In order to see this let us examine the case shown in the lower figure, where the projections are not normal to P_1C at the point P_1, where they touch. It is at once evident that sliding must occur at P_1, from the very nature of the case, and where two bodies slide upon one another the direction of sliding must always be along the common tangent to their surfaces at the point of contact, hence the direction of sliding here must be P_1P^1. But P_1 is the point of contact and is therefore a point in each wheel, and the motion of the two wheels must be the same as if the two pitch circles rolled together, having contact at C. Such being the case, if we place two projections, as shown on the wheels, the direction of motion at their point of contact should be perpendicular to P_1C, whereas here it is perpendicular to P_1C^1. This would cause slipping at C, and would give the

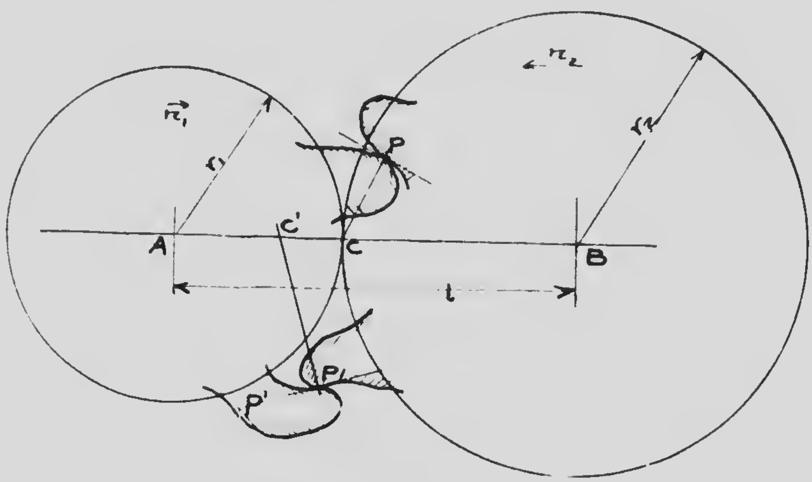

Fig. 11.

proper shape for pitch circles of radii AC^1 and BC^1, which would correspond to a different velocity ratio, thus C^1 should lie at C and P_1P^1 should be normal to P_1C.

From the foregoing we may make the following important statements: **The shapes of the projections on the wheels must be such that at any point of contact they will have a common normal passing through the fixed pitch point, and that while the pitch circles roll on one another the projections will have a sliding motion.** These projections on gear wheels are called *teeth*, and for convenience in manufacturing, all the teeth on each gear have the same shape, although this is not at all necessary to the motion. The teeth on the pinion are not the same shape as those on the gear with which it *meshes*.

There are a great many shapes of teeth, which will satisfy the necessary condition set forth in the previous paragraph, but