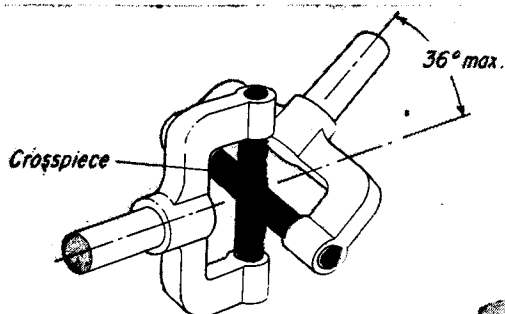


10 UNIVERSAL

FEDERICO STRASSER

HOOKE'S JOINTS

The commonest form of a universal coupling is Hooke's joint. This can transmit torque efficiently up to a maximum shaft-alignment angle of about 36° . At slow speeds, on hand-operated mechanisms, the permissible angle can reach 45° . Simplest arrangement for a Hooke's joint is two forked shaft-ends coupled by a cross-shaped piece. There are many variations and a few of them are included here.



Basic design . . .

of Hooke's joint can transmit heavy loads. Anti-friction bearings are a refinement often used.

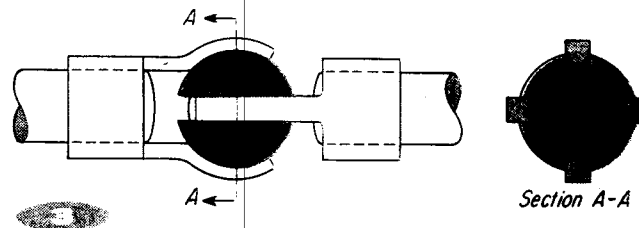
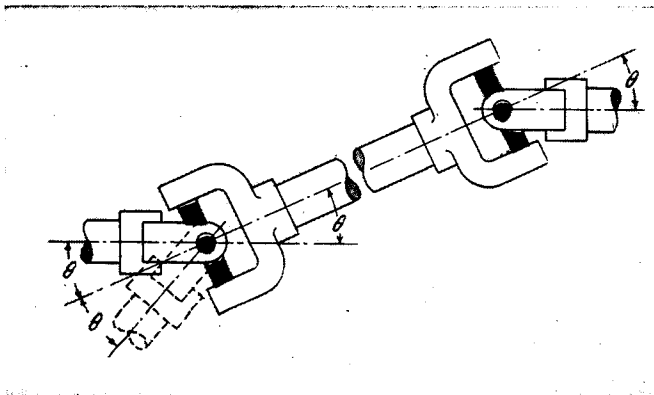


Pinned sphere . . .

replaces crosspiece in this design. Result is a more compact joint.

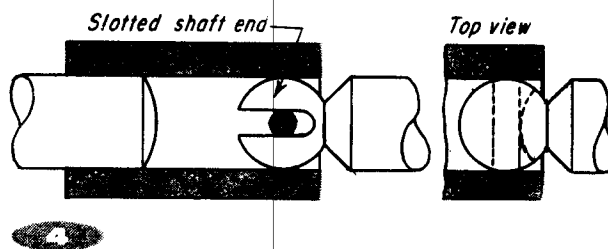
CONSTANT-VELOCITY COUPLINGS

The disadvantage of a single Hooke's joint is that velocity of driven shaft varies. Its maximum velocity can be found by multiplying driving-shaft speed by secant of the shaft angle;



Grooved sphere . . .

is modification of pinned sphere. Tongues on fastening sleeves are bent over sphere on assembly. Greater sliding contact of tongues in grooves makes ample lubrication essential at high torques and alignment angles.



Pinned sleeve . . .

fastened to one shaft engages forked, spherical end on other shaft to provide joint that also allows for axial shaft-movement. In this example, however, angle between shafts can only be small. Also, joint is only suitable for low torques.

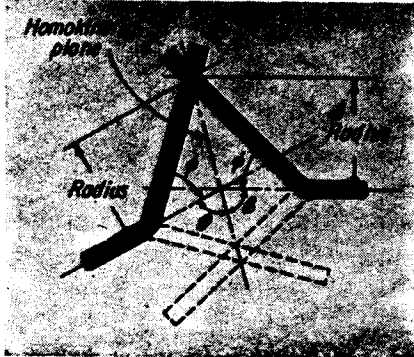
for minimum speed multiply by the cosine. An example of speed variation: Driving shaft rotates at 100 rpm; angle between shafts is 20° . Min output is 100×0.9397 , which equals 93.97 rpm; max output is 1.0642×100 , or 106.4 rpm. Thus the difference is 12.43 rpm. When output speed is high, output torque is low and vice versa. This is an objectionable feature in some mechanisms. However, two universal joints connected by an intermediate shaft solve the problem.



