Preliminary Mechanical Design

1C03 - Milestone I

Group 41

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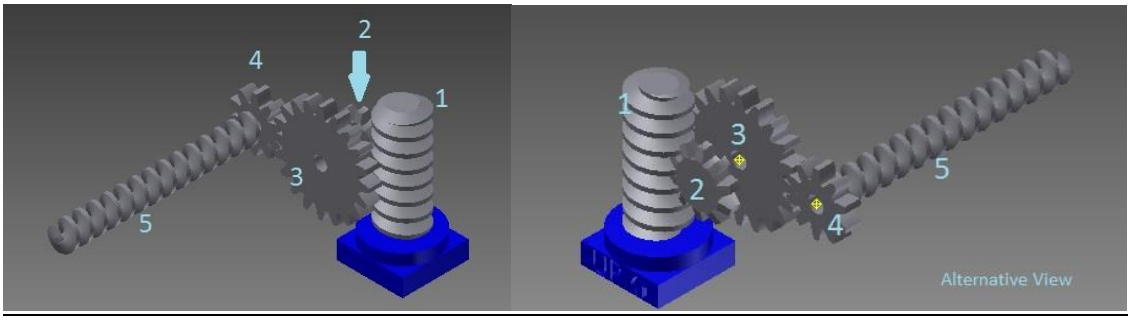
Mechanism Overview

