

**Chapter 22****G CAR****A. OPEN B FILE.**

Step 1. When you start a new drawing away start with the B file. If you started this drawing as the B file go directly to Steps B. If your did not start as the B file complete these Steps: Click **Open** from the File Menu. Click **F1 No** to save current part. Key in **b** for the filename and press ENTER.

**B. CHANGE TO SIDE VIEW.**

Step 1. Change to the Side View. Use **ALT-V 2**. Hold down ALT and press V. Key in 2 and press ENTER.

**C. CREATE A RECTANGLE.**

Step 1. ESC to Main Menu.

Step 2. F1 CREATE.

Step 3. F1 LINE.

Step 4. F7 RECTANGLE.

Step 5. F2 WIDTH/HEIGHT.

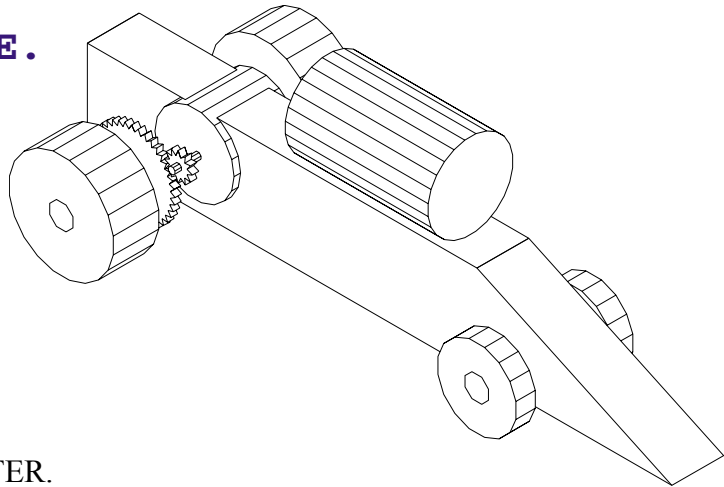
Step 6. Key in **9** for width and press ENTER.

Step 7. Key in **1.4** for height and press ENTER.

Step 8. F9 KEY IN.

Step 9. Key in:  
Zero (0) for coordinate X and press ENTER.  
0 for Y and press ENTER.  
0 for Z and press ENTER.

Step 10. Use **ALT-A** to center the drawing on the screen. Hold down ALT and press A.

**D. DRAW CHASSIS SHAPE.**

Step 1. ESC to Main Menu.

Step 2. F1 CREATE.

Step 3. F1 LINE.

Step 4. F1 ENDPOINTS.

Step 5. F6 ALONG LINE.

Step 6. To indicate Start Point move cursor to the top line of the chassis toward the front (right) and click, **Fig. 1**.

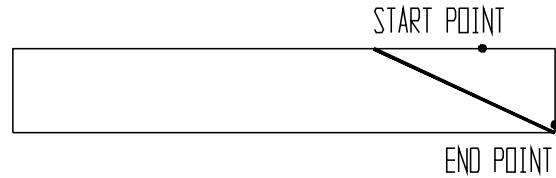


FIG. 1

Step 7. Key in 3 for distance and press ENTER.

Step 8. F3 ENDENT.

Step 9. To indicate End Point click the bottom front corner, **Fig. 1**.

Step 10. At this time it is a good idea to save the drawing. Click **Save As** from the File Menu. Key **g car** filename and press ENTER. Press ESC for Part Description.

### E. TRIM CHASSIS USING TRIM FIRST.

Step 1. ESC to Main Menu.

Step 2. F2 EDIT.

Step 3. F1 TRIM/EXTEND.

Step 4. F1 FIRST.

Step 5. To trim part of a line, click the line you are to keep, Line 1, **Fig. 2**. Move cursor close to the intersection with Line 2 and click.

