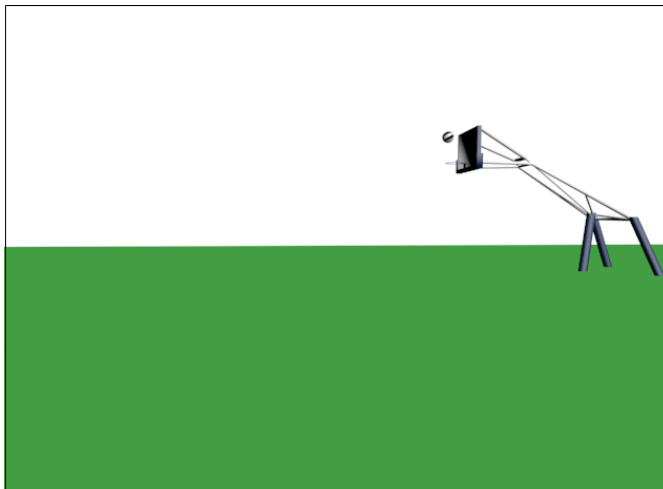# Chapter *15*

Complex Animation

Learning Objectives

After completing this chapter, you will be able to:

• *Create dummy objects*
• *Use graph editor to add, copy, and position keys*
• *Create snapshot objects*
• *Hide objects during animation*
• *Animate and link camera*

INTRODUCTION

In this chapter, you will learn to animate objects using dummy objects. Dummy objects link the objects to control their movement. If several objects are linked to a dummy object, the dummy can be used to move all objects simultaneously. The objects linked to a dummy can also be moved individually without affecting the dummy object or any other object linked to the dummy object.

TUTORIAL

Before starting the tutorial, you need to download the *c15_3dsmax_2020_tut.zip* file from *www.cadcim.com*. The path of the file is as follows: *Textbooks > Animation and Visual Effects > 3ds Max > Autodesk 3ds Max 2020 for Beginners: A Tutorial Approach*

Extract the contents of the zip file and save them in the *Documents* folder.

Tutorial 1

In this tutorial, you will create the animation of a steel manufacturing process. You will create dummy objects to assist in movement during animation, refer to Figure 15-1.
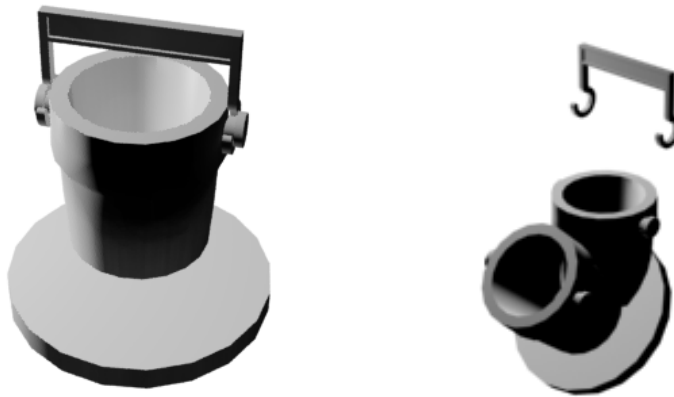
(Expected time: 35 min)

Figure 15-1 *Animation at different frames*

The following steps are required to complete this tutorial:

a.   Create the project folder.
b.   Open the file.
c.   Create dummy objects.
d.   Link the objects.
e.   Set continuity value.
f.   Animate the hook and cauldron.
g.   Add a position key.
h.   Create a snapshot.

i.   Hide the object during animation.
j.   Hide the object using object properties.
k.   Preview the animation.
l.   Set the camera view.
m.   Save and preview the animation.

Creating the Project Folder
Create the project folder with the name *c15_tut1* in the *3dsmax 2020* folder, as discussed in earlier chapters.

Opening the File
1.   Choose **Open** from the **File** menu; the **Open File** dialog box is displayed. In this dialog box, browse to the location *\Documents\c15_3dsmax_2020_tut* and select the **c15_tut1_start. max** file from it. Choose the **Open** button to open the file, refer to Figure 15-2.

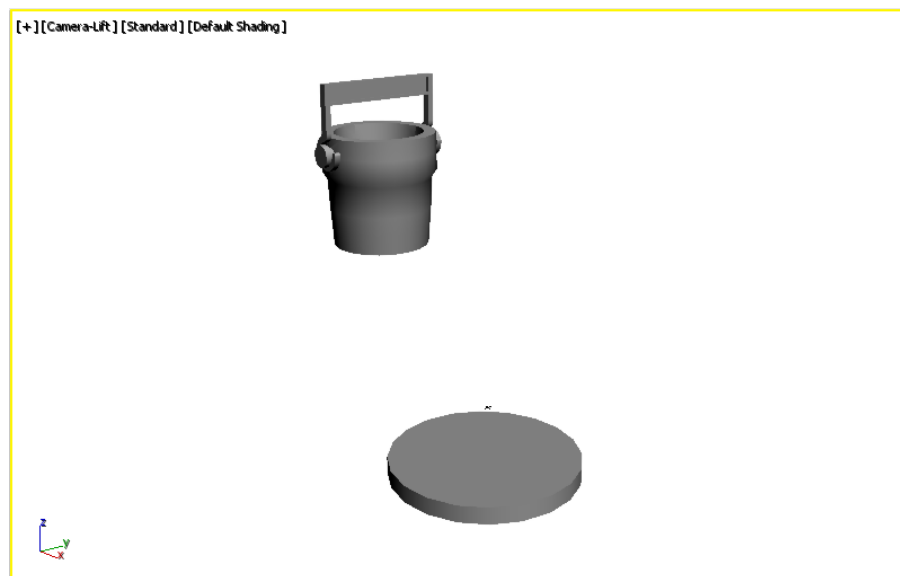[+] [Camera-Lift] [Standard] [Default Shading]

Figure 15-2 The c15_tut1_start.max file

2.   Choose **Save As** from the **File** menu; the **Save File As** dialog box is displayed. Browse to the location *\Documents\3dsmax 2020\c15_tut1\scenes*. Save the file with the name *c15tut1.max* at this location.

Creating Dummy Objects
In this section, you will set the number of frames in the animation and create dummy objects.

1.   Choose the **Time Configuration** button from the animation playback controls; the **Time Configuration** dialog box is displayed, as shown in Figure 15-3.

2.   In the **Animation** area, set **150** in the **Length** spinner and choose the **OK** button; the total number of frames for the animation is set to 150.
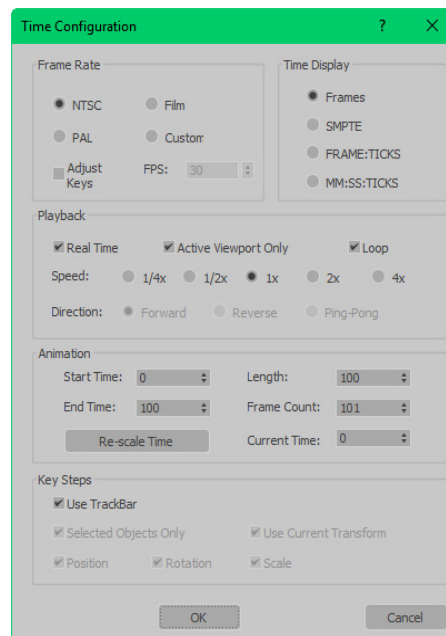
*Figure 15-3 The **Time Configuration** dialog box*

3. Choose **Create > Helpers** in the **Command Panel**. Next, invoke the **Dummy** tool from the **Object Type** rollout.

4. Restore the four viewports configuration and activate the Front viewport by clicking on it.

5. Click at a point below *Cauldron* and drag the mouse to create a small cube. Next, move the cube in the Left viewport to position it below *Cauldron*; a dummy object is created, as shown in Figure 15-4.

    The size of the cube does not matter. This cube is the dummy object and will not be visible in the rendered animation. Resize the cube such that you can select it easily and it also does not interfere with the selection of other objects in the scene.

