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Orbitary Mechanism

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ABSTRACT:-In Mechanical Engineering, the power transmission system plays vital role while functioning of all the concerned machining elements. As per the position of shafts i.e. inline, parallel, non-intersecting or intersecting, there are various systems used for power transmission. Some of them are belt drives, rope drives, chain drives, gears, etc. The gears show some backlash error. The mounting and alignment of gears is also very critical. So it was conceived to develop a mechanism for power transmission in angular shafts without using the gear drives. This concept uses the sliding bent pins inside circular disks mounted on rotating shaft.

I. INTRODUCTION:-

1) The power transmission between two shafts is a very important aspect of mechanical engineering design. Generally for intersecting shafts, the power transmission is achieved by using bevel gear but the disadvantages of bevel gears are that they must be precisely mounted and the shafts' bearings must be capable of supporting significant forces. Gear is very costly to manufacture and the Mechanical efficiencies of the gear drives is comparatively quite poor as compared to the link motion transmission drives. In case of gear drives the power is lost due to back lash in the teeth of the gears, Chattering of the gears and hunting of gear trains. The Bent Pin Mechanism is also called as orbital mechanism since the rotating parts revolve around the axis similar to planets.

2) The Bent Pin Mechanism is also called as orbital mechanism since the rotating parts revolve around the axis similar to planets revolving around the sun. Sometimes the mechanism is also called as an angular drive or oblique drive mechanism. Whenever angular drives are required for machinery equipment the Bent Pin Mechanism comes in handy. The Bent Pin drive was later perfected by the Phillips company of Denmark for use in sterling engine for obtaining phase angle of the expansion and compression pistons for the necessary timing sequence. Now-a-days the mechanism is manufactured in polypropylene high density plastics and used in various angular drives, because of space restriction. Link motion drives are simpler to manufacture, simple to operate and less costly than the gear drives.

II. DESIGN CONCEPT:-

1)An unusual form of transmission of shaft located at an angle is shown by diagram motion is transmitted from driving to driven shaft through the rods which are bent to conform to the angle between the shafts. These rods are located in holes equally space around a circle and they are free to slide in and out shaft revolve. This type of a drive is suitable for where quite operation at high speed is essential but it is only recommended for light duty. The operation of this transmission will be apparent by the action of one rod during a revolution. If we assume that driving shaft „A‟ is revolving clockwise , then driven shaft „B‟ will rotate counter clockwise. As shaft „A‟ turns the half revolution, rod "C‟ shown in the inner on most effective driving position slides out of both shafts „A‟ and „B‟ during the first half revolution and rod "C‟ then will be at the top.

2) Then during the remaining half, this rod „C‟ slides inwards until it again reaches to innermost position as shown in fig.1. In the meanwhile, the outer rod have of course passed through the same cycle of movement all rods are successively sliding inwards and outwards

3)Although this transmission is old one, many mechanics are skeptical about its operation, however it is not only practicable, but has provided satisfactory for various applications, when the drive is for shafts which are permanently located at a given angle. Although this illustration shows 135 degree angle transmission, this drive can be applied to shaft located at intermediate angle between 0° and 180°.

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III. WORKING:-

An unusual form of transmission of shaft located at an angle is shown by diagram motion is transmitted from driving to driven shaft through the rods which are bent to confirm to the angle between the shafts. These rods are located in holes equally spaced around a circle and they are free to slide in and out shaft revolve. This type of a drive is suitable for where quite operation at high speed is essential but it is only recommended for light duty.

The operation of this transmission will be apparent by the action of one rod during a revolution. If we assume that driving shaft 'A' is revolving as indicated by arrow ,then driven shaft 'B' will rotate counter clockwise. As shaft 'A' turns the half revolution, rod 'c' shown in the inner on most effective driving position slides out of both shafts 'A' and 'B' during the first half revolution and rod 'C' then will be at the top. Then during the remaining half , this rod 'c' slides inwards until it again reaches to innermost position as shown in fig.1. In the meanwhile, the outer rod have of course passed through the same cycle of movement all rods are successively sliding inwards and outwards.

Although this transmission is old one, many mechanics are skeptical about its operation, however it is not only practicable, but has provided satisfactory for various applications, when the drive is for shafts which are permanently located at a given angle. Although this illustration shows right angle transmission, this drive can be applied to shaft located at intermediate angle between 0° and 90°.