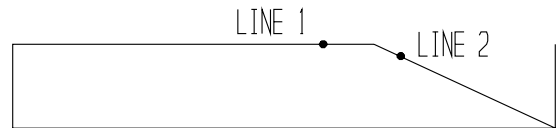


FIG. 2

Step 6. Delete Line 3, **Fig. 3**. Use **CTRL-Q** to delete the line. Hold down CTRL and press Q. Move the cursor over the line, select with a click and press ENTER.



FIG. 3

Step 7. Use CTRL-R to clear temporary markers. Hold down CTRL and press R.

### F. X-FORM THE 3rd DIMENSION FOR THE CHASSIS.

Step 1. Change to Isometric View. Use **ALT-V 7**. Hold down ALT and press V. Key in 7 and press ENTER.

Step 2. Use **ALT-A** to center the drawing on the screen. Hold down ALT and press A.

Step 3. ESC to Main Menu.

Step 4. F4 X-FORM.

Step 5. F1 DELTA.

Step 6. F3 JOIN.

Step 7. F7 ALL DISPLAYED.

Step 8. F1 ALL.

Step 9. Key in 1 for the Number of Copies and press ENTER.

Step 10. Key in:  
0 for dX and press ENTER.  
.8 for dY and press ENTER.  
0 for dZ and press ENTER.

Step 11. ESC to Main Menu.

Step 12. Save the drawing. Use **CTRL-S**.

### **G. CHANGE DISPLAY TO 4 VIEW PORTS.**

Step 1. ESC to Main Menu.

Step 2. Click Viewport from the Menu Bar.

Step 3. Click Layout from the Viewport menu.

Step 4. Click the bottom right viewport to set 4 viewports.

Step 6. Click on the top right viewport to make it active.

Step 7. Use **ALT-A** to center the drawings in the 4 viewports. **Then, press ENTER.**

Step 8. Turn on the Grid in all displays. Use **CTRL-G**. Hold down CTRL and press G.

Step 9. Click to **check All** in **Grid Properties**. Click OK.

### **H. CREATE THE REAR WHEELS.**

Step 1. Turn on Tracking. Use **CTRL-T**. Hold down CTRL and press T.

Step 2. F3 WORLD.

Step 3. When you move the cursor you can view the coordinates in the Tracking Window located at the bottom of the display.

Step 4. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 5. F1 VALUE.

Step 6. Key in **1.5** for the new depth and press ENTER.

Step 7. **Set the Snap to .1.** Use **CTRL-G**. Hold down CTRL and press G. Change the **Snap Properties Increment to X = .1 and Y = .1** Click OK.

Step 8. Draw the wheel in a different color. Change the color to **red**. Click the color swatch in the side Tool Bar. Click the red, number 2.

Step 9. ESC to Main Menu.

Step 10. F1 CREATE.

Step 11. F5 POLYLINE.

Step 12. F3 N-GON.

Step 13. Key in **20** for the Number of Sides and press ENTER.

Step 14. Key in 0 for Rotation Angle.

Step 15. Key in **.8** for Radius.

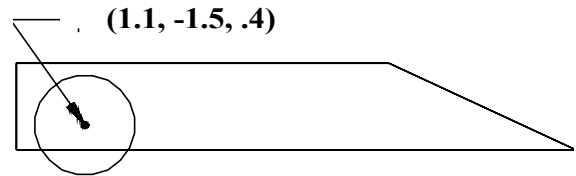


FIG. 4

Step 17. In the Side View, move cursor to coordinates **(1.1, -1.5, .4)** and click for the center of the wheel, **Fig. 4**.

Step 18. Use **ALT-A** to center the drawing in the view ports. Hold down ALT and press A. Press ENTER.

## **I. CREATE THE FRONT WHEELS.**

Step 1. ESC to Main Menu.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **.5** for the new depth and press ENTER.

Step 5. F1 CREATE.

Step 6. F5 POLYLINE.

Step 7. F3 N-GON.

Step 8. Key in **16** for the Number of Side and press ENTER.

Step 9. Key in 0 for Rotation Angle.

Step 10. Key in **.6** for Radius.

Step 11. F2 FLAT.

