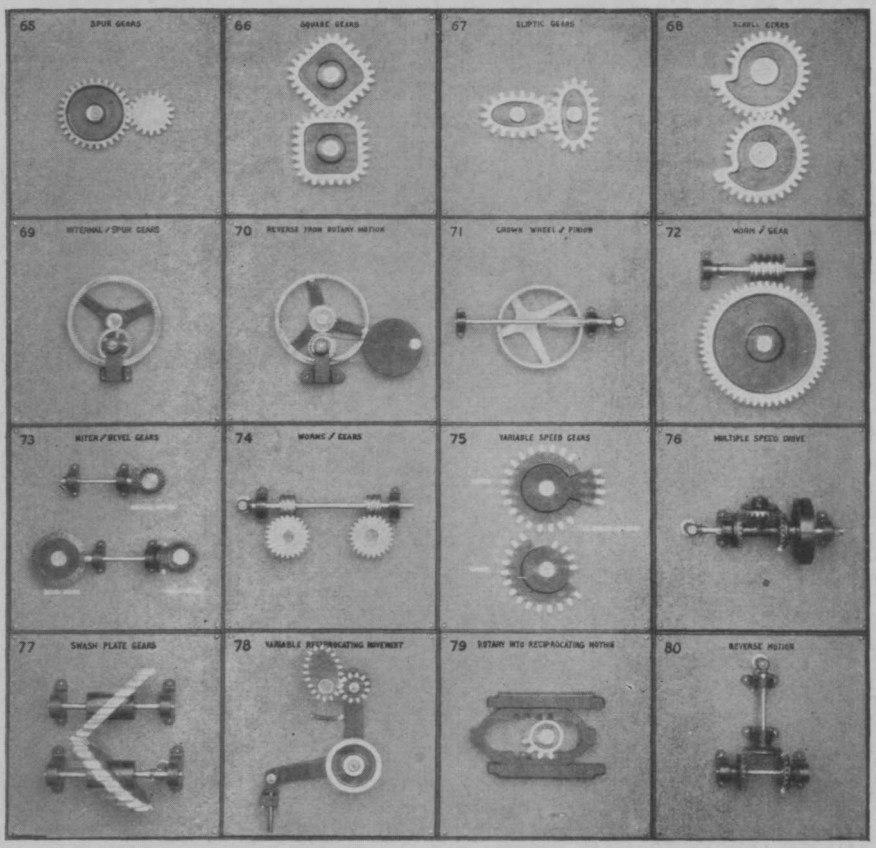

SECTION V Nos. 65—80

Gearing group, all types of gearing used in machine construction, gear combinations.

Section V

65. Spur gears. Gears are used to transmit power from one shaft to another and are now used in practically every complicated machine. There are a variety of types.

This model shows ordinary spur gears, having grooves parallel to the shaft. When the large gear is the driver the small one is driven at a greater speed having eighteen teeth to the thirty of the driving gear. When the small gear is the driver, the large one revolves at a correspondingly slower speed.

66. Square gears. This type of gearing transmits a variable speed. The top gear is the driver and has a constant speed. The lower gear runs slow when the corners are up in position and faster when driver engages the flat sides. This type is not commonly used.

67. Elliptic gears. These are the most common of the non-circular gears. Left gear running constant, drives right gear at a variable speed depending upon the shape of the ellipse. Used in certain types of printing presses.

68. Scroll gears. This type of gearing produces a gradual increasing and decreasing speed during one revolution. The speed of driven gear is slowest when its longest point from center is engaged with driver. There are a variety of scroll gears to suit the condition of motion required.