One application that proved successful was an special multiple spindle drilling machine for drilling meter cases. This machine had between 30 and 40 spindles equipped with small drill which small drill which revolves at 1500 to 1800 r.p.m. this transmission was used to replace universal joints consisting of forked ends, each of which pivoted by means of screw to a connecting block. These universal joints rapidly deteriorate but the sliding rod transmission proved durable & quiet.

In lubrication this transmission it is essential to have the holes for a given rod located accurately in each shaft, all holes must be equally spaced in radial and circumferential direction. The holes in each must also be parallel to each shaft must also be parallel to each other and each rod should be bent to at an angle at which the shafts are to be located. If the holes drilled in the end of the shaft have 'blind' or closed end, there

To be a small vent at bottom of each rod, hole for the escape of air compressed by the pumping action of the rods. These holes are useful for oiling. To avoid blind holes, shaft may have enlarged ends with holes extending clear through the enlarged port or shoulder. This transmission may be provided with a central rod located in line with the axis of each shaft and provided with a circular groove at each end or a cross pin to permit rotation of the shaft about the rod, simply acting as retaining device for shipping and handling purposes.

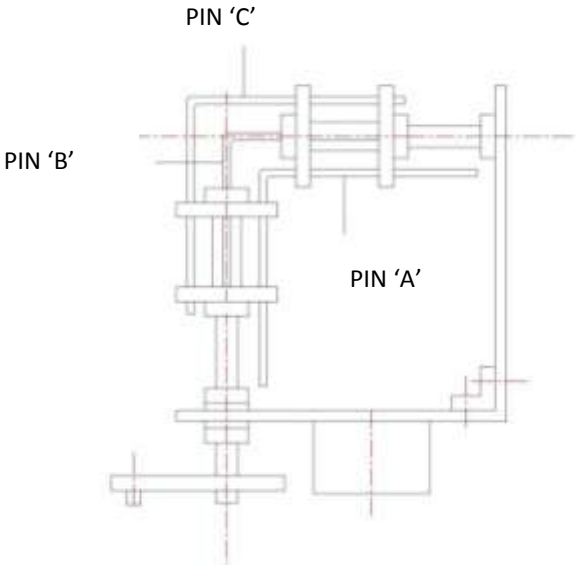

Fig- 1.1

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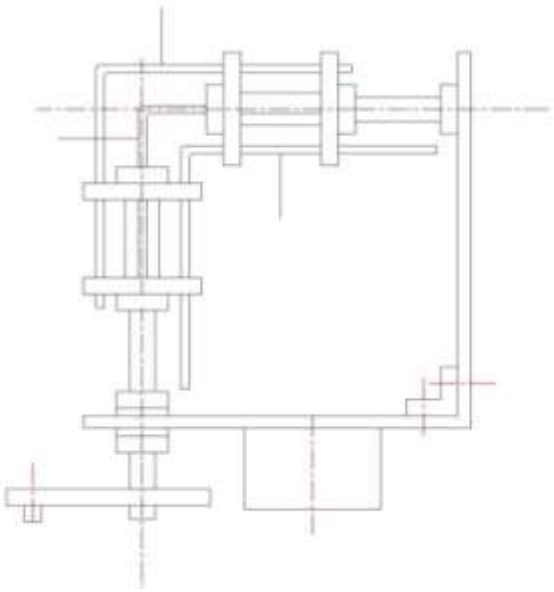

Fig1.2

The bent pin input shaft runs in a journal bearing of support plate. The input shaft is driven by a reduction vee pulley through a v-belt driving pulley of the electric motor. Thus mechanism is driven through a set of driving and driven vee belt pulley by connecting a variable speed electric motor. A flywheel is mounted on output shaft. Both the supports of mechanism are rigidly fitted to the foundation base plate.