Step 12. In the Side View, move cursor to coordinates **(6.5, -.5, .3)** and click for the center of the wheel, **Fig. 5**.

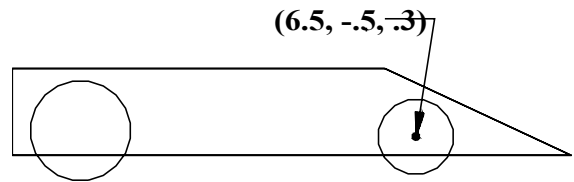


FIG. 5

### J. ADD THE 3rd DIMENSION TO WHEELS.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

Step 6. In the Isometric View, click on **rear wheel, Fig. 6** and press ENTER.

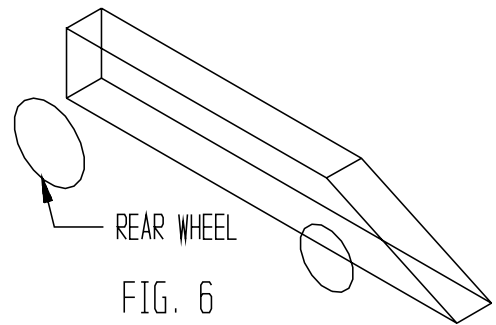


FIG. 6

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:  
0 for dX and press ENTER.  
.7 for dY and press ENTER.  
0 for dZ and press ENTER.

Step 9. F10 BACKUP **two times**.

Step 10. F1 SINGLE.

Step 11. In the Isometric View, click on the **front wheel, Fig. 7** and press ENTER.

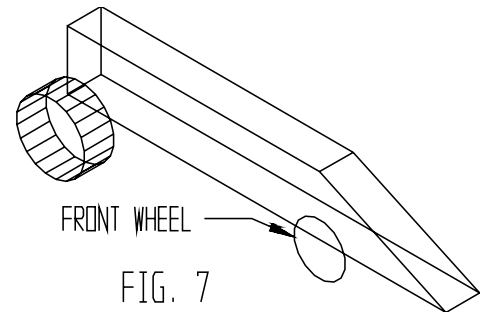


FIG. 7

Step 12. Key in 1 for the Number of Copies and press ENTER.

Step 13. Key in:  
0 for dX and press ENTER.  
.3 for dY and press ENTER.  
0 for dZ and press ENTER.

Step 14. Save the drawing. Use **CTRL-S**.

**K. MIRROR WHEELS TO OTHER SIDE OF CHASSIS.**

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F5 MIRROR.

Step 4. F2 COPY.

Step 5. F3 WINDOW.

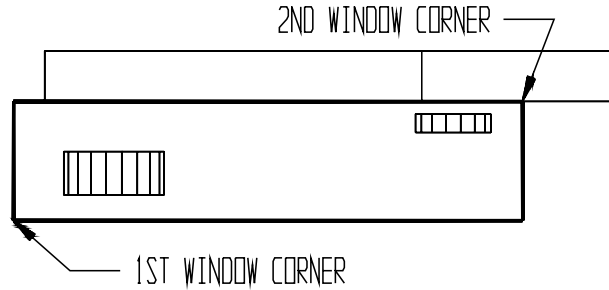


FIG. 8

Step 6. In the Top View, window around the both wheels. To window, move the cursor to just below and outside the rear wheel and click to start the 1ST WINDOW CORNER, **Fig 8**. Stretch the window to surround both wheels. Click to set 2ND WINDOW CORNER.

Step 7. F1 1 POINT HORIZONTAL.

Step 8. F4 CENTER.

Step 9. In the Top View, to indicate position on the plane, click the rear vertical line of the chassis rectangle, **Fig. 9**.

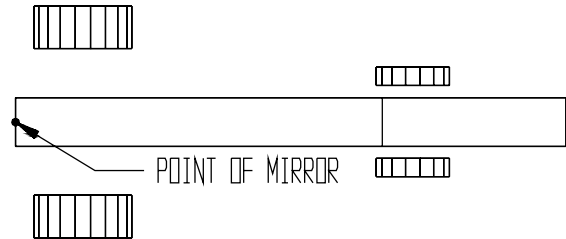


FIG. 9

Step 10. ESC to Main Menu.