6. Enter **Cal-Dummy** in the **Name and Color** rollout.

7. Invoke the **Dummy** tool again from the **Object Type** rollout. In the Front viewport, click at a point below *Base* and drag the cursor to create another small cube. Adjust the position of the cube in the Left viewport to position it below *Base,* as shown in Figure 15-5.

8. Enter **Base-Dummy** in the **Name and Color** rollout.

9. Activate the Top viewport. Next, use the **Align** tool from the **Main Toolbar** to center *Base-Dummy* with the center of the Base object along the X and Y axes. Also, align the center of *Cal-Dummy* with the center of *Cauldron* along the X and Y axes.
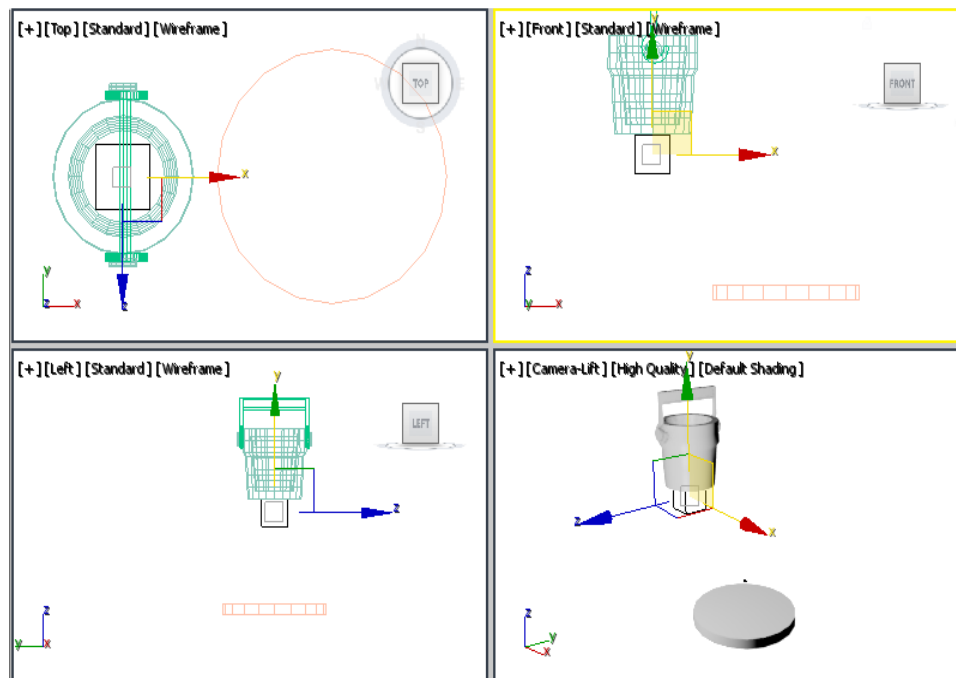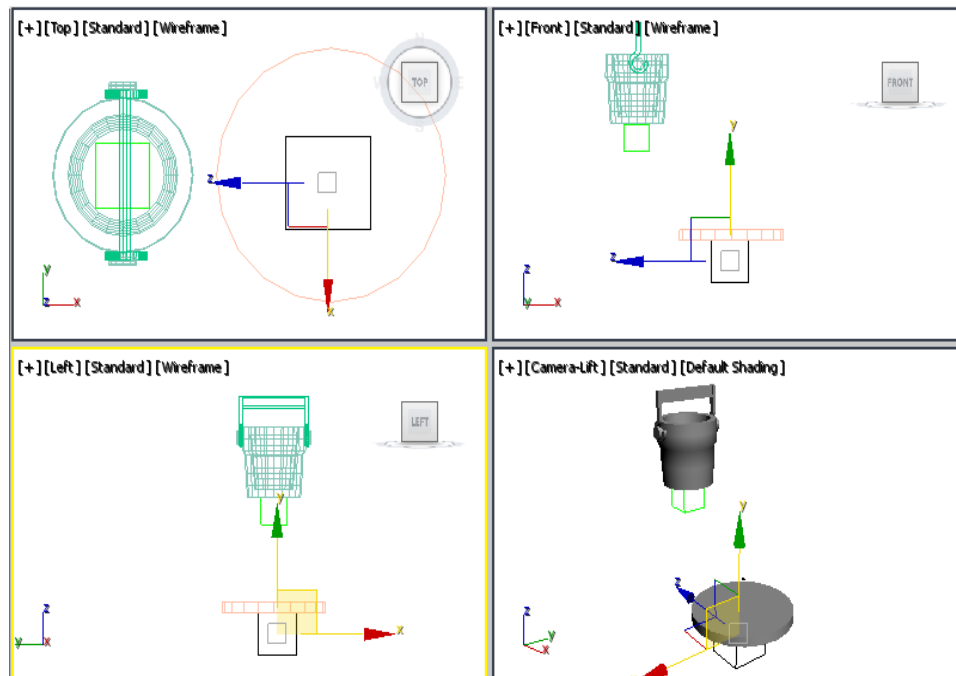
Figure 15-4 *A dummy object created*

Figure 15-5 *Adjusting the position of the cube below Base*

Linking the Objects

In this section, you will link the objects in the scene. Linking more than one object to a dummy object simplifies the animation process and allows individual movement later in the animation.

1. Invoke the **Select and Link** tool from the **Main Toolbar**.

2. Click *Cauldron* and drag the cursor to *Cal-Dummy* and then release the left mouse button, refer to Figure 15-6. Invoke the **Select Object** tool to exit the **Select and Link** tool.
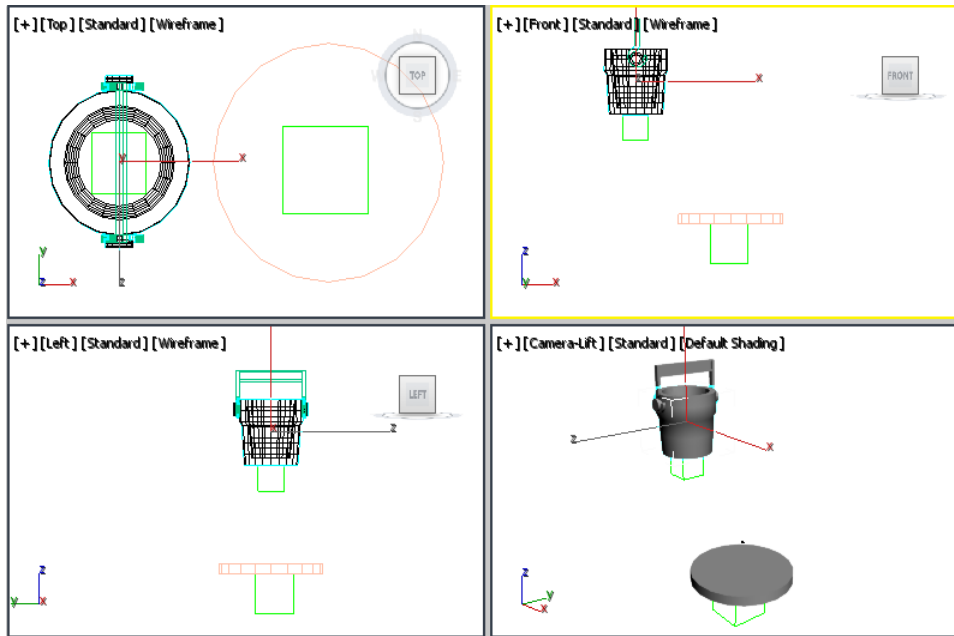

Figure 15-6 Linking Cauldron with Cal-Dummy

When the first object is selected, the link cursor appears. On dragging the mouse button and releasing it on the second object, the two objects will be linked. *Cauldron* becomes a child of *Cal-Dummy* and will follow its movement.

3. Choose the **Select and Link** tool. Next, click *Hook*, drag the cursor to *Cal-Dummy*, and release the left mouse button. Invoke the **Select Object** tool to exit the tool; *Hook* becomes a child of *Cal-Dummy* and follows its movement.

