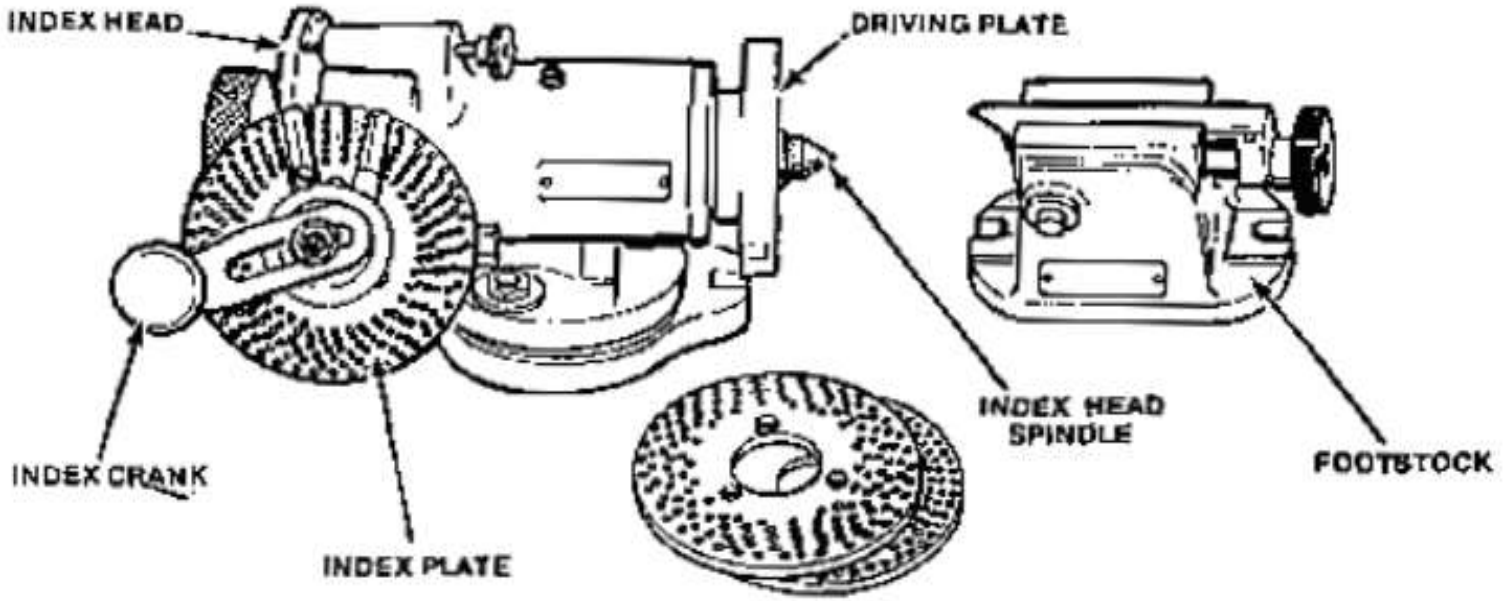
The Indexing or Dividing Head

Indexing

- Indexing is the process of evenly dividing the circumference of a circular work piece into equally spaced divisions, such as in cutting gear teeth, cutting splines, milling grooves in reamers and taps, and spacing holes on a circle.
- The index head of the indexing fixture is used for this purpose.

Index Head

- The index head of the indexing fixture (Figure) contains an indexing mechanism which is used to control the rotation of the index head spindle to space or divide a work piece accurately. A simple indexing mechanism consists of a 40-tooth worm wheel fastened to the index head spindle, a single-cut worm, a crank for turning the worm shaft, and an index plate and sector. Since there are 40 teeth in the worm wheel, one turn of the index crank causes the worm, and consequently, the index head spindle to make 1/40 of a turn; so 40 turns of the index crank revolve the spindle one full turn.