Step 11. Use **ALT-A** to center the drawing in the view ports. Press ENTER.

Step 12. Save the drawing. Use **CTRL-S**.

**L. CREATE THE AXLES.**

Step 1. Draw the axles in a different color. Change the color to **yellow**. Click the color swatch in the side Tool Bar. Click the yellow, number 4.

Step 2. ESC to Main Menu.

Step 3. F1 CREATE.

Step 4. F5 POLYLINE.

Step 5. F3 N-GON.

Step 6. Key in **8** for the Number of Sides and press ENTER.

Step 7. Key in **0** for Rotation Angle.

Step 8. Key in **.18** for Radius.

Step 9. F2 FLAT.

Step 10. In the Side View, move cursor to the center of the front wheel, coordinates (6.5, -.5, .3) and click for the center of the front axle, **Fig. 10**.

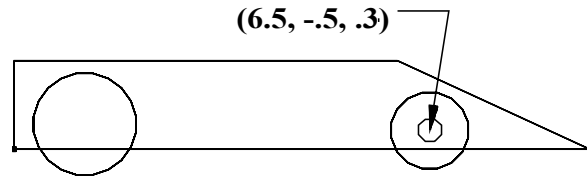


FIG. 10

Step 11. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 12. F1 VALUE.

Step 13. Key in **1.5** for the new depth and press ENTER.

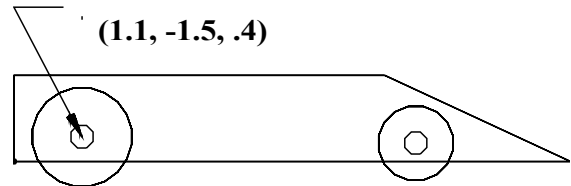


FIG. 11

Step 14. In the Side View, move cursor to the center of the rear wheel, coordinates (1.1, -1.5, .4) and click for the center of the rear wheel, **Fig. 11**.

### M. ADD 3rd DIMENSION TO AXLES.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

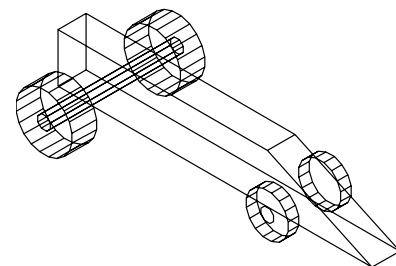
Step 6. In the Side View, click the **rear axle**, **Fig. 12** and press ENTER.



FIG. 12

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:  
0 for dX and press ENTER.  
3.8 for dY and press ENTER.  
0 for dZ and press ENTER.



Step 9. F10 BACK UP **two times** to choose new option.

Step 10. F1 SINGLE.

Step 11. In the Side View, click the **front axle**, **Fig. 13** and press ENTER.

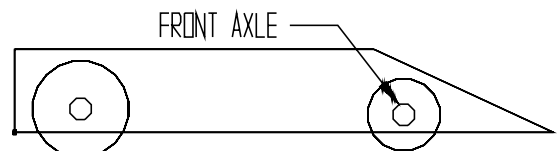
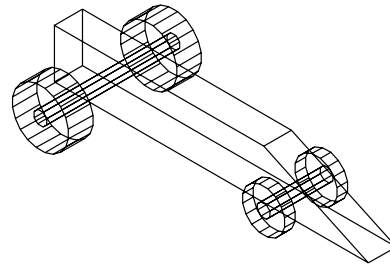


FIG. 13

Step 12. Key in 1 for the Number of Copies and press ENTER.

- Step 13. Key in:  
 0 for dX and press ENTER.  
 1.8 for dY and press ENTER.  
 0 for dZ and press ENTER.



