

## CHAPTER V.

## OF AGGREGATE COMBINATIONS IN MECHANISM.

SECTION I.—*General Explanations.*

225. **Aggregate Combination Defined.**—“Aggregate Combinations” is a term introduced by Professor Willis, to denote those assemblages of pieces in mechanism in which the motion of one follower is the resultant of motions impressed upon it by more than one driver. The number of independently-acting drivers which impress directly a compound motion on one follower cannot be greater than three; because each driver determines the motion of at least one point in the follower; and the determination of the motion of three points in a body determines the motion of the whole body. In most cases which occur in practice, the number of independent drivers which act directly on one follower is *two*.

226. **General Principle of their Action.**—The follower which has such a compound motion directly communicated to it by more than one primary piece must necessarily be a *secondary piece*, as defined in Article 37, page 17; its motion at any instant is the *resultant* of the motions impressed upon it separately by the pieces which act as its drivers; and the determination of that resultant motion depends upon the principles already explained in Chapter III. of this Division, pages 43 to 75. Several examples of the motion of secondary pieces have been given in the preceding Chapter, in treating of those secondary pieces, such as links and bands, and the sheaves of running blocks, which act as connectors in elementary combinations.

227. **Aggregate Combinations terminating in a Primary Piece.**—Very often an aggregate combination is of the nature of a train; and although a secondary piece receives in the first instance a compound motion from two or from three primary pieces, that secondary piece communicates motion in the end to a primary piece. In such cases the motion of that last primary follower may be determined, by finding the motions which would be communicated to it through the intermediate secondary piece or pieces by the several primary drivers acting separately, and taking the resultant of those motions.

228. **Shifting Trains.**—A secondary piece in an aggregate combination has very often a form like that of a primary piece, and

