SELF CENTRING MECHANISM

Application :
3 - Jaw Chuck

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Introduction

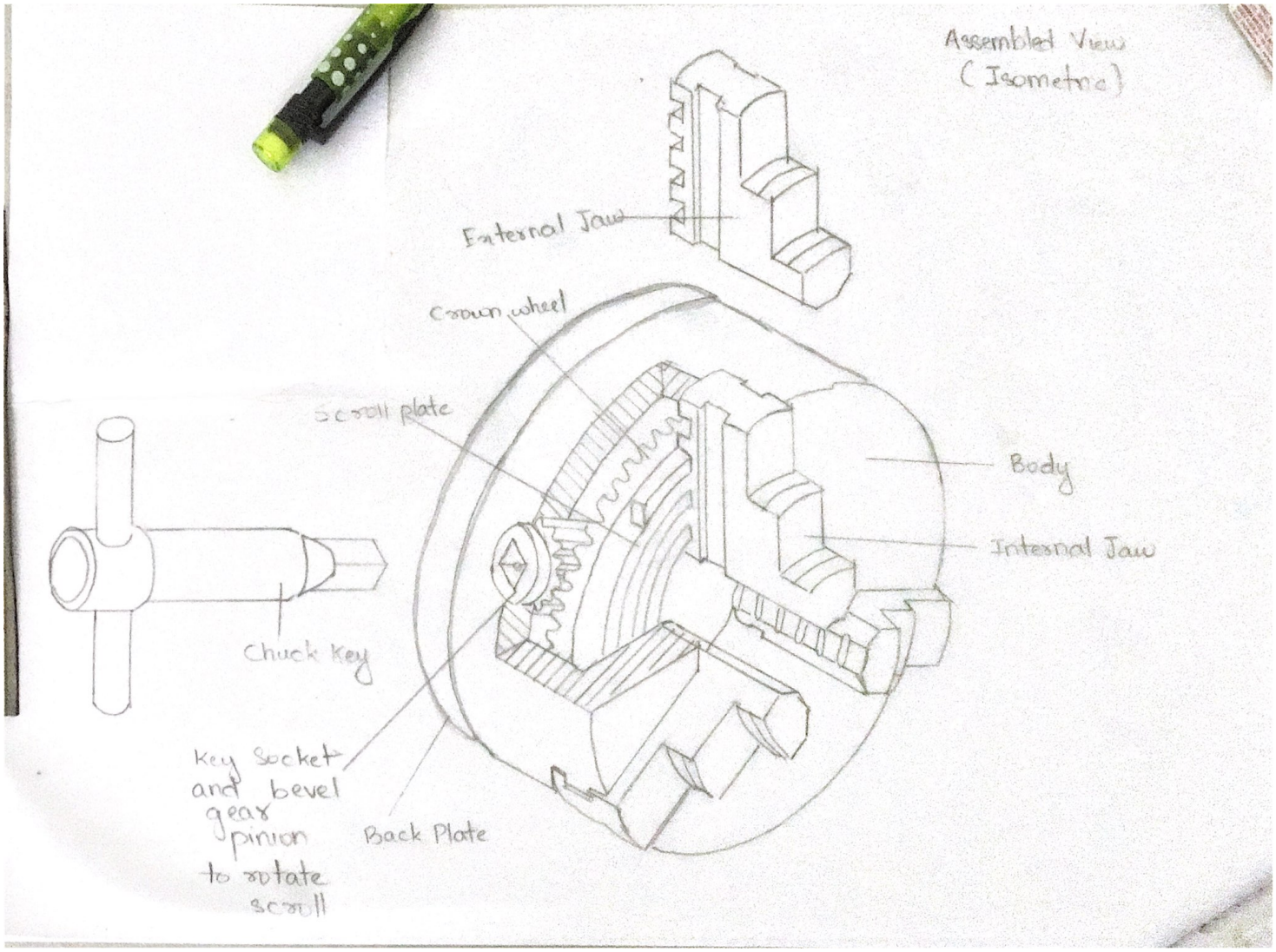
A self centering chuck uses jaws (2, 3, 4, 6 are common, 3 most common) to hold onto a tool or workpiece. They are best suited for holding circular or hexagonal cross sections when very fast, reasonably accurate (0.125 mm) centering is desired. I discuss the 3 jaw chuck.