- Step 14. ESC to Main Menu.  
 Step 15. Save the drawing. Use **CTRL-S**.

**N. CREATE MOTOR.**

- Step 1. Draw the motor in a different color. Change the color to **pink**. Click the color swatch in the side Tool Bar. Click the pink, number 13.  
 Step 2. **Set the Snap to .05**. Use **CTRL-G**. Hold down CTRL and press G. Change the **Snap Properties Increment to X = .05 and Y = .05** Click OK.  
 Step 3. **Change the Depth**. Use **CTRL-D**. Hold down CTRL and press D.  
 Step 4. F1 VALUE.  
 Step 5. Key in **.1** for the new depth and press ENTER.  
 Step 6. ESC to Main Menu.  
 Step 7. F1 CREATE.  
 Step 8. F5 POLYLINE.  
 Step 9. F3 N-GON.  
 Step 10. Key in **18** for the Number of Sides and press ENTER.

- Step 11. Key in 0 for Rotation Angle.  
 Step 12. Key in **.6** for Radius.

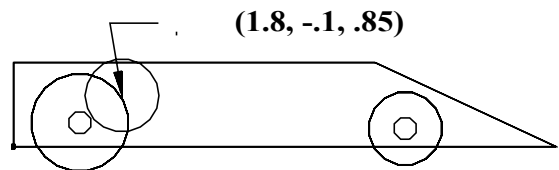


FIG. 14

- Step 13. F2 FLAT.  
 Step 14. In the Side View, move cursor to coordinates **(1.8, -1, .85)** and click for the center of the motor, **Fig. 14**.

**O. DRAW THE MOTOR SHAFT.**

- Step 1. Draw the motor shaft in a different color. Change the color to **peach**. Click the color swatch in the side Tool Bar. Click the peach, number 12.  
 Step 2. ESC to Main Menu.

Step 3. F1 CREATE.

Step 4. F5 POLYLINE.

Step 5. F3 N-GON.

Step 6. Key in **8** for the Number of Side and press ENTER.

Step 7. Key in **0** for Rotation Angle.

Step 8. Key in **.05** for Radius.

Step 9. F2 FLAT.

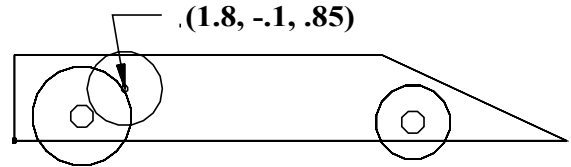


FIG. 15

Step 10. In the Side View, move cursor to the center of the motor, coordinates **(1.8, -.1, .85)** and click for the center of the motor shaft, **Fig. 15**.

Step 11. Use CTRL-R to clear temporary markers. Hold down CTRL and press R. Then, press ENTER.

Step 12. Save the drawing. Use **CTRL-S**.

**P. ADD THE 3rd DIMENSION TO MOTOR SHAFT.**

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

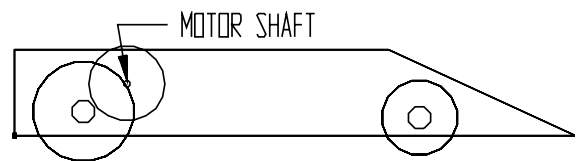
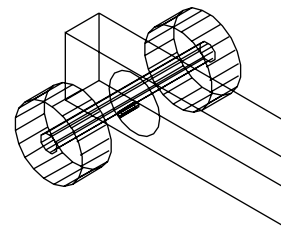


FIG. 16

Step 6. In the Side View, click the polygon of the motor shaft, **Fig. 16**, and press ENTER.

Step 7. Key in **1** for the Number of Copies and press ENTER.

Step 8. Key in:  
 0 for dX and press ENTER.  
 -.4 for dY and press ENTER.  
 0 for dZ and press ENTER.



**Q. ADD THE 3rd DIMENSION TO MOTOR.**

Step 1. Draw the motor in a different color. Change the color to **pink**. Click the color swatch in the side Tool Bar. Click the pink, number 13.