IV. DIAGRAM OF ORBITARY MECHANISM:

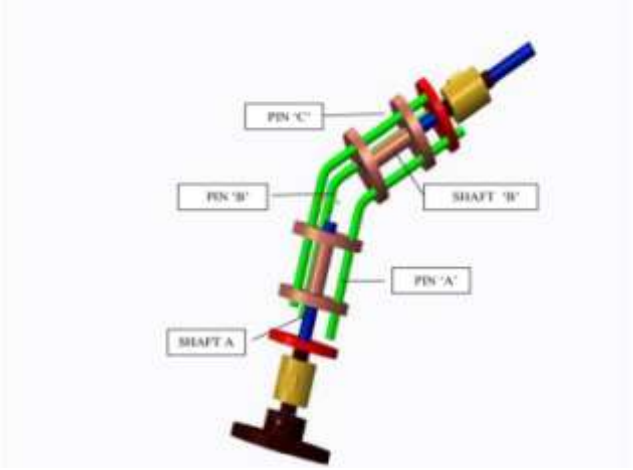

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Fig:- Orbital mechanism

V. METALLURGICAL SPECIFICATION:-

The ferrous raw materials used in all the project models confirm to "Emergency Number Series". The specifications of chemical properties & physical properties of ferrous material were formulated in1939 during World War-2.The metallurgy of these ferrous materials was liberalized in order to meet the requirement of steel speedily for manufacturing weapons &armaments at very quick rate. These specifications are designated by "EN-NO"& should not be confused with the, British, American, German standards or with the Indian Standard I.S.S.NO.

All the EN specifications confirm to data books of Indian Steels Manufactures such as TISCO, ISCO, Hindustan Steel, Machine Ugine, etc. The EN-NO still prevalent& understood better by the local steel suppliers.

The "Emergency Series" start with EN-0 to EN-48 as the properties go on increasing from lowest to highest grade. EN=0 is softest iron &is called free cutting steel, Dead steel or Wrought Iron. It is soft & ductile falling in compressive & tensile strengths. Steel from EN-8 onwards are treatable & therefore hardened to Rockwell 'c' scale called shortly RC-Number.

These material specifications are now detailed as follows.

a) Ferrous materials -:

i) Low Carbon Steels : EN-1 toEN-3
Carbon- 0.05 to 0.08%
Tensile strength- 420 to 550MPA
Yield Strength- 275 to 350

ii) Mild Steels : EN-4 to EN-6
Carbon- 0.15 to 0.35%
Tensile strength- 1200 to 1420MPA
Yield strength- 750 to 1170MPA

iii) High Carbon Steels : EN-10 to EN-28
Carbon- 0.85 to 1.6%
Manganese-0.5%
Chromium-0.08%
Tensile strength- 500 to 600MPA
Yield strength- 415 to 645MPA

b) No ferrous materials-:

i)Industrial Aluminum : LM-(Light Metal-4)
Copper- 4%
Manganese- 0.5%
Silicon- 0.5%
Rest is pure Aluminum
Tensile strength- 180 to 425MPA.
Yield strength- 69 to 275MPA.

VI. ADVANTAGES:-

A) High output efficiency.

The Bent pin Mechanism has comparatively high efficiency as compared to the bevel gear drive efficiency, due to absence of power transmission losses, like backlash error, pitting, wearing as in case of bevel gears.

B) No special purpose machines are required.

The Bent pin Mechanism components are machined on the ordinary center lathe machine. Manufacturing of components is s easier, also machining cost is less. No skilled labour required.

C) High precision instrument.

The Bent pin Mechanism is suitable for transferring loads of light & medium duty applications. Bent pin Mechanism is a high precision drive, hence it can be used in surgical instruments, space applications etc.

D) Power transmission in different planes.

Power can be transmitted even if the input & output shafts are in different horizontal planes. By varying bending angle of pins, power can be transmitted at different planes.

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VII. CONCLUSION:-

While concluding this report, we will quite contend in having completed the project assignment well on the time. We had got the practical experience on manufacturing of the working project model. We are, as such, overwhelmingly elated in arriving at the targeted mission.

The entire credit goes to the healthy co-ordination of our project group in bringing out a resourceful fulfillment of our assignment prescribed by University. Although the design criterions imposed challenging problems which however were overcome by us due to availability of good reference books. The selection of choice raw materials helped us in machining of the various components to very close tolerances and thereby minimizing the level of wear and tear.

Needless to emphasize here that we had left no stone unturned in our potential efforts during machining, fabrication and the assembly work of the project model to our entire satisfaction.

The stupendous experience gained by us is during the period of project work will surely beneficial for the betterment of our prospects in future.

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