4. Choose the **Select and Link** tool. Next, click *Base*, drag the cursor to *Base-Dummy*, and release the left mouse button; *Base* becomes a child of *Base-Dummy*. Now, invoke the **Select Object** tool to exit the tool.

Setting Continuity Value

In this section, you will set the continuity value using the **Set Controller Defaults** dialog box. Continuity controls the movement of an object through animation keys and creates life-like or mechanical motion.

A continuity default value can be set before creating animation keys so that you need not adjust each key later.

1. Choose **Customize > Preferences** from the menu bar; the **Preference Settings** dialog box is displayed. Next, choose the **Animation** tab in the **Preference Settings** dialog box.

2. In the **Controller Defaults** area, choose the **Set Defaults** button; the **Set Controller Defaults** dialog box is displayed, as shown in Figure 15-7.

3. In this dialog box, select **TCB Float** from the list and then choose the **Set** button; the **TCB Default Key Values** dialog box is displayed, as shown in Figure 15-8.
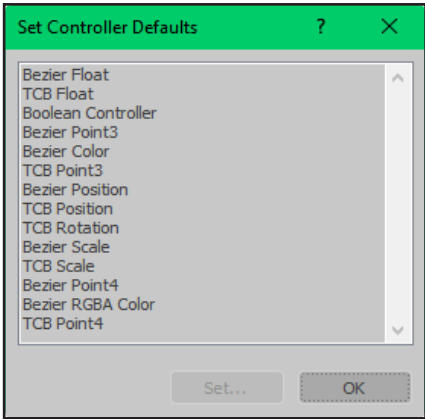

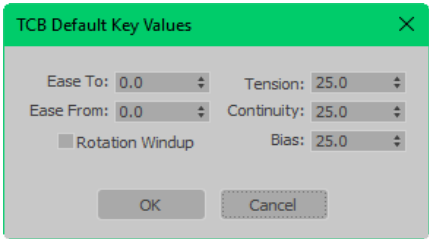*Figure 15-7* *The **Set Controller Defaults** dialog box*

Figure 15-8 *The **TCB Default Key Values** dialog box*

4. In this dialog box, set the value **0** in the **Continuity** spinner and then choose the **OK** button.

5. Choose **OK** in the **Set Controller Defaults** dialog box. Next, choose **OK** in the **Preference Settings** dialog box.

Animating the Hook and Cauldron
In this section, you will animate *Hook* and *Cauldron*. To create an animation, a series of keys are defined.

1. Choose the **Toggle Auto Key Mode** button to turn the animation mode on (red).   `Auto Key`

    When the **Toggle Auto Key Mode** button is chosen (red), any transformation creates an animation key on the current frame. If this button is off, the transformation is applied to frame 0 regardless of the current frame.

2. Drag the time slider to frame 25. Alternatively, you can set the value in the spinner at the left side of the **Time Configuration** button as **25**.

3. Activate the Front viewport and click *Cal-Dummy*. Next, right-click on the **Select and Move** tool; the **Move Transform Type-In** dialog box is displayed, refer to Figure 15-9.

4. Set the value **300** in the **X** spinner of the **Offset:Screen** area and press the ENTER key; *Cauldron* is now centered over *Base*.
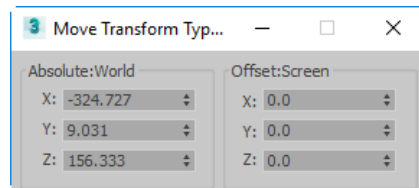

Figure 15-9 *The **Move Transform Type-In** dialog box*

5. Drag the time slider to frame 50.

6. Make sure *Cal-Dummy* is selected. In the **Move Transform Type-In** dialog box, set **–300** in the **Y** spinner of the **Offset:Screen** area and press the ENTER key; *Cauldron* is placed on *Base*, refer to Figure 15-10.
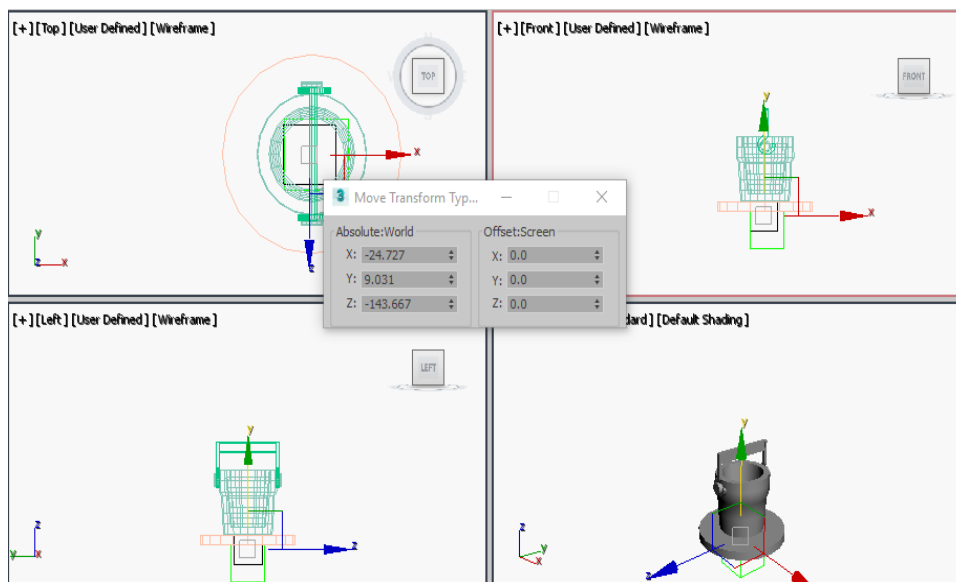

Figure 15-10 *The Cauldron placed on the circular Base*

7. Close the **Move Transform Type-In** dialog box and exit the animation mode by choosing the **Toggle Auto Key Mode** button.

Adding a Position Key

If the movement of *Hook* is animated, the movement would begin at frame 0 and would end at the active frame that was current when *Hook* was moved. As a result, *Hook* would gradually drift away from its parent object. To prevent this, *Hook* needs a position key added at frame 50. The position key locks the *Hook's* position at frame 50. Any movement applied to *Hook* only affects the frames between frame 50 and the current frame. In this section, you will use different frame settings in the **Track View - Dope Sheet** window to create the position key.

1. Select all objects in the viewport. Next, choose **Graph Editors > Track View - Dope Sheet** from the menu bar; the **Track View - Dope Sheet** window is displayed.

2. In this window, click on the plus sign at the left of **Hook** and then click on the plus sign at the left of **Transform**. Notice that currently there are no animation keys for *Hook*.

3. Choose the **Add/Remove Key** button on the upper left of the **Track View - Dope Sheet** window.

4. Click on the **Position** track for *Hook* at frame 50; a position key for *Hook* is created at frame 50, refer to Figure 15-11. Next, close the **Track View - Dope Sheet** window.
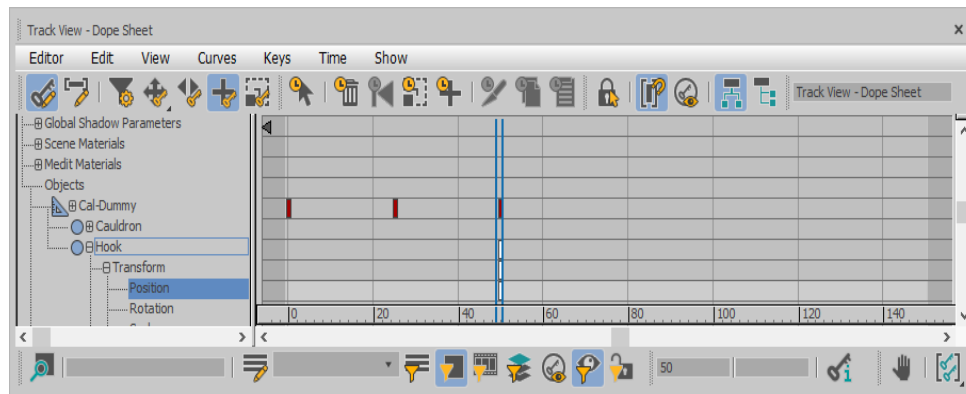

Figure 15-11 *The new key added to the Hook's* **Position** *track*

5. Drag the time slider to frame 55 and choose the **Toggle Auto Key Mode** button.

6. Select *Hook* in the Front viewport. Move *Hook* –60 units on the X axis and –60 units on the Y axis; *Hook* is detached from *Cauldron*.