Step 2. ESC to Main Menu.

Step 3. F4 X-FORM.

Step 4. F1 DELTA.

Step 5. F3 JOIN.

Step 6. F1 SINGLE.

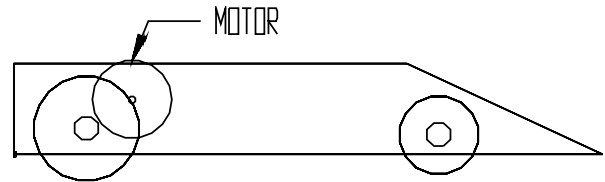
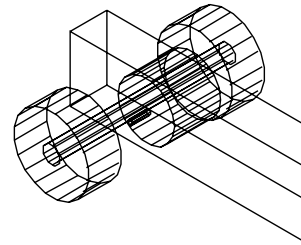


FIG. 17

Step 7. Click the motor polygon, **Fig. 17**, and press ENTER.

Step 8. Key in 1 for the Number of Copies and press ENTER.

Step 9. Key in:  
0 for dX and press ENTER.  
1 for dY and press ENTER.  
0 for dZ and press ENTER.



Step 10. Save the drawing. Use **CTRL-S**.

**R. RETRIEVE BIG GEAR PATTERN FILE.**

Step 1. ESC to Main Menu.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **.4** for the new depth and press ENTER.

Step 5. Click the **File** from the Menu Bar.

Step 6. Click **Import** from the File Menu..

Step 7. Click **CADKEY Pattern** from the Sub-Menu.

Step 8. Key in **gearbig** for the filename and press ENTER.

Step 9. F2 YES to Group Pattern.

Step 10. Press ENTER to accept the default group filename.

Step 11. F1 CURRENT LEVEL.

Step 12. Press ENTER to accept the default Scale Factor of 1.

Step 13. Press ENTER to accept the default 0 Rotation Angle.



FIG. 18

Step 14. In the Side View, move cursor to the center of the **rear axle**, coordinates (1.1, -.4, .4) and click for the center of the big gear, **Fig. 18**.

### S. RETRIEVE SMALL GEAR PATTERN FILE.

Step 1. ESC to Main Menu.

Step 2. Click the **File** from the Menu Bar.

Step 3. Click **Import** from the File Menu..

Step 4. Click **CADKEY Pattern** from the Sub-Menu.

Step 5. Key in **gearsml** as filename and press ENTER.

Step 6. F2 YES to Group Pattern.

Step 7. Press ENTER to accept the default group filename.

Step 8. F1 CURRENT LEVEL.

Step 9. Press ENTER to accept the default Scale Factor of 1.

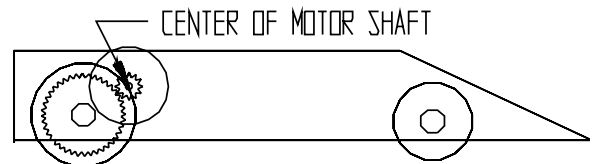


FIG. 19

Step 10. Press ENTER to accept the default 0 Rotation Angle.

Step 11. Move cursor to the center of the motor shaft, coordinates (1.8, -.4, .85) and click for the center of the small gear, **Fig. 19**.

Step 12. Save the drawing. Use **CTRL-S**.

### T. ADD 3rd DIMENSION TO BOTH GEARS.

Step 1. ESC to Main Menu.

Step 2. Draw the big gear 3rd dimension in a different color. Change the color to **red**. Click the color swatch in the side Tool Bar. Click the red, number 2.

Step 3. F4 X-FORM.

Step 4. F1 DELTA.

Step 5. F3 JOIN.

Step 6. F4 GROUP.

Step 7. F1 SELECT.

Step 8. Click on the big gear, **Fig. 20**.

Step 9. Key in 1 for the Number of Copies and press ENTER.

Step 10. Key in:  
 0 for dX and press ENTER.  
 .1 for dY and press ENTER.  
 0 for dZ and press ENTER.