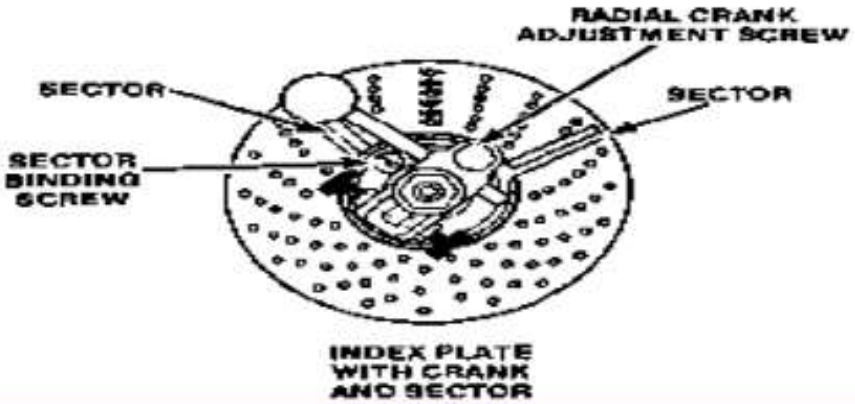


Index Plate

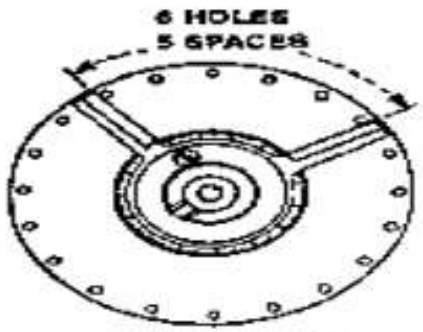
- The indexing plate (Figure) is a round plate with a series of six or more circles of equally spaced holes; the index pin on the crank can be inserted in any hole in any circle. With the interchangeable plates regularly furnished with most index heads, the spacing necessary for most gears, bolt heads, milling cutters, splines, and so forth can be obtained.

Sector

- The sector (Figure) indicates the next hole in which the pin is to be inserted and makes it unnecessary to count holes when moving the index crank after each cut. It consists of two radial, beveled arms which can be set at any angle



INDEX PLATE WITH CRANK AND SECTOR



OPERATION OF SECTOR

Index Plate Types

- Brown and Sharpe type consists of 3 plates of 6 circles each drilled as follows:
  - Plate I - 15, 16, 17, 18, 19, 20 holes
  - Plate 2 - 21, 23, 27, 29, 31, 33 holes
  - Plate 3 - 37, 39, 41, 43, 47, 49 holes
- Cincinnati type consists of one plate drilled on both sides with circles divided as follows:
  - First side - 24, 25, 28, 30, 34, 37, 38, 39, 41, 42, 43 holes
  - Second side - 46, 47, 49, 51, 53, 54, 57, 58, 59, 62, 66 holes

Indexing Methods

Simple Indexing or Plain Indexing

- In simple or plain indexing, an index plate selected for the particular application, is fitted on the worm shaft and locked through a locking pin'
- To index the work through any required angle, the index crank pin is withdrawn from the hole of the index plate than the work is indexed through the required angle by turning the index crank through a calculated number of whole revolutions and holes on one of the hole circles, after which the index pin is relocated in the required hole
- If the number of turns that the crank must be rotated for each indexing can be found from the formula
  - $N = 40 / Z$
  - Where
  - Z - No of divisions or indexings needed on the work
  - 40 – No of teeth on the worm wheel attached to the indexing plate, since 40 turns of the index crank will turn the spindle to one full turn

- Suppose it is desired to mill a gear with eight equally spaced teeth. l/8th of 40 or 5 turns (Since 40 turns of the index crank will turn the spindle one full turn) of the crank after each cut, will space the gear for 8 teeth. If it is desired to space equally for 10 teeth, 1/10 of 40 or 4 turns would produce the correct spacing.
- The same principle applies whether or not the divisions required divide equally into 40. For example, if it is desired to index for 16 divisions, 16 divided into 40 equals 2 8/16 turns. i.e for each indexing we need two complete rotations of the crank plus 8 more holes on the 16 hole circle of plate 1(**Plate I - 15, 16, 17, 18, 19, 20 holes)**

Direct Indexing

- In direct indexing, the index plate is directly mounted on the dividing head spindle (no worm shaft or wheel)
- While indexing, the index crank pin is withdrawn from the hole of the index plate than the pin is engaged directly after the work and the indexing plate are rotated to the desire number of holes
- In this method fractions of a complete turn of the spindle are limited to those available with the index plate
- Direct indexing is accomplished by an additional index plate fastened to the index head spindle. A stationary plunger in the index head fits the holes in this index plate. By moving this plate by hand to index directly, the spindle and the work piece rotate an equal distance. Direct index plates usually have 24 holes and offer a quick means of milling squares, hexagons, taps, and so forth. Any number of divisions which is a factor of 24 can be indexed quickly and conveniently by the direct indexing method.

Differential Indexing

- Sometimes, a number of divisions is required which cannot be obtained by simple indexing with the index plates regularly supplied. To obtain these divisions, a differential index head is used. The index crank is connected to the worm shaft by a train of gears instead of a direct coupling as with simple indexing. The selection of these gears involves calculations similar to those used in calculating change gear ratio for lathe thread cutting.
- Gear Ratio $I = 40/K\ (K - Z)$

  Where
  - K – a number very nearly equal to Z
  - For example if the value of Z is 53, the value of K is 50

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