7. Drag the time slider to frame 70. Next, move *Hook* 300 units on the Y axis.

8. Choose **Graph Editors > Saved Track Views > Track View - Dope Sheet** from the menu bar; the **Track View-Dope Sheet** window is displayed with the previous settings active.

9. Choose the **Add/Remove Key** button on the upper left of the **Track View-Dope Sheet** window.

10. Zoom in the window and add a key in the **Position** track at frame 90 for *Hook*. Next, close the **Track View-Dope Sheet** window; the current position of *Hook* is recorded in a key at frame 90.

11. Choose the **Absolute Mode Transform Type-In** button; it is replaced by the **Offset Mode Transform Type-In** button.

12. Drag the time slider to frame 105. Next, in the Front viewport, move *Hook* –300 units on the Y axis.

13. Drag the time slider to frame 110. Next, move *Hook* 60 units on the X axis and 60 units on the Y axis; *Hook* is reattached to *Cauldron*.

14. Choose **Graph Editors > Saved Track Views > Track View-Dope Sheet** from the menu bar; the **Track View-Dope Sheet** window is displayed. Next, select *Cal-Dummy* in the viewport and click on the plus sign on the left of **Cal-Dummy** and then click **Transform** in the **Track View-Dope Sheet** window.

15. Choose the **Add/Remove Key** button and add a key to the **Position** track at frame 110 for *Cal-Dummy*. Next, close the **Track View-Dope Sheet** window.

16. Drag the time slider to frame 130.

17. In the Front viewport, move *Cal-Dummy* 300 units on the Y axis; *Cal-Dummy*, *Hook*, and *Cauldron* move.

18. Drag the time slider to frame 150.

19. Move *Cal-Dummy* –300 units on the X axis.

20 Choose the **Toggle Auto Key Mode** button to exit the animation mode. Next, drag the time slider to left and right to replay the animation. Alternatively, choose the **Play Animation** button to see the animation in the viewport.

Creating a Snapshot

The **Snapshot** tool duplicates an object in its current state, but unlike the **Copy** tool, it does not copy any animation keys associated with the object. The snapshot copy can then be used for complex animation sequences. In this section, you will create a snapshot of *Cauldron* and rotate it by 45 degrees.

1. Drag the time slider to frame 50. Next, select *Cauldron*.

2. Choose **Tools > Snapshot** from the menu bar; the **Snapshot** dialog box is displayed, as shown in Figure 15-12.

3. Make sure the **Single** radio button is selected in the **Snapshot** area. Also, select the **Copy** radio button in the **Clone Method** area, and then choose **OK** to close the dialog box.

   A duplicate copy of *Cauldron* is created at the same location as the original. Therefore, the copy is to be moved to frame 50 and is named as *Cauldron001*.

Note
*The **Snapshot** dialog box allows you to create multiple copies over a range of frames using the **Range** radio button or a single copy using the **Single** radio button.*

4. Drag the time slider to frame 0.

There are now two cauldrons in the scene: the original and the copy located at the original's position at frame 50 when the snapshot was created.
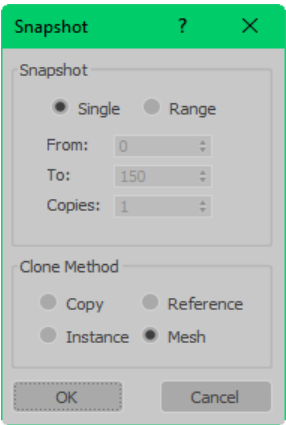

*Figure 15-12 The **Snapshot** dialog box*

5.   Invoke the **Select and Link** tool from the **Main Toolbar**.

6.   Click and drag *Cauldron001* to *Base Dummy,* as shown in Figure 15-13. Release the left mouse button and invoke the **Select Object** tool to exit the tool; *Cauldron001* is now the child of *Base Dummy* and will follow its movement.
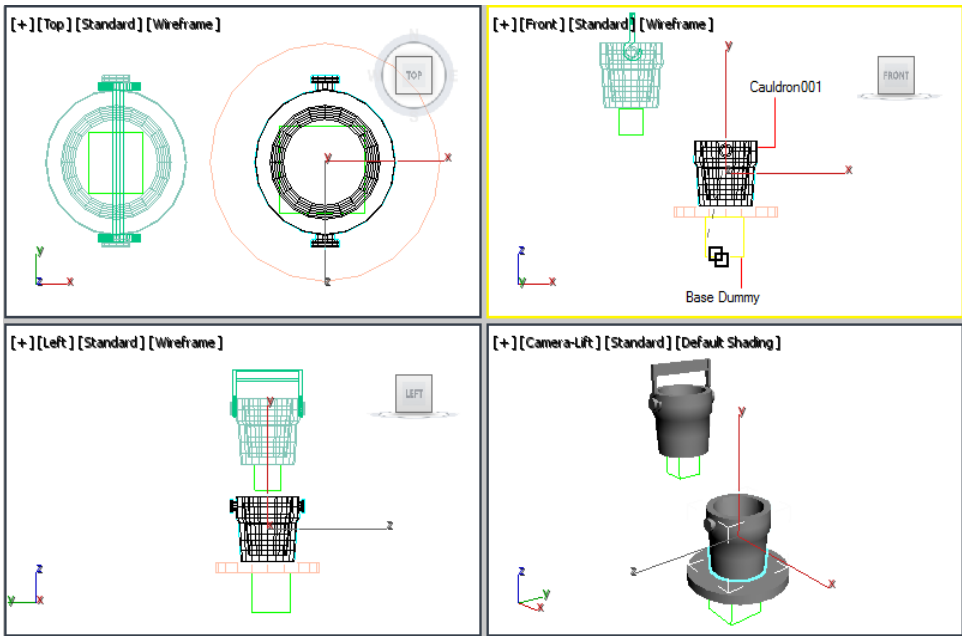

Figure 15-13 Linking Cauldron with Base-Dummy

7.   Select *Base Dummy* in the viewport.

8. Choose **Graph Editors** > **Saved Track Views > Track View-Dope Sheet** from the menu bar; the **Track View-Dope Sheet** window is displayed. Next, click on the (**+**) plus sign at the left of **Base-Dummy** and **Transform**.

9. Make sure the **Add/Remove Key** button is activated and add a key to the **Rotation** track at frame 70 for *Base Dummy*. Next, close the **Track View - Dope Sheet** window.

10. Drag the time slider to frame 80. Choose the **Toggle Auto Key Mode** button to enter the animation mode.

11. In the Front viewport, rotate *Base Dummy* object – 45 degrees on the Z axis, as shown in Figure 15-14.
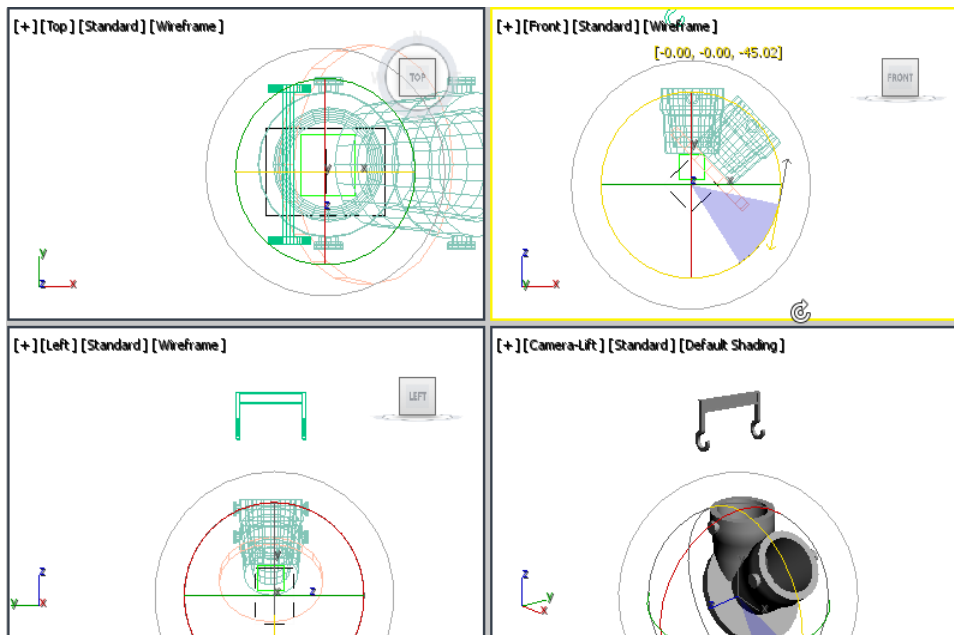

Figure 15-14 *Rotating Base-Dummy -45 degrees on the Z axis*

12. Drag the time slider to frame 90. In the Front viewport, rotate *Base Dummy* +45 degrees on the Z axis, as shown in Figure 15-15.