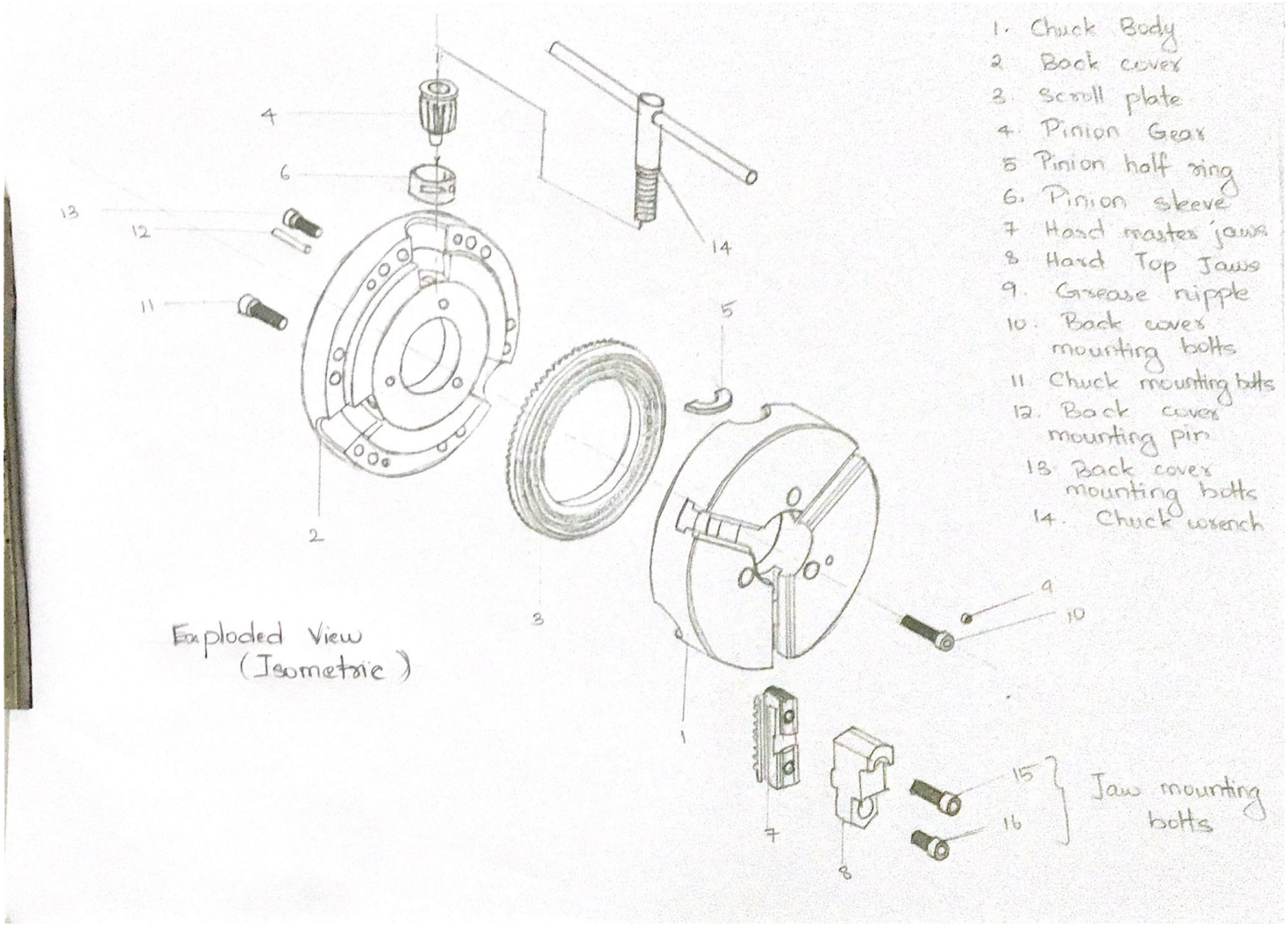
Details of Mechanism:

The major parts of a 3 ~~jteh~~ jaw chuck includes

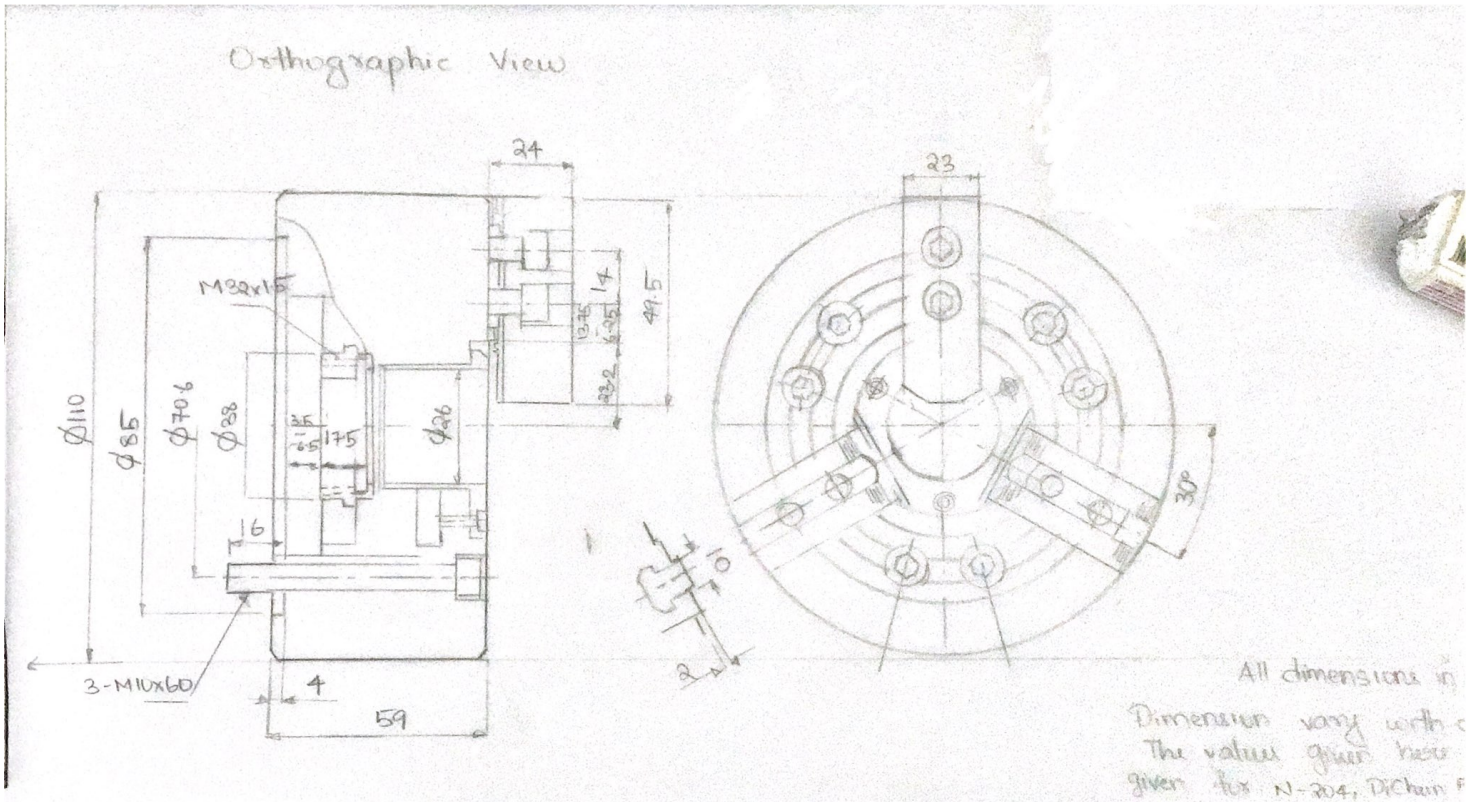
1) Hard Solid jaw: (Top) The purpose of this past is to hold the job tightly. It contains some groves so that it can easily place and align in the body.
2) Chuck body: It is solid casing that contains groove to give horizontal guidance to hard solid jaw.
3) Scroll plate: This is the main part of the 3 jaw chuck mechanism. It contains teeth as well as spiral.
4) Pinion gears: These are placed in bearing above cover for proper alignment of bearing
5) Hard master Jaws (base thread): It is the part that contains spiral threading at the bottom. Normally hard solid jaw and base thread jaw is made a single part.
6) Back cover: It is the base of the chuck that attach to lathe machine. It attaches to the main spindle of the lathe. Face plate covers the mechanism along with back cover. These also include the links of the mechanisms. They are connected by pinion half ring, pinion sleeve, grease nipple, back cover mounting bolts, chuck mounting bolts, back cover mounting pin, ~~back cover mounting bolts~~ and jaw mounting bolts

as shown in the exploded view (isometric) of the mechanism. These constitute joints. The input is through pinion gear, which is driven manually using chuck wrench. These are also indicated in the isometric view.


Assembled View
(Isometric)
External Jaw
Crown wheel
Scroll plate
Body
Internal Jaw
Chuck Key
Key Socket and bevel gear pinion to rotate scroll
Back Plate


1. Chuck Body
2. Back cover
3. Scroll plate
4. Pinion Gear
5. Pinion half ring
6. Pinion sleeve
7. Hard master jaws
8. Hard Top Jaws
9. Grease nipple
10. Back cover mounting bolts
11. Chuck mounting bolts
12. Back cover mounting pin
13. Back cover mounting bolts
14. Chuck wrench
15
16
Jaw mounting bolts
Exploded View (Isometric)

