a *step-up* transformer, and one which lowers voltage a *step-down* transformer.

Again, electric currents may be of various types, such as con­tinuous, single-phase alternating, polyphase alternating, undirectional but pulsating, &c. Accordingly, transformers may be distinguished in another way, in accordance with the type of transformation they effect, (1) *An alternating current trans­former* is an appliance for creating an alternating current of any required magnitude and electromotive force from another of different value and electromotive force, but of the same fre­quency. An alternating current transformer may be con­structed to transform either single-phase or polyphase currents. (2) *A continuous current transformer* is an appliance which effects a similar transformation for continuous currents, with the difference that some part of the machine must revolve, whereas in the alternating current transformer all parts of the machine are stationary; hence the former is generally called a rotatory transformer, and the latter a static transformer. (3) *A rotatory or rotary transformer* may consist of one machine, or of two separate machines, adapted for converting a single-phase alter­nating current into a polyphase current, or a polyphase current into a continuous current, or a continuous current into an alter­nating current. If the portions receiving and putting out power are separate machines, the combination is called a *motor-gene­rator.* (4) A transformer adapted for converting a single-phase alternating current into a unidirectional but pulsatory current is called a *rectifier,* and is much used in connexion with arc lighting in alternating current supply stations. (5) *A phase trans­former* is an arrangement of static transformers for producing a polyphase alternating current from a single-phase alternating current. Alternating current transformers may be furthermore divided into (*a*) single-phase, (*b*) polyphase. Transformers of the first class change an alternating current of single-phase to one of single-phase identical frequency, but different power; and transformers of the second class operate in a similar manner on polyphase currents. (6) The ordinary induction or spark coil may be called an intermittent current transformer, since it transforms an intermittent low-tension primary current into an intermittent or alternating high-tension current.

*Alternating Current Transformer.*—The typical alternating current transformer consists essentially of two insulated electric circuits wound on an iron core constituting the magnetic circuit. They may be divided into (1) open magnetic circuit static transformers, and (2) closed magnetic circuit static trans­formers, according as the iron core takes the form of a terminated bar or a closed ring. A closed circuit alternating current trans­former consists of an iron core built up of thin sheets of iron or steel, insulated from one another, and wound over with two insulated conducting circuits, called the primary and secondary circuits. The core must be laminated or built up of thin sheets of iron to prevent local electric currents, called eddy currents, from being established in it, which would waste energy. In practical construction, the core is either a simple ring, round or rectangular, or a double rectangular ring, that is, a core whose section is like the figure 8. To prepare the core, thin sheets of iron or very mild steel, not thicker than ∙014 of an inch, are stamped out of special iron (see Electromagnetism) and care­fully annealed.

The preparation of the particular sheet steel or iron used for this purpose is now a speciality. It must possess extremely small hysteresis loss (see Magnetism), and various trade names, such as “ stalloy,” “ lohys,” are in use to describe certain brands. Barrett, Brown and Hadfield have shown (*Jοurn. Inst. Elec. Eng. Lond.,* 1902, 31, p. 713) that a silicon iron containing 2∙87% of silicon has a hysteresis loss far less than that of the best Swedish soft iron. In any case the hysteresis loss should not exceed 3∙o watts per kilo­gram of iron measured at a frequency of 50 ~ and a flux-density of 10,000 lines per square centimetre. This is now called the “ figure of merit ” of the iron.

Examples of the shapes in which these stampings ’are supplied are shown in fig. 1. The plates when annealed are varnished or covered with thin paper on one side, and then piled up so as to make an iron core, being kept together by bolts and nuts or by pressure plates. The designer of a transformer core has in view, first, economy in metal so that there may be no waste fragments, and second, a mode of. construction that facili­tates the winding of the wire circuits. These consist of coils of cotton- covered copper wire which are wound on formers and baked after being well saturated with shellac varnish. The primary and secondary circuits are sometimes formed of separate bobbins which are sandwiched in between each other; in other cases they are wound one over the other (fig. 2).

In any case the primary and secondary coils must be symmetri­cally distributed. If they were placed on opposite sides of the iron circuit the result would be considerable magnetic leakage. It is usual to insert sheets or cylinders of micanite between the primary and secondary windings. The transformer is then well baked and placed in a cast-iron case sometimes filled in with heavy insulating oil, the ends of the primary and secondary circuits being brought out through water-tight glands. The most ordinary type of alternating current transformer is one intended to transform a small electric current produced by a large electromotive force (2000 to 10,000 volts) into a larger current of low electromotive force (100 to 200 volts). Such a step­down transformer, may be obvi­ously employed in the reverse direction for raising pressure and reducing current, in which case it is a step-up transformer. A trans­former when manufactured has to be carefully tested to ascertain, first, its power of resisting break­down, and, second, its energy­-dissipating qualities. With the first object, the transformer is subjected to a series of pressure tests. If it is intended that the primary shall carry a current