13. Choose the **Toggle Auto Key Mode** button to exit the animation mode. Next, drag the time slider left and right to replay the animation.

Hiding the Object During Animation

All parts of the animation are now completed, but there are two cauldrons visible during the animation. You must turn off the visibility, or hide the cauldrons during different segments of the animation. In this section, you will hide object using the **Track View - Dope Sheet** window. There are two ways to do this. You can use the **Track View - Dope Sheet** window or modify the object's properties.
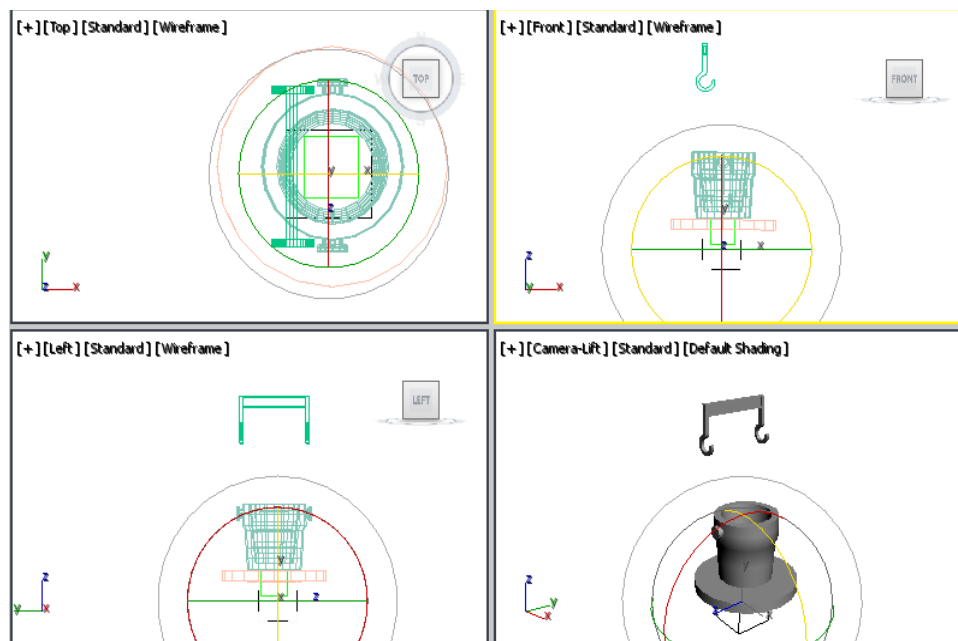
Figure 15-15 *Rotating Base-Dummy +45 degrees on the Z axis*

1.   Select *Cauldron* in the viewport. Next, choose **Graph Editors > Saved Track Views > Track View-Dope Sheet** from the menu bar; the **Track View - Dope Sheet** window is displayed.

2.   Select **Cauldron** in the **Track View - Dope Sheet** window. Click on the (**+**) plus sign at the left of *Cauldron*.

3.   Choose **Edit > Visibility Tracks > Add** from the menu bar in the **Track View - Dope Sheet** window; a visibility track is added for **Cauldron**.

4.   Choose the **Add/Remove Key** button and add a key in the **Visibility** track at frame 0 for *Cauldron*, refer to Figure 15-16.
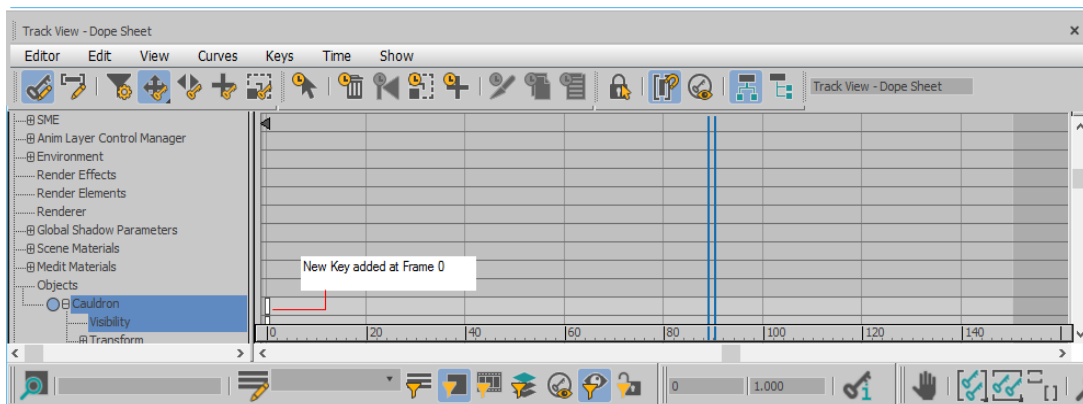

Figure 15-16 *Adding a new key in the **Visibility** track at frame 0*

5. Right-click on the new key; the **Cauldron\Visibility** dialog box is displayed. In this dialog box, make sure **1.0** is set in the **Value** spinner. Also, set the square mechanical transition in the **In** and **Out** image tiles, as shown in Figure 15-17. Do not close the **Cauldron\Visibility** dialog box; *Cauldron* is fully visible at frame 0.
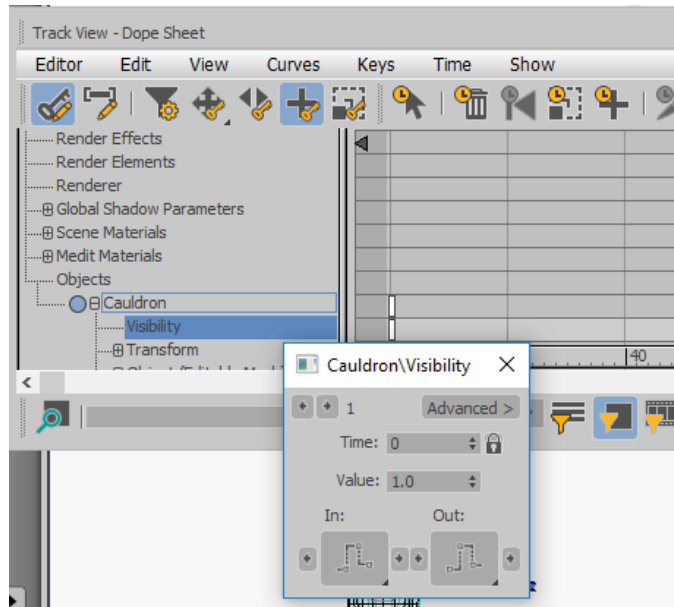

*Figure 15-17   The **Cauldron\Visibility** dialog box*

6. Add a key to the **Visibility** track at frame 50 for *Cauldron*.

7. In the **Cauldron\Visibility** dialog box, set the value **0** in the **Value** spinner. Also, set the **In** and **Out** image tiles to the square mechanical transition; *Cauldron* is invisible at frame 50. Close the **Cauldron\Visibility** dialog box.