Orthographic View

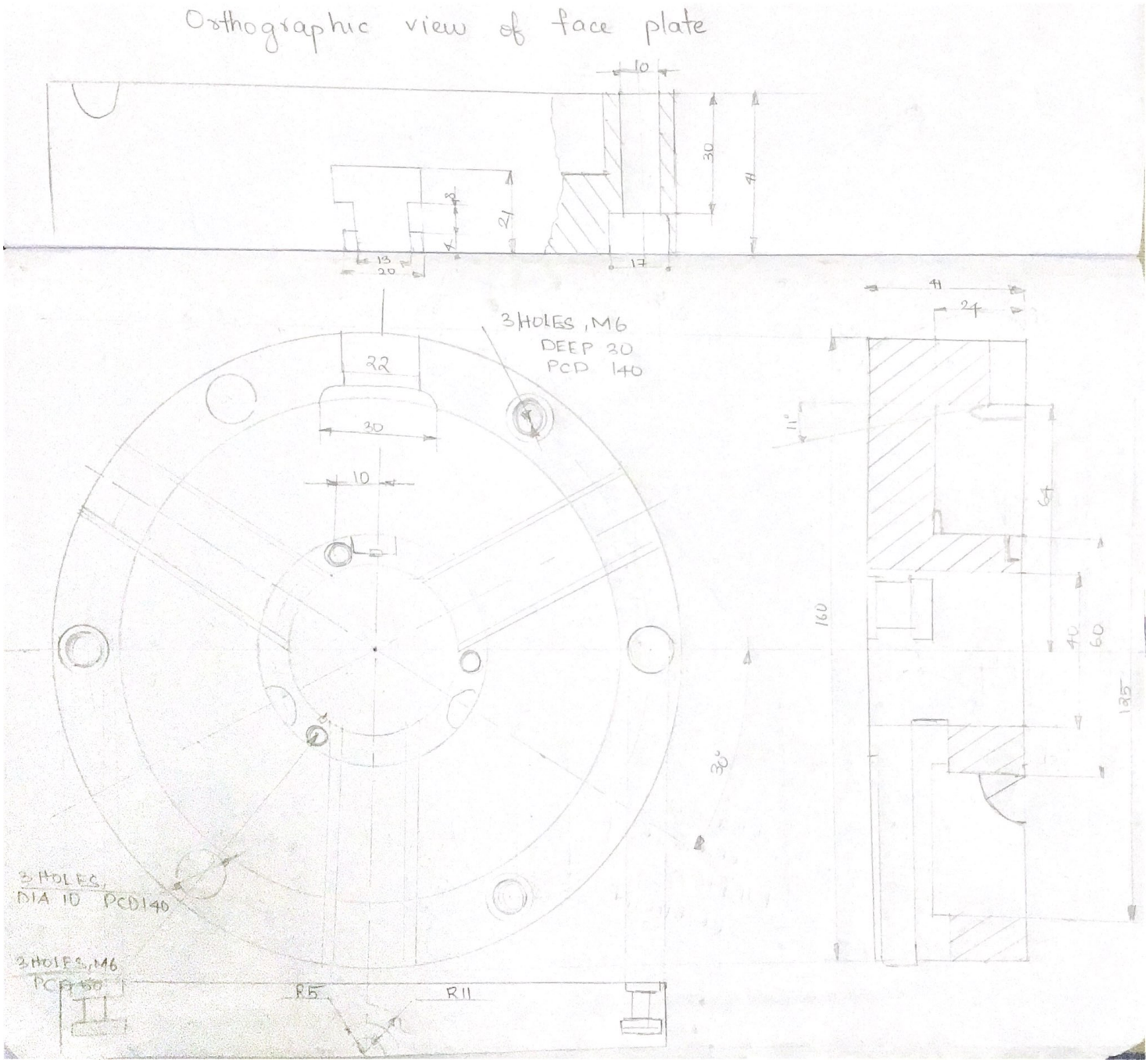


All dimensions in

Dimension vary with c
The values given here
given for N-204, Dichem

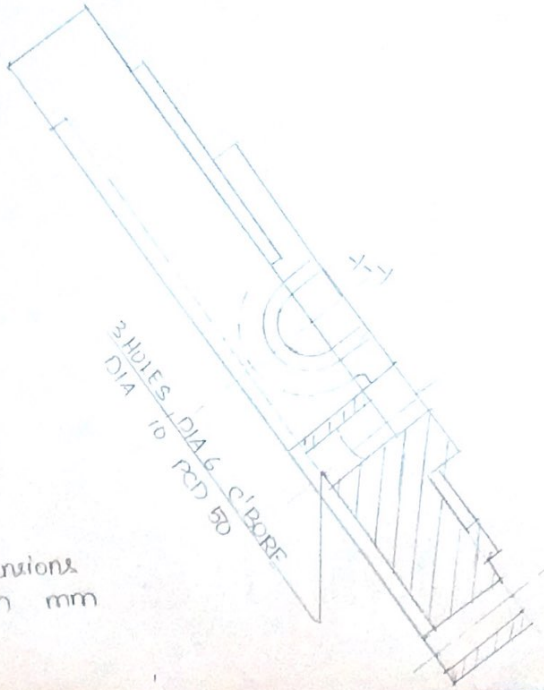
Detailed Orthographic View of Links

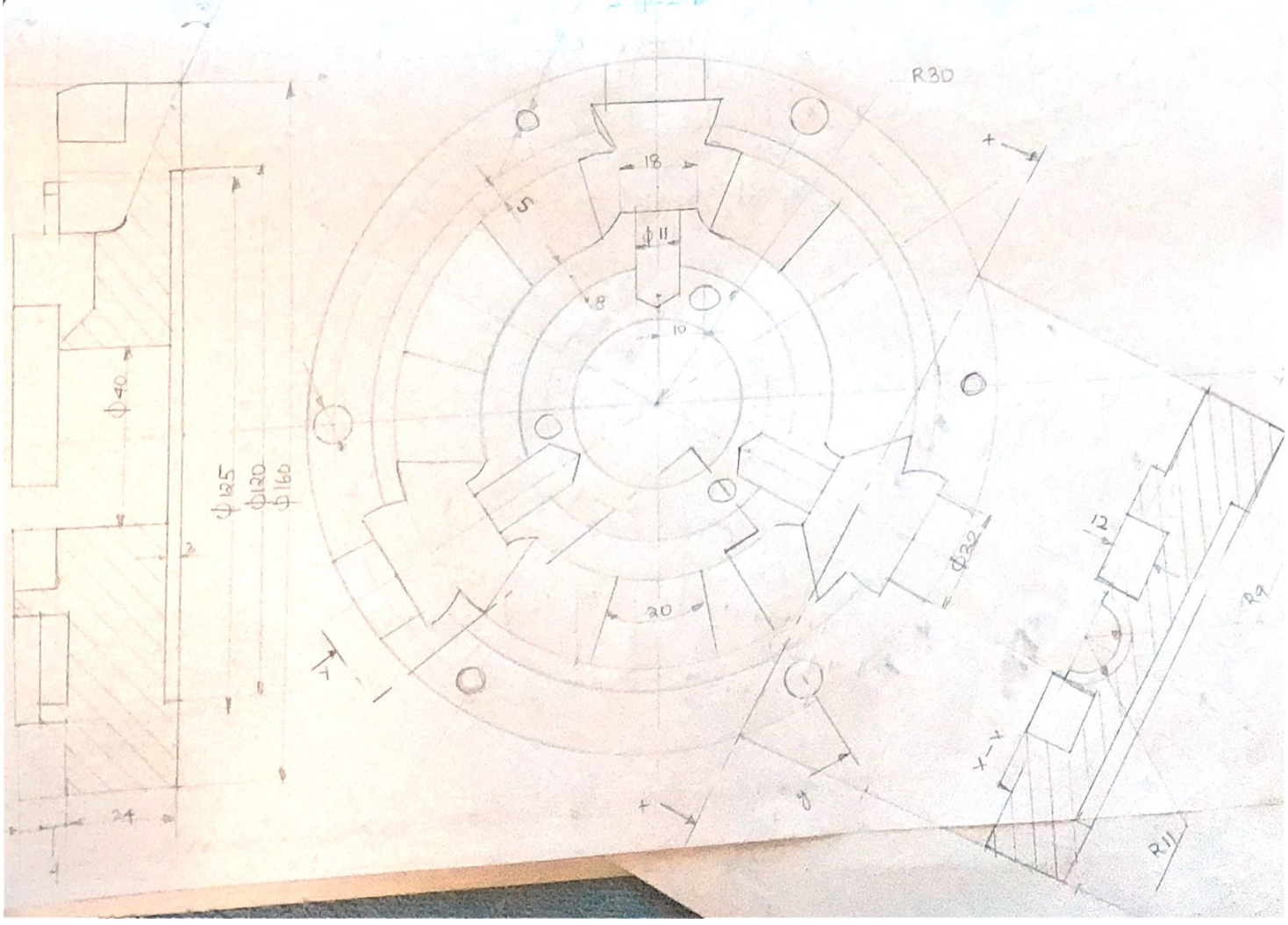
Orthographic view of face plate



Orthographic and sectional view of back plate

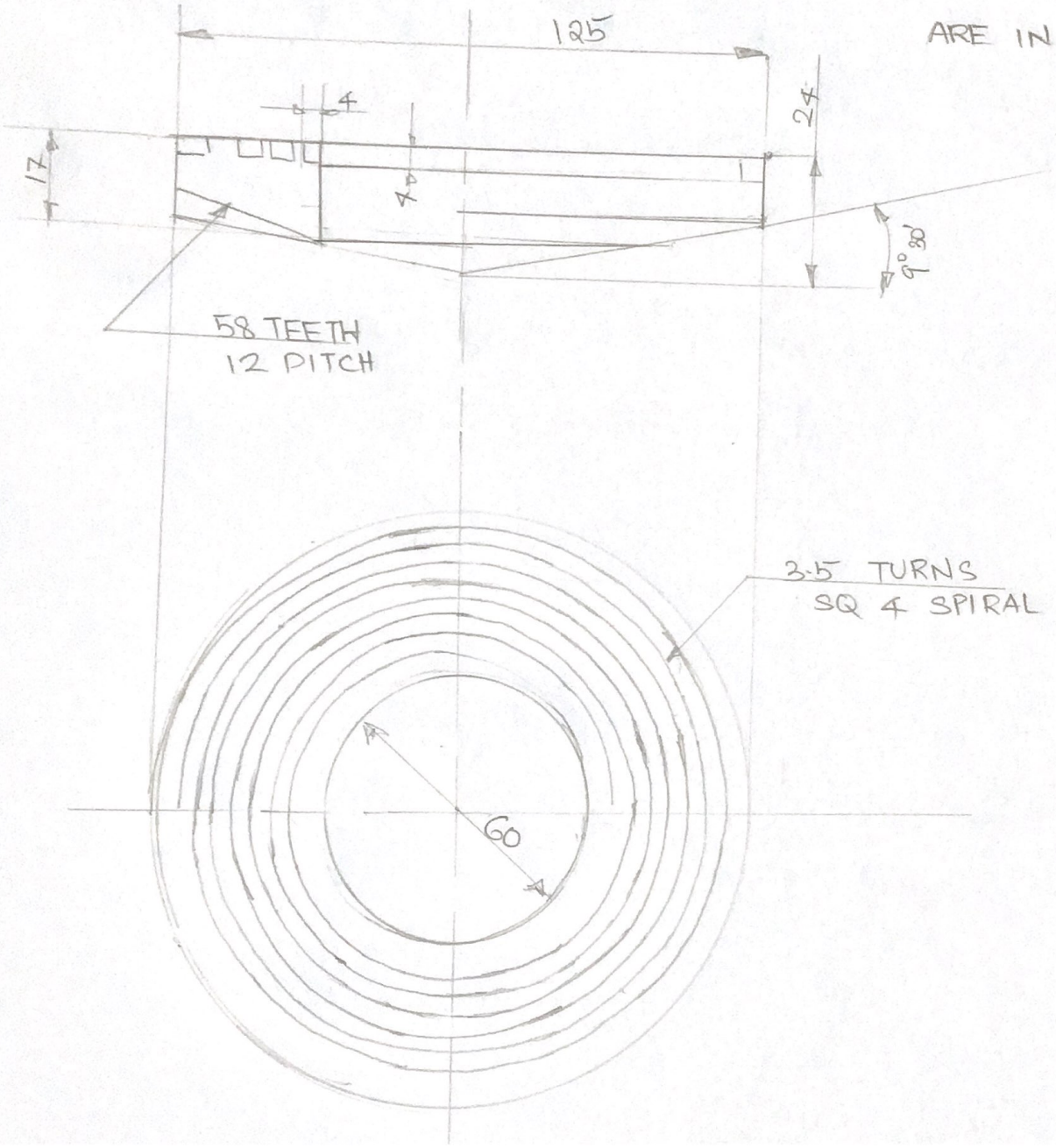
All dimensions are in mm

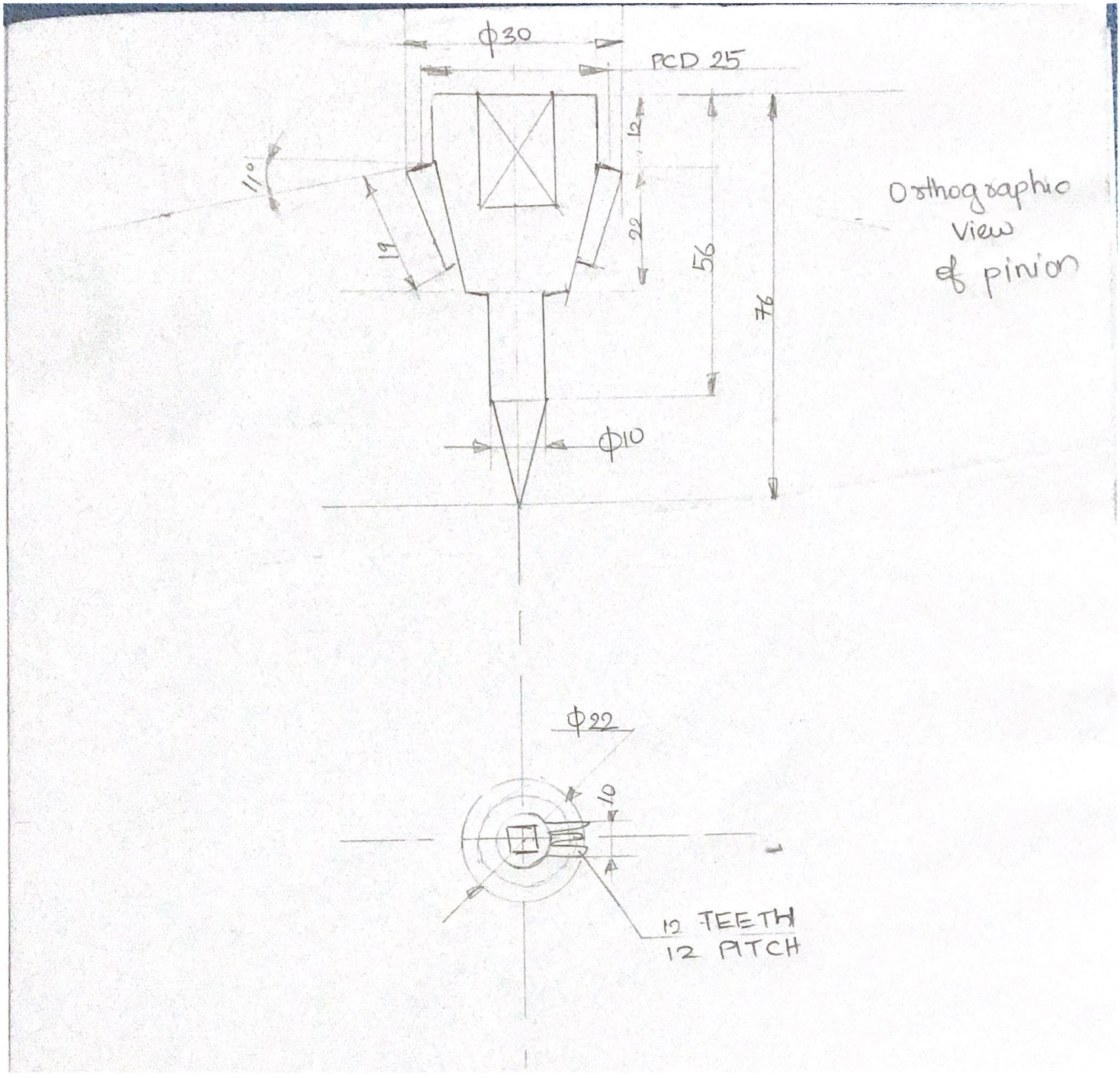




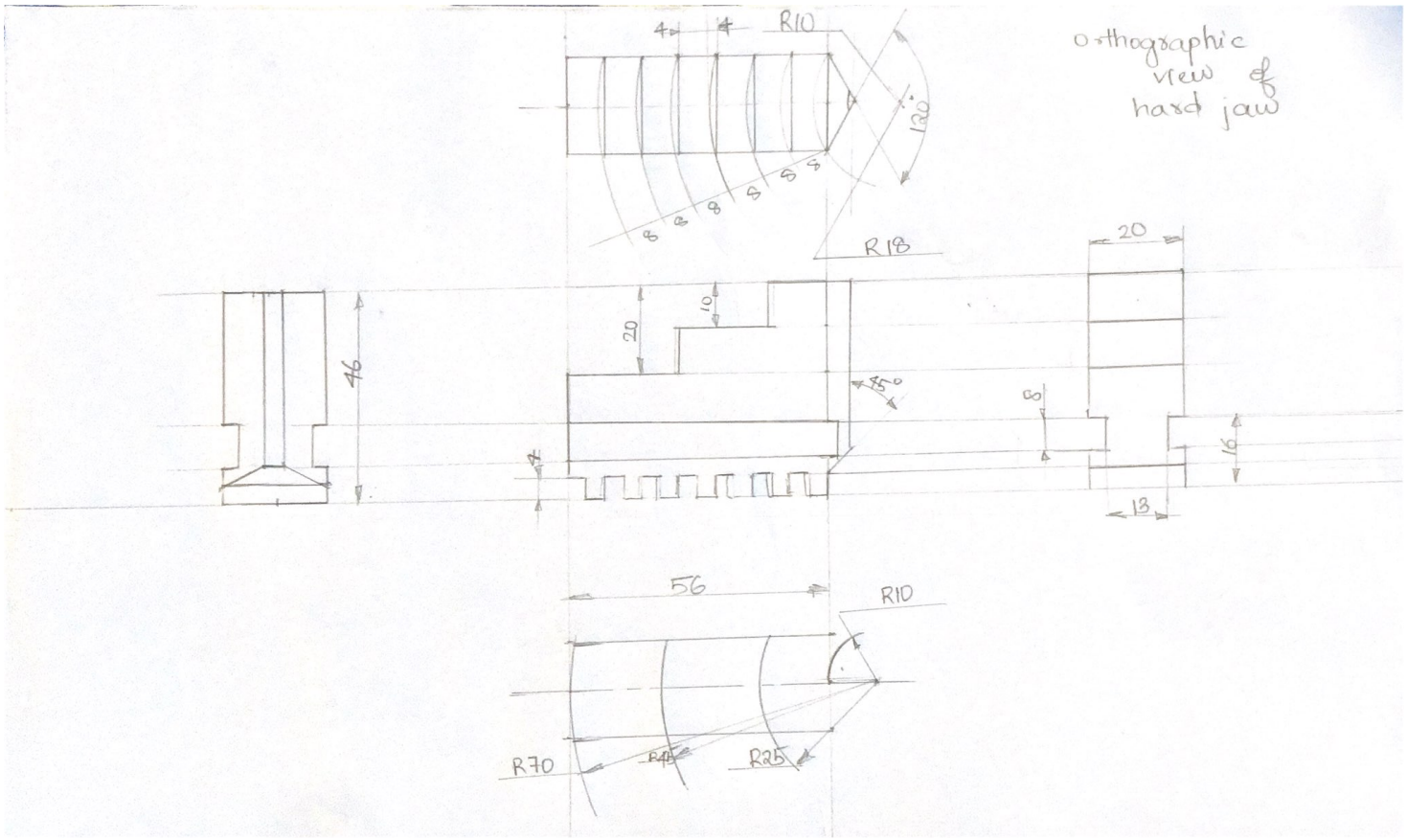
ORTHOGRAPHIC VIEW OF SPIRAL PLATE

All DIMENSION'S ARE IN mm





Orthographic View of pinion


orthographic view of hard jaw
4
4
R10
120
8
8
8
5
5
5
R18
20
10
20
45°
46
4
20
8
16
13
56
R10
R70
R45
R25

Method of Assembly:

The scroll plate is fitted into the circular recess at the back of the face plate. Three pinions are mounted in position in the face plate, such that, their teeth engage with those on the back of the scroll plate. The back plate is fastened onto the face plate by 6 bolts (or more sometimes) (back cover mounting bolts). This assembly is fastened onto the flange by 3 socket headed screws (back cover mounting bolts). The 3 jaws are joined using jaw mounting bolt. They are engaged with the scroll plate. By rotation of any one pinion by chuck key, the 3 jaws move in the radial direction to or from the centre. The threaded hole in the flange facilitates the mounting of the chuck in the threaded headstock spindle. This is done using chuck mounting bolts. The pinion was mounted into the face plate using pinion half ring and pinion sleeve.

Working:

When the pinion gear rotates (using chuck key), it rotate the scroll plate since the below surface of scroll plate has gear. Even a single pinion rotation will give movement to all jaw due to spiral mechanism. They move radially in or out depending on input rotation. Since their movement is uniform and radial, it is

as self centring mechanism.

- The ratio b/w pinion gear and scroll plate is an important parameter will determines the rotation of the scroll w.r.t pinion. Say ratio = n; Then if pinion move 360, scroll only moves $\frac{360}{n}$.

- Any parameter used to determine how much the jaws move is determined by spiral pitch. A pitch of y mm ⇒ when a spiral plate moves 360°, the jaw moves y mm radially.

Material