Constant-velocity . . .

joint made by coupling two Hooke's joints must have input and output angles equal for correct action. Also, the forks must be assembled so that they will always be in the same plane. Shaft-alignment angle may be double that for a single joint.

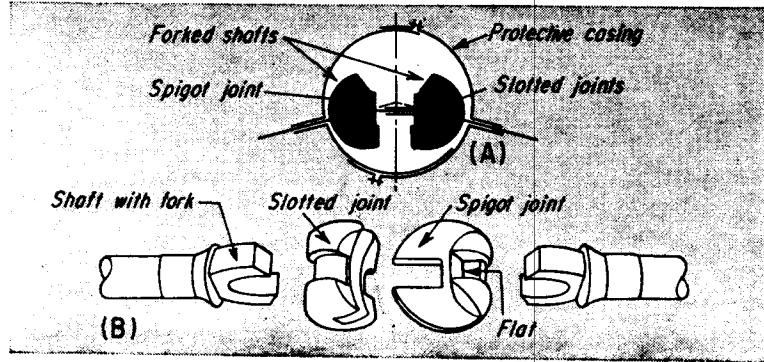
SHAFT-COUPPLINGS



6

Single constant-velocity . . .

coupling is based on principle (6) that contact point of the two members must always lie on the homokinetic plane. Their rotation speed will then always be equal because radius to contact point of each member will always be equal. Such simple couplings are ideal for toy, instrument and other light-duty mechanisms. For heavy duty, such as front-wheel drive of military vehicles, a more



7

complex coupling, shown diagrammatically (7A) has two joints close coupled with a sliding member between them. Exploded view (7B) shows these members. There are other designs for heavy-duty universal couplings; one, known as the Rzeppa, consists of a cage that keeps six balls in the homokinetic plane at all times. Another constant-velocity joint, the Bendix-Weiss, incorporates balls also.

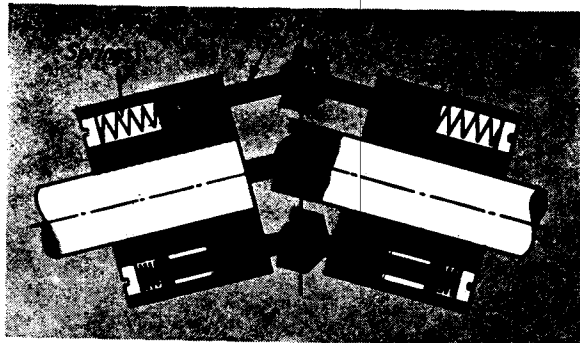
8

MISCELLANEOUS COUPLINGS



Flexible shaft . . .

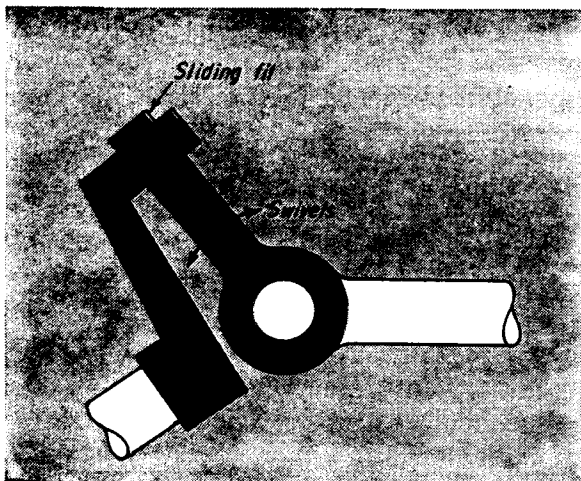
allows any shaft angle. Such shafts, if long, should be supported to prevent backlash and coiling.



9

Pump-type coupling . . .

is so called because reciprocating action of sliding rods can be used to drive pistons in cylinders.



10

Light-duty coupling . . .

is ideal for many economical mechanisms. Sliding swivel-rod must be kept well lubricated.