8. Add a key in the **Visibility** track at frame 90 for *Cauldron*.

9. Right-click on the new key; the **Cauldron\Visibility** dialog box is displayed. In this dialog box, set the value **1.0** in the **Value** spinner. Also, set the **In** and **Out** image tiles to the square mechanical transition; *Cauldron* is fully visible at frame 0. Next, close the **Cauldron\Visibility** dialog box and the **Track View-Dope Sheet** window.

Hiding the Object Using Object Properties

In this section, you will hide the objects using the object properties.

1. Drag the time slider to frame 0.

2. Select *Cauldron001* in any viewport. Right-click in the viewport; the quad menu is displayed. Choose **Object Properties** from the lower-right quadrant of the quad menu; the **Object Properties** dialog box is displayed, as shown in Figure 15-18.
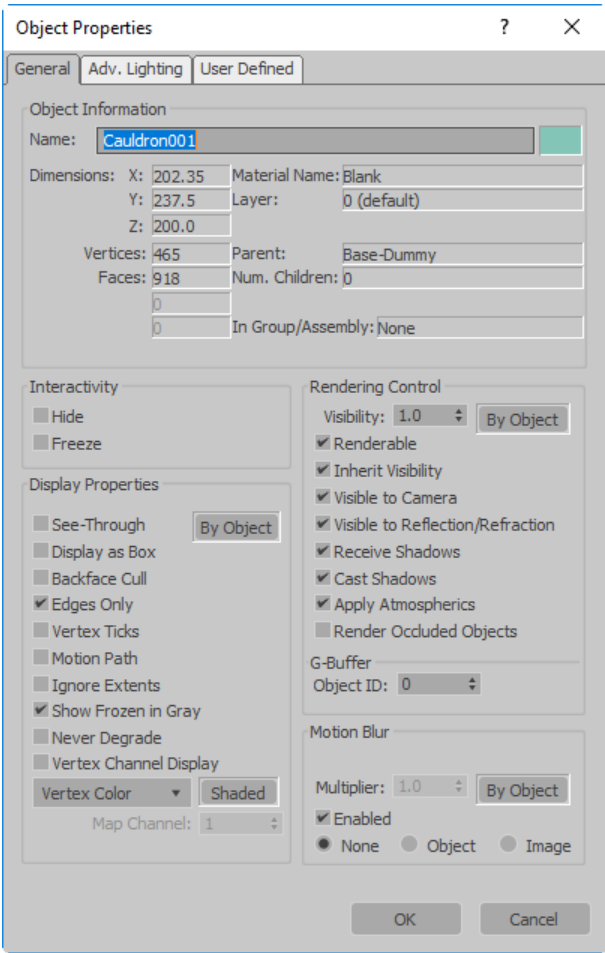
*Figure 15-18 The **Object Properties** dialog box*

3. In this dialog box, make sure the **By Object** button is activated; the options in this area are activated.

> ✎ **Note**
> *If the **By Layer** button is displayed in the **Object Properties** dialog box, you need to click on this button so that the **By Object** button is displayed.*

4. Set the value **0** in the **Visibility** spinner. Next, choose the **OK** button to close the **Object Properties** dialog box; *Cauldron001* is invisible at this frame (frame 0). This also adds a visibility track in the **Track View - Dope Sheet** window.

5. Drag the time slider to frame 50 and then choose the **Toggle Auto Key Mode** button to enter the animation mode.

6. Make sure *Cauldron001* is selected. Next, right-click in the viewport; the quad menu is displayed. Next, choose **Object Properties** from the quad menu; the **Object Properties** dialog box is displayed.

7. Set the value **1.0** in the **Visibility** spinner of the **Object Properties** dialog box.

    You will notice that the corners of the spinner turn red indicating the parameter is animated.

8. Choose the **OK** button to close the **Object Properties** dialog box; *Cauldron001* becomes visible at frame 50.

9. Drag the time slider to frame 90. Make sure *Cauldron001* is selected. Next, right-click in the viewport; the quad menu is displayed. Next, choose **Object Properties** from the quad menu.

10. Set **0** in the **Visibility** spinner of the **Object Properties** dialog box. Next, choose the **OK** button to close the **Object Properties** dialog box; *Cauldron001* is invisible at frame 90.

11. Choose the **Toggle AutoKey Mode** button to exit the animation mode. Drag the time slider left and right to replay the animation.

    You will notice that *Cauldron001* fades in and out. Therefore, you need to adjust the transition in the **Track View - Dope Sheet** window.

12. Choose **Graph Editors > Saved Track Views > Track View-Dope Sheet** from the menu bar; the **Track View-Dope Sheet** window is displayed. In this window, click on the plus sign on the left of **Cauldron001** to expand the tree, if it is not already expanded.

13. Right-click on the first key in the **Visibility** track; the **Cauldron001/Visibility** dialog box is displayed. In this dialog box, set the **In** and **Out** image tiles to the square mechanical transition.

14. Repeat this for the visibility keys at frame 50 and frame 90. Close the **Cauldron/Visibility** dialog box and the **Track View-Dope Sheet** window.

15. Drag the time slider left and right to preview the animation or choose the **Play Animation** button.

    Notice that *Cauldron001* no longer fades in and out. The visibility changes for both cauldron objects are instantaneous which gives an illusion of only one cauldron in the scene.

Previewing the Animation
In this section, you will preview the animation. The preview animation is a low resolution/low color format used to quickly verify that the animation is working correctly.

1. Make sure the Camera-Lift viewport is activated.

2. Choose **Tools > Preview - Grab Viewport > Create Preview Animation** from the menu bar; the **Make Preview** dialog box is displayed, as shown in Figure 15-19.
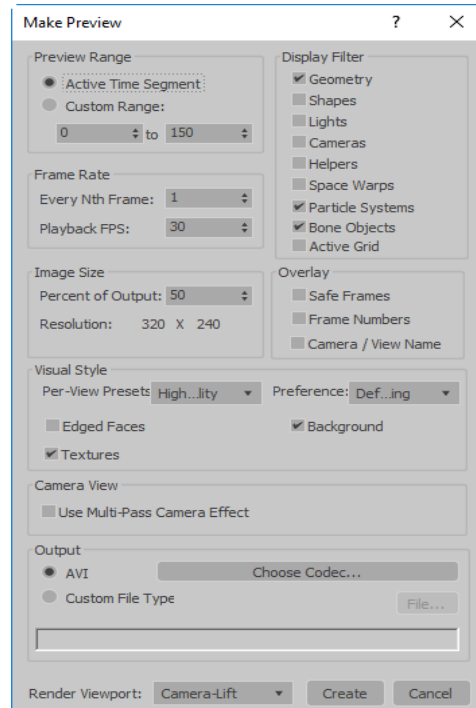

*Figure 15-19 The **Make Preview** dialog box*

3. In this dialog box, select the **Frame Numbers** check box in the **Overlay** area. Next, choose the **Create** button. If the **Video Compression** dialog box is displayed, choose **OK** to accept the default settings.

    When the animation is completed, it is played in Windows Media Player. Notice that the invisible cauldrons will not appear clearly. This is just a representation in the preview rendering. In the final animation, the cauldrons are completely invisible.

Setting the Camera View

In this section, you will set the camera view such that all objects are visible throughout the animation.

1. Choose the **Display** tab in the **Command Panel**.

2. In the **Hide by Category** rollout, clear the **Cameras** check box; the camera named *Camera-Lift* is displayed in the scene.

3. Invoke the **Zoom Extents All** tool; the scene is zoomed out in the viewports so that the camera and target fit on the screen.