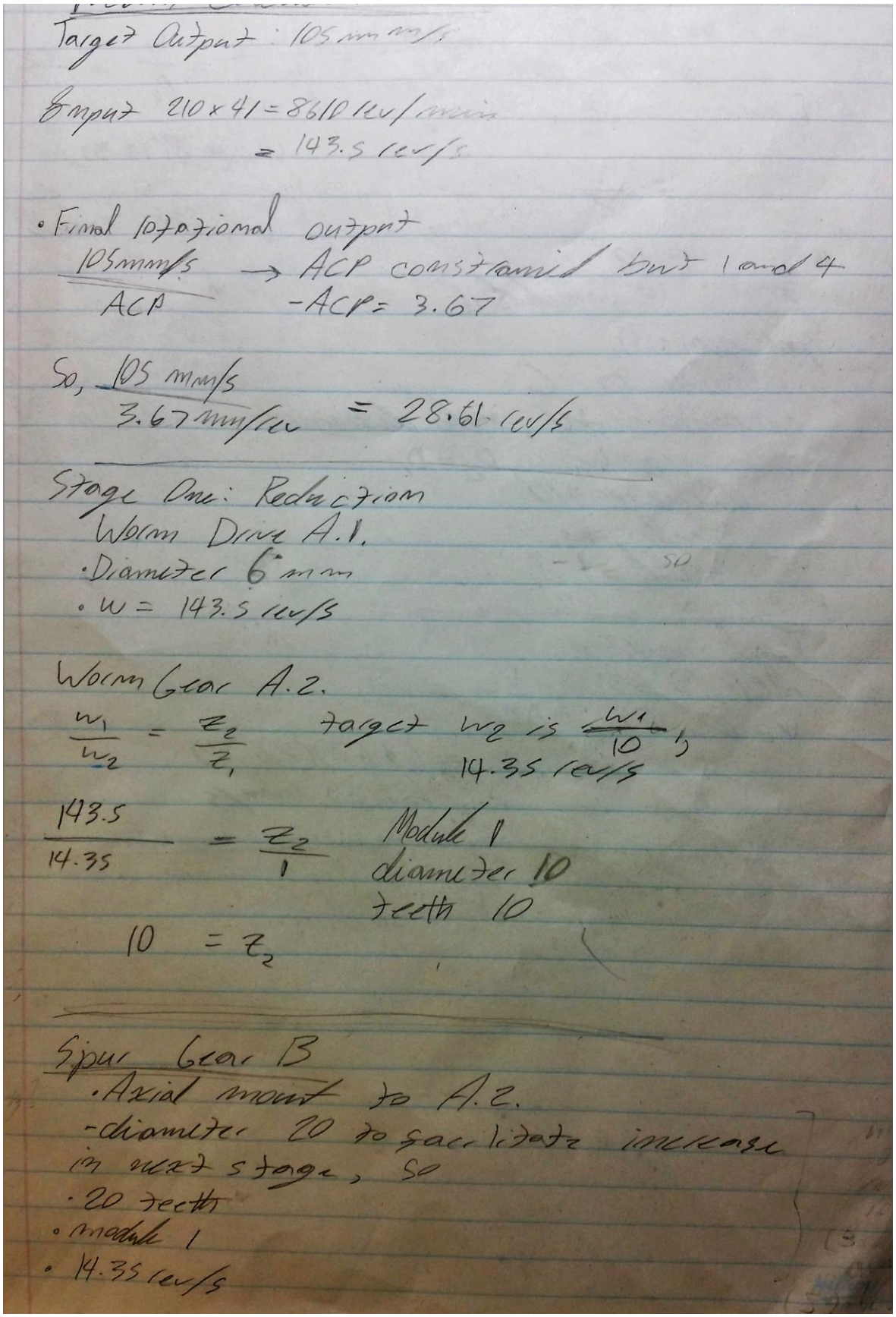


This mechanism has a total of five gears. The blue section in the above diagrams depicts the motor which drives the first worm (1). Gear 1 and gear 2 in the above diagram worm a worm-drive pair, meaning the worm gear (2) is turned by the first worm (1). The worm gear (2) then reduces the output of the worm (1) by a factor of 10 and is mounted to the first spur gear (3) at a distance such that the worm's (1) motion is unaffected by the first spur gear (3). Both, the worm gear (2) and the first spur gear (3), rotate at the same speed. In order to increase the speed again for the final output, the second spur gear (4), meshed with the first spur gear (3), provides an increase by a factor of 2. This motion is then transferred to the final worm (5) from the second spur gear (4) along an axial mount. The final worm (5) and second spur gear (4) rotate at the same speed. As the final worm (5) rotates, the pin, attached to the read head, moves horizontally. This converts the rotational motion into linear motion.

Group Meetings

The group has planned to meet every week on Wednesday at 6:30pm. The group will also meet during printing times, and any other necessary times needed outside our regular time on Wednesdays.

Calculations



Target Output: 105 mm/s

Input 210 × 41 = 8610 rev/min
= 143.5 rev/s

- Final rotational output
  105 mm/s / ACP → ACP constant but 1 and 4
  -ACP = 3.67

So, 105 mm/s / 3.67 mm/rev = 28.61 rev/s

Stage One: Reduction
Worm Drive A.1.
- Diameter 6 mm
- w = 143.5 rev/s

Worm Gear A.2.
$\frac{w_1}{w_2} = \frac{z_2}{z_1}$ target w_2 is $\frac{w_1}{10}$;
14.35 rev/s

$\frac{143.5}{14.35} = \frac{z_2}{1}$ Module 1
diameter 10
teeth 10

$10 = z_2$

Spur Gear B
- Axial mount to A.2.
- diameter 20 to facilitate increase in next stage, so
- 20 teeth
- module 1
- 14.35 rev/s

Spur gear C
• mesh to B
Diameter C = $\frac{D_B}{2}$
= $\frac{20}{2}$
= 10
teeth 10, module 1

$\frac{w_2}{w_1} = \frac{w_1}{14.35} = \frac{D_1}{D_0} = \frac{20}{10}$

$w_4 = 2(14.35)$
= 28.7 rev/s

Spur gear D
• mesh to C
• maintain w, make distance
so $w_2 = w_1$, $D_2 = D_1$
diameter = 10
teeth = 10
module = 1

Final worm
ACP 3.67
v = 105

$\frac{V}{ACP} = w$

$V = (3.67)(28.7)$
≈ 105.32 mm/s