69. Internal and spur gears. This shows two types of gears, internal and external spur gears

in combination. Note that the large internal gear is driving a small spur gear and both are turning in the same direction. Referring to No. **65,** you will see that spur gears in combination turn in opposite directions. Application of this combination may be found in No. **38.**

70. Reverse from rotary motion. There are three gears in combination in this model—internal, spur, and mutilated gear in center. The large or internal gear and mutilated gear are both drivers. When the teeth on the internal gear mesh with the teeth on the small spur gear the motion is in one direction. When teeth in the mutilated gear mesh with spur gear the action is reversed. The red target disk indicates this. Motion is transmitted to the target disk by a chain drive (See No. **7.**) This movement is usable in any type of machine where advance is slow and return fast or vice versa.

71. Crown wheel and pinion. The cogwheel or pinion rotating on the horizontal shaft is driving the large crown wheel. The pinion runs at constant speed because it is on the driving shaft but that of the crown wheel varies at every point from slower to faster movement because it rotates on a point off-center.

72. Worm and gear. The worm or continuous screw on the horizontal shaft is the driver. This combination reduces the speed of the driven member and also multiplies its power. The power increases proportionally as the speed decreases. The speed ratio of shafts depends upon the relation of number of threads on the worm (single or multiple) to the number of teeth in

the worm wheel or gear. This type of speed reducer is used between shafts at right angles to each other.

73. Miter and bevel gears. The miter gears are the two models on the right. Miter gears are used to transmit motion between two shafts placed at right angles to each other. Since the gears are of equal diameter, they both revolve at the same speed. The angle of the grooves to the shaft is 45° in all miter gears. Helical miters are so cut that they are noiseless. Therefore they are used for high speed transmission.

The lower model on the left shows the action of bevel gears. Bevel gears also run at right angles to each other but the two gears in combination are of different sizes. Since the speed transmitted is different these gears are used when a differential speed is desired. The angle of the teeth depends on the diameter on the two gears.

The spiral gears are developed primarily for automobile drives but are applicable to any high speed machinery where quiet running is desired.

74. Worms and gears. This combination shows the method of changing rotation of driven gear. Note the right and left hand angle of the threads in the continuous screw or worm. Teeth in lower gears have corresponding left and right angles. The threads of these worms are of the multiple type and have five leads while that in No. **72** is a single thread, having only one lead.

75. Variable speed gears. In this combination of gears there are two speeds and a stop move-

ment due to the relation of the diameters of the parts that mesh. When the teeth of equal diameters are meshed, as on black sectors, both gears turn at the same speed. But when red sectors are in mesh the speed of the lower gear is doubled because it has a diameter of four inches while that of the upper projection is eight inches. When no gears mesh, there is a stop in the rotation of the lower gear.

76. Multiple speed drive. When more than two gears are in mesh such a combination is a train of mechanisms and is called a gear train or a train of gears. This train of gears is of a special type called epicyclic, because the one on the left is fixed and the horizontal gear is carried on a shaft which rotates about the axis of the fixed gear. The gear on the right is attached to the driven shaft and is made to rotate at double speed, being the sum of two movements of the horizontal gear, its rotation on its own axis and its meshing with the fixed gear about which it rotates.

77. Swash plate gears. This combination of gears is unusual and the only known application was in a dough-mixing machine. The action is identical with two plain spur gears of same diameter. Close observation will show that the teeth are cut parallel with the shafts and all are the same distance from their respective centers. Take a diagonal slice from a great length of a spur gear, and the result is a swash plate gear.

78. Variable reciprocating movement. The combination of gearing in this model produces a variable speed and movement of the lever and

arm. Many different combinations are worked out in this manner. A particular use is in textile machinery.

79. Rotary into reciprocating motion. The constant rotation of the four-toothed wheel inside of a specially constructed rack gives the reciprocating motion to the shaft through alternate meshing of the teeth on rack.

80. Reverse motion. The reverse motion of the driven shaft is caused by the meshing of a mutilated bevel gear with two bevel gears at right angles to it. It is also caused because the meshing of the gears is on opposite sides of the driver. The motion of both the driving and driven shafts is rotary. Compare action to that in No. **39.**