4. Set the Camera-Lift and Camera-Lift.Target in all viewports so that all objects in the scene are visible throughout the animation, refer to Figure 15-20.
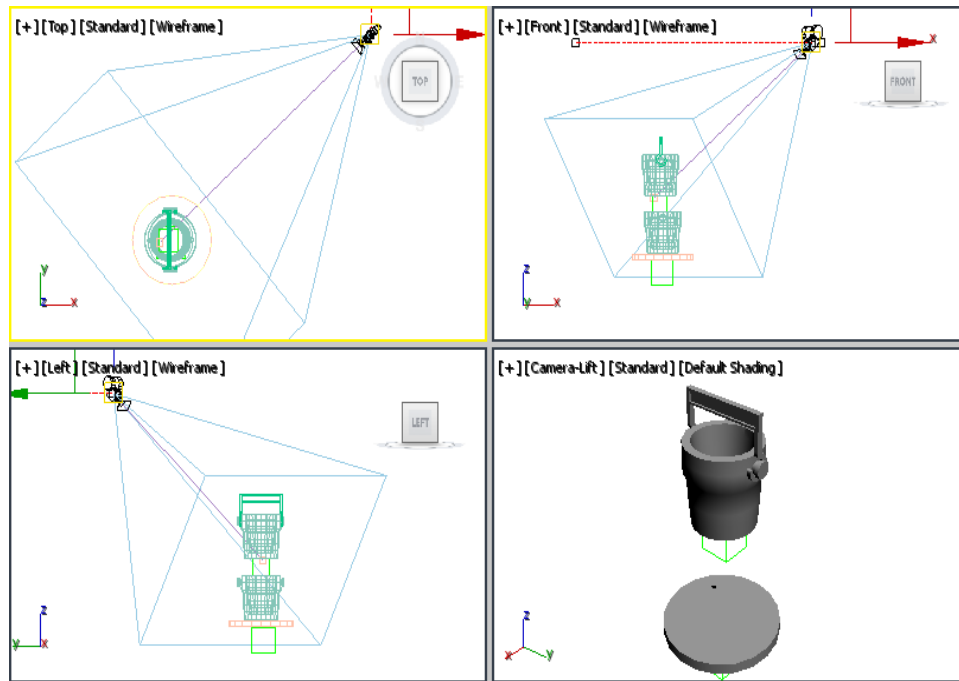

Figure 15-20 *Adjusting the Camera-Lift and Camera-Lift.Target in all viewports*

Next, you will preview the animation to view the effect of moving the camera.

5. Make sure the Camera-Lift viewport is activated. Next, choose **Tools > Preview - Grab Viewport > Create Preview Animation** from the menu bar; the **Make Preview** dialog box is displayed.

6. In this dialog box, choose the **Create** button. If the **Video Compression** dialog box is displayed, choose the **OK** button to accept the default settings.

Saving and Previewing the Animation

In this section, you will create a quick preview of the updated animation to show the movement of the camera target.

1. Change the background color of the scene to white by following the steps given in Tutorial 1 of Chapter 2.

2. Choose **Save** from the **File** menu.

3. Make sure the Camera-Lift viewport is activated.

4. Choose **Tools > Preview - Grab Viewport > Create Preview Animation** from the menu bar; the **Make Preview** dialog box is displayed.

5. Choose the **Create** button. If the **Video Compression** dialog box is displayed, choose the **OK** button to accept the default settings.

When the animation is completed, it is played in the Windows Media Player.

Tutorial 2

In this tutorial, you will create a basket ball animation, as shown in Figure 15-21.

(Expected time: 35 min)

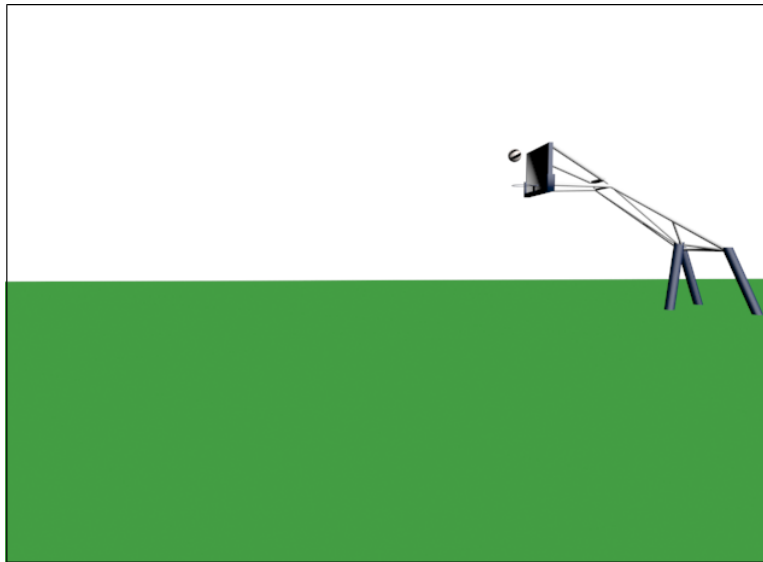*Figure 15-21 Basketball animation at frame11*

The following steps are required to complete this tutorial:

a. Create the project folder.
b. Open the file.
c. Animate the basketball.
d. Fine-tune the animation.
e. Save and render the animation.

Creating the Project Folder

Create the project folder with the name *c15_tut2* in the *3dsmax 2020* folder, as discussed in earlier chapters.

Opening the File

1. Choose **Open** from the **File** menu; the **Open File** dialog box is displayed. In this dialog box, browse to the location *\Documents\c15_3dsmax_2020_tut* and select the **c15_tut2_start.max** file from it. Choose the **Open** button to open the file, refer to Figure 15-22.
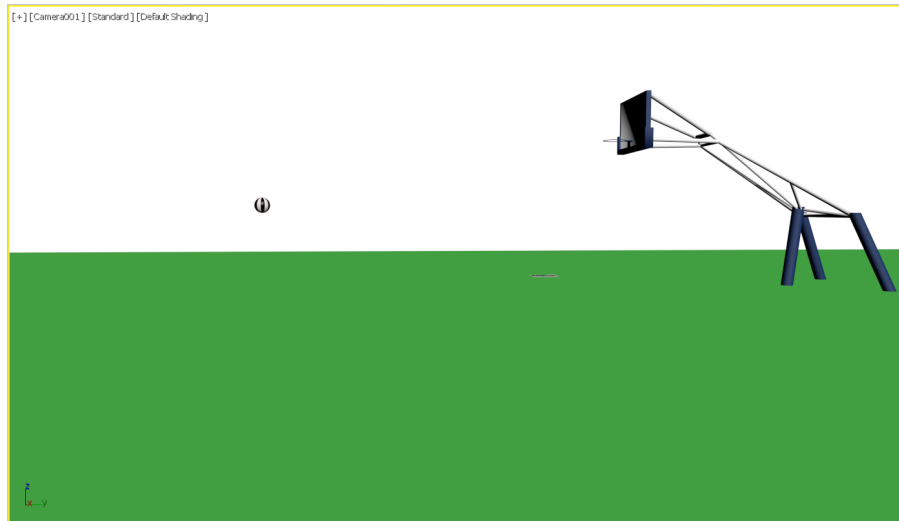
Figure 15-22 *The c15_tut2_start.max file*

2. Choose **Save As** from the **File** menu; the **Save File As** dialog box is displayed. Browse to the location *\Documents\3dsmax 2020\c15_tut2\scenes*. Save the file with the name *c15tut2.max* at this location.

Animating the Basketball

In this section, you will set the number of frames in the animation and create keyframes.

1. Choose the **Time Configuration** button from the animation playback controls; the **Time Configuration** dialog box is displayed, as shown in Figure 15-23.

2. In the **Animation** area, set **120** in the **Length** spinner and choose the **OK** button; the total number of frames for the animation is set to 120.

3. Make sure the time slider is set at frame 0. Next, choose the **Toggle Auto Key Mode** button.

4. Drag the time slider to frame 5 and select *basketball*. Next, right-click on the **Select and Move** tool in the **Main Toolbar**; the **Move Transform Type-In** dialog box is displayed. In this dialog box, set **555**, **-132**, and **880** in the **X**, **Y**, and **Z** spinners of the **Absolute World** area, refer to Figure 15-24; the *basketball* is positioned, as shown in Figure 15-25 and keyframes are created at frame 0 and 5. Do not close the **Move Transform Type-In** dialog box.

