Machine Construction & Drawing.

(From *Collin's Elementary Science Series.*)

(*Continued from page* 127.)

As our space would not admit of the continuation of this work in May number, we give this month 2 extra pages. The plates we cannot furnish until near the completion of the work, which will be completed before the end of the year.

The value of this work cannot be too much appreciated by young machinists. They are actually getting a work for nothing that cost $2.

43. We will now define the term *pitch*, so that it shall be independent of the number of threads in the screw, which we consider to be the clearest manner of expressing it. In all cases either the screw or the nut is fixed, and prevented from moving lengthwise (in direction of the axis of the screw); we shall consider the nut to be the moving piece, as being most suitable for the definition. The *pitch* of a *screw* is the distance moved through by the nut during one revolution of the screw. To find the size or thickness of the thread for square-threaded screws, divide the pitch by twice the number of threads in the screw, and the quotient will be the required size. In fig. 96, ab = the pitch, and therefore the thickness of the thread = $\frac{1}{4}$ ab.

44. Screws are right or left-handed, according to the direction in which the nut moves; when the screw is turned round in the direction of the hands of a watch, the nut moves in the direction ba, figs. 92, 94, 96, *from left to right*, the screw is therefore *right-handed;* and *left-handed* if *vice versâ*.

A left-handed square-threaded screw, $2\frac{1}{2}''$ diameter, $\frac{1}{2}''$ pitch, is shown in figs. 97, 98, drawn to a scale of $\frac{1}{4}$. Fig. 98 shows a common approximation to the true form of the thread. If the screw be turned round in the direction indicated by the arrows, the nut will move in the direction *ab, from right to left.*

Screws are considered to be right-handed single thread, unless otherwise stated. Left-handed screws are only used in special cases.

45. For square-threaded screws there is no strict standard for the number of threads per inch of length according to the diameter of the screw, as there is for the V-threaded screw. In some establishments the rule is, for the same diameter of screw, to allow the number of threads per inch to be one-half that of the V-threaded screw. This rule agrees very nearly with the following table :—

TABLE III.

Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.	Dia. of Screw.	No. of Threads per in.
$\frac{1}{4}$	10	$\frac{5}{8}$	7	1	5	$1\frac{5}{8}$	$2\frac{1}{2}$
$\frac{5}{16}$	10	$\frac{11}{16}$	7	$1\frac{1}{8}$	4 .	$1\frac{7}{8}$	$2\frac{1}{4}$
$\frac{3}{8}$	9	$\frac{3}{4}$	6	$1\frac{1}{4}$	$3\frac{1}{2}$	2	$2\frac{1}{4}$
$\frac{7}{16}$	8	$\frac{13}{16}$	6	$1\frac{3}{8}$	3	$2\frac{1}{8}$	$2\frac{1}{4}$
$\frac{1}{2}$	7	$\frac{7}{8}$	6	$1\frac{1}{2}$	3	$2\frac{1}{4}$	2
$\frac{9}{16}$	7	$\frac{15}{16}$	6	$1\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{1}{2}$	2

46. In this chapter we shall consider some of the kinds of wheels used as connecting pieces between shafts for the direct transmission of motion.

Spur Wheels are used for the purpose of transmitting motion from one shaft to another when the shafts are parallel. If the wheels are circular the motion is regular; and it is irregular in the case of *elliptic* and *lobed* wheels. We shall only consider the former kind, and confine ourselves to the simplest form of spur wheels, those having teeth projecting from the rim and parallel to the axis of the wheel. By giving proper diameters to the wheels we may obtain any required number of revolutions, within certain limits, for each shaft respectively.

47. In figs. 99, 100, Plate IX., A and B are the centres of two shafts, which are required to be connected by spur wheels, so that B shall make two revolutions to one of A. Required the diameters of the wheels. From A draw any line Ab, making an angle of about 30° with AB, and upon it set off Ac, cb, so that Ac = $2cb$. Join Bb, and from c draw cC, parallel to Bb, cutting AB in C, then AC, BC are the required semi-diameters or radii. We could have found C by dividing AB by trial, as the division is a simple one; but the plan adopted can be applied whatever be the ratio of the diameters of the wheels, and is therefore a general solution. The wheel A we shall term the *driver* and B the *follower.*

The act of giving motion to a piece is termed *driving* it, and that of receiving motion from a piece is termed *following* it.*

In this example we have considered the wheels to be toothless, and to be *rolling* together without *sliding*, so that for each inch or fraction of an inch of the circumference of the wheel A passing the point C, an equal length of the circumference of the wheel B passes the same point. The two shafts rotate in opposite directions; thus, if A turns in the direction of the hands of a watch, B will turn in the opposite direction. Wheels used to transmit motion are usually provided with *teeth* to ensure regularity of motion and the transmission of greater force than could be obtained conveniently with toothless wheels. The circles CDE, CFH, then become the *pitch circles* of the wheels, which are situated near the middle of the length of the teeth. See Ch. IX. on the Teeth of Wheels.

48. The diameters of wheels are generally referred to their pitch circles; thus we speak of the diameter of the pitch circle of a wheel of, say, 30 *teeth*, 1″ *pitch*. Figs. 101, 102 represent a pair of wheels in *outline* (not showing the form of the teeth), A has 24, and B 18 teeth, $\frac{3}{4}''$ pitch. The *pitch* is the distance, measured along the pitch circle, from the centre of one tooth to the centre of the next tooth. In fig. 101 the dotted circle marked t represents the top, and that marked b the bottom of the teeth. A is a *plate* wheel, the *boss* is marked a; c is the plate, and d the *rim* of the wheel. The wheel B is solid, having projecting pieces, e, on each side, termed *facings*. The figures are drawn to a scale of $\frac{1}{4}$. To draw the wheels it is necessary to know the distance AB and the diameter of one of the wheels, from which we can readily obtain the diameter of the other, or the diameters of both wheels. We will take the problem as follows :—

49. Given the number of teeth and the pitch of a pair of spur wheels, and the kind of wheels (solid, plate, or with arms), to make a drawing of them in outline. Having drawn the common centre line AB, fix upon A or B for one centre; now find the diameter of each pitch circle, which may be done as follows:—The diameter of a circle bears a constant ratio to its circumference, the ratio is 1 : 3·1416, or 1 : $3\frac{1}{7}$ nearly, that is to say, the circumfer-

* *Principles of Mechanism*, by Prof. Willis.