Step 11. F10 BACKUP **two times**.

Step 12. Draw the small gear 3rd dimension in a different color. Change the color to **green**. Click the color swatch in the side Tool Bar. Click the green, number 1.

Step 13. F4 GROUP.

Step 14. F1 SELECT.

Step 15. Click on the small gear, **Fig. 21**.

Step 16. Key in 1 for the Number of Copies and press ENTER.

Step 17. Key in:  
 0 for dX and press ENTER.  
 .2 for dY and press ENTER.  
 0 for dZ and press ENTER.

Step 18. ESC to Main Menu.

Step 19. Save the drawing. Use **CTRL-S**.

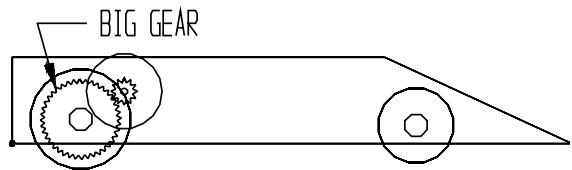


FIG. 20

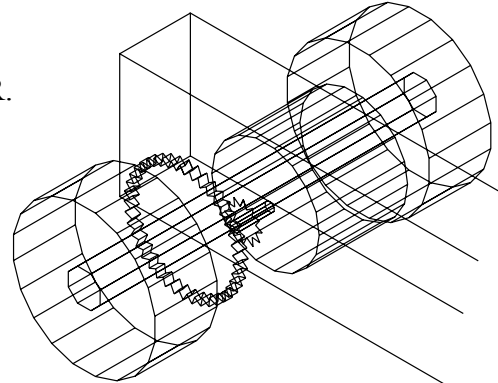
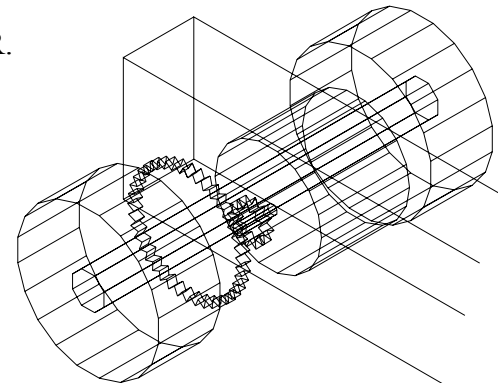


FIG. 21



## **U. CREATE BATTERY IN FRONT VIEW.**

Step 1. Draw the battery in a different color. Change the color to **dark blue**. Click the color swatch in the side Tool Bar. Click the dark blue, number 8.

Step 2. **Change the Depth.** Use **CTRL-D**. Hold down CTRL and press D.

Step 3. F1 VALUE.

Step 4. Key in **5.5** for the new depth and press ENTER.

Step 5. ESC to Main Menu.

Step 6. F1 CREATE.

Step 7. F5 POLYLINE.

Step 8. F3 N-GON.

Step 9. Key in **24** for the Number of Sides and press ENTER.

Step 10. Key in 0 for Rotation Angle.

Step 11. Key in **.65** for Radius.

Step 12. F2 FLAT.

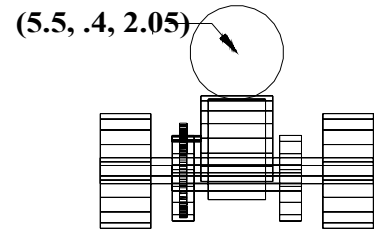


FIG. 22

Step 13. In the Front View, move cursor to the coordinates **(5.5, .4, 2.05)** and click for the center battery, **Fig. 22**.

## V. ADD 3rd DIMENSION TO THE BATTERY.

Step 1. ESC to Main Menu.

Step 2. F4 X-FORM.

Step 3. F1 DELTA.

Step 4. F3 JOIN.

Step 5. F1 SINGLE.

Step 6. In the Front View click on the battery, **Fig. 23** and press ENTER.

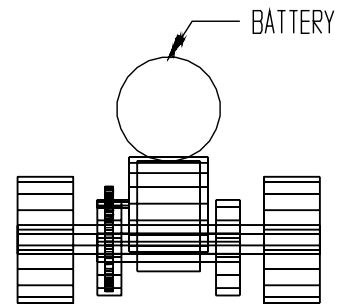


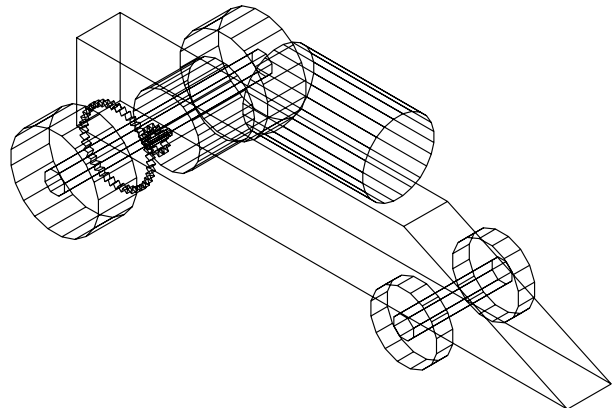
FIG. 23

Step 7. Key in 1 for the Number of Copies and press ENTER.

Step 8. Key in:  
**-2.2** for dX and press ENTER.  
 0 for dY and press ENTER.  
 0 for dZ and press ENTER.

Step 9. ESC to Main Menu.

Step 10. Save the drawing. Use **CTRL-S**.



**W. CREATE LAYOUT VIEW.**

Step 1. G Car construction is now complete. The final step is to create a layout drawing of the G Car in three different views, plus the Isometric View.

Step 2. ESC to Main Menu.

Step 3. Click the **down arrow** on the top Tool Bar until the **Layout Button** is displayed.

Step 4. Click the **Layout Button**.

Step 5. Key in: **gcar** for the Name.

Step 6. Set the **Paper Size** to **B**.

Step 7. Set the **Drawing Scale** to **1:1**.

Step 8. Click OK.

Step 9. F5 INSTANCE.

Step 10. F1 CREATE.

Step 11. Select **Top View** and click OK.

Step 12. Key in **0** for Rotation Angle and Press ENTER.

Step 13. F9 KEYIN.

Step 14. Key in:                   For **TOP VIEW**,  
    **5** for X and press ENTER.  
    **6.5** for Y and press ENTER.  
    **0** for Z and press ENTER.

Step 15. F1 CREATE.

Step 16. Select **Front View** and click OK.

Step 17. Key in **0** for Rotation Angle and Press ENTER.

Step 18. F9 KEYIN.

Step 19. Key in:                   For **FRONT VIEW**,  
    **5** for X and press ENTER.  
    **2** for Y and press ENTER.  
    **0** for Z and press ENTER.

Step 20. F1 CREATE.

Step 21. Select **Left View** and click OK.

Step 22. Key in **0** for Rotation Angle and Press ENTER.

Step 23. F9 KEYIN.

Step 24. Key in: For **LEFT VIEW**,  
**13.2** for X and press ENTER.  
**2** for Y and press ENTER.  
**0** for Z and press ENTER.

Step 25. F1 CREATE.

Step 26. Select **Isometric View** and click OK.

Step 27. Key in **0** for Rotation Angle and Press ENTER.

Step 28. F9 KEYIN.

Step 29. Key in: For **ISOMETRIC VIEW**,  
**13.4** for X and press ENTER.  
**7.7** for Y and press ENTER.  
**0** for Z and press ENTER.

## Z. REFINE THE VIEWS.

Sep 1. Window, ALT-W in and delete the line that can not be seen in the Isometric View. Use CTRL-Q to delete.

Use ALT-B to go back to a previous view, instead of going to ALT-A.

Step 2. Trim lines, Use ESC, EDIT, TRIM and both First and Divide. Be careful!!.