5. In the **Command Panel**, choose the **Display** tab. Next, scroll down and select the **Motion Path** check box from the **Display Properties** area. You will notice that motion path of *basketball* is visible now, refer to Figure 15-26.
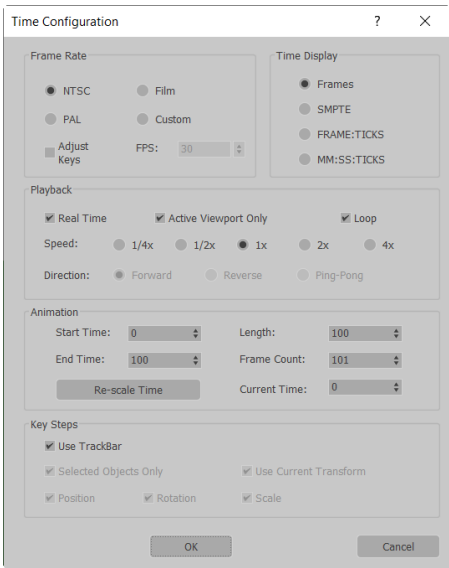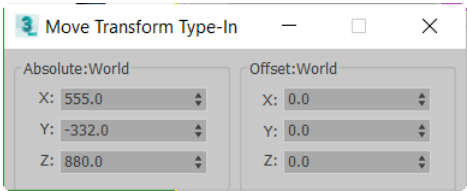
*Figure 15-23 The **Time Configuration** dialog box*

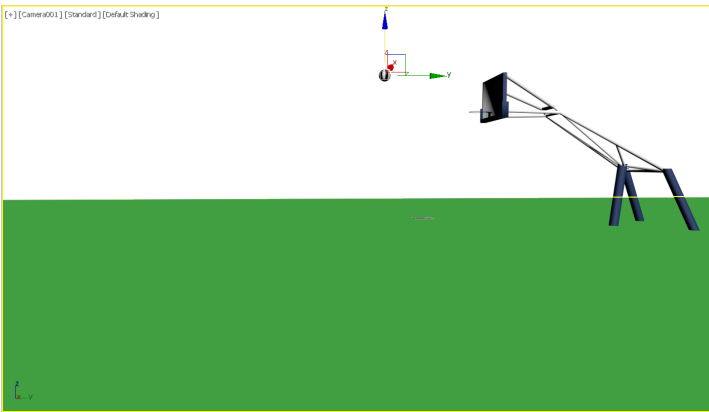*Figure 15-24 Values in the **Move Transform Type-In** dialog box*

Figure 15-25 The basketball positioned at frame 5

6. Drag the time slider to frame 10. In the **Move Transform Type-In** dialog box, set **555**, **147**, and **859** in the **X**, **Y**, and **Z** spinners of the **Absolute World** area; keyframe is created at frame 10 and basketball is positioned, as shown in Figure 15-27.
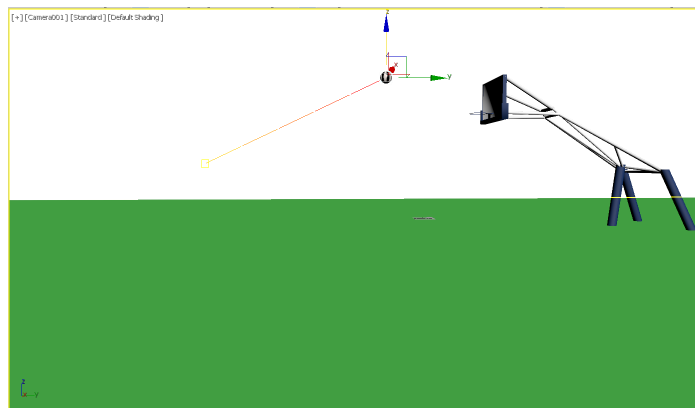
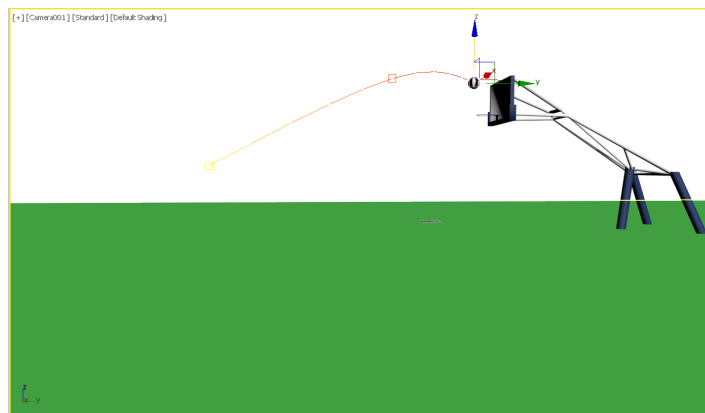**Figure 15-26** *The basketball motion path displayed*

Figure 15-27 *The basketball positioned at frame 10*

7. Similarly, drag the time slider to frames and set the values in the **Move Transform Type-In** dialog box as given in Table 15-1. Next, close this dialog box. Figure 15-28 shows *basketball* positioned at frame 120.

Table 15-1 The transformation values of basketball

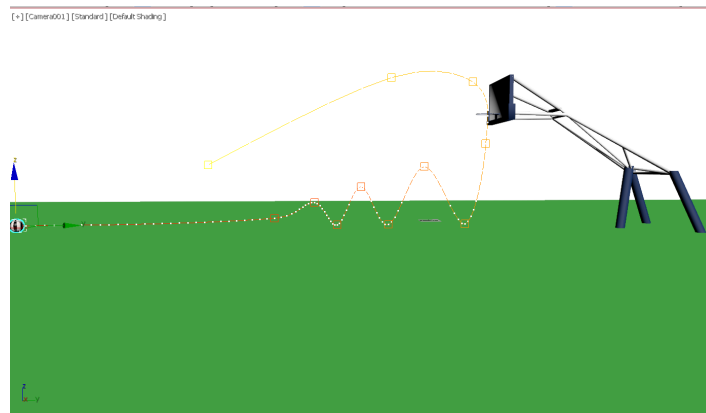| Frames to be selected	X	Y	Z
20	555	228.5	503
30	555	111	29
40	555	-134	368
50	555	-347	29
60	555	-508	251
70	555	-647	29
80	555	-780	159
90	555	-1011	29
120	555	-2448	29

Figure 15-28 *The basketball positioned at frame 120*

8. Choose the **Play Animation** button to play the animation.

   Next, you will rotate *basketball*. To do so, you will use the **Track View Dope Sheet** window.

9. Make sure *basketball* is selected. Next, choose **Graph Editors > Track View - Dope Sheet** from the menu bar; the **Track View Dope Sheet** window is displayed.

10. In this window, click on the plus sign at the left of **basketball** and then click on the plus sign at the left of **Transform**. Notice that currently position keys are assigned to *basketball*.

11. Select the **Rotation** track from the list at the left in the **Track View Dope Sheet** window, refer to Figure 15-29.

12. Choose the **Add/Remove Key** button on the upper left of the **Track View - Dope Sheet** window and then click on the **Rotation** track for *basketball* at frame 0; a keyframe is created at frame 0.

13. Right-click on the keyframe on the **Rotation** track at frame 0; the **Basketball/Rotation** dialog box is displayed. In this dialog box, make sure **0** is displayed in the **Angle** spinner and **1** is displayed in the **X** spinner, as shown in Figure 15-29. Next, close this dialog box.

14. Make sure the **Add/Remove Key** button is chosen on the upper left of the **Track View - Dope Sheet** window and then click on the **Rotation** track for *basketball* at frame 30; a keyframe is created at frame 30.

15. Right-click on the keyframe on the **Rotation** track at frame 30; the **Basketball/Rotation** dialog box is displayed. In this dialog box, set **180** in the **Angle** spinner and make sure **1** is displayed in the **X** spinner. Next, close this dialog box.

16. Select the keyframe on the **Rotation** track at frame 0. Next, press and hold the SHIFT key and drag the keyframe to frame 51, refer to Figure 15-30; keyframe at frame 0 is copied to frame 51.