Basically we use cast iron and, hardened steel ~~for~~ manufacture. Cast iron is used for chuck body, back plate, scroll plate and pinion gears. This is because cast iron ~~has~~ is 1) tough
2) high machinability than steel.
3) Good wear resistance
4) Good vibration damping
5) Good corrosion resistance.

For the back plate specifically, if something goes wrong with the spindle threading to plate, spindle wins and we need to replace only a new backing plate. Such guarantee are not possible for steel. Cast iron is also nice to machine and it also minimizes the chances of galling when spinning the chuck on and off. This is useful for scroll plate and gears and also for back plate. A steel body can make them worse.

Now, why ~~can it~~ it ~~be~~ used for hard jaws? It may be used, but steel has some other advantages. First being cast iron is harder and stronger, but its not tough as

steel. It's brittle. Hard jaws require toughness so that they don't break or wear of while holding hard materials. Further it is very cheap. Here high machining is not required like for scroll plates.

- These components can be manufactured on a lathe by turning, drilling and other basic operations. Threading is needed for screws and scroll plate. Milling is done for jaws. A combination of general purpose lathe and universal milling machine is sufficient for chuck manufacture However other efficient and powerful techniques are used for large scale precise manufacturing.

Please refer reference 10 on how to make a Chuck by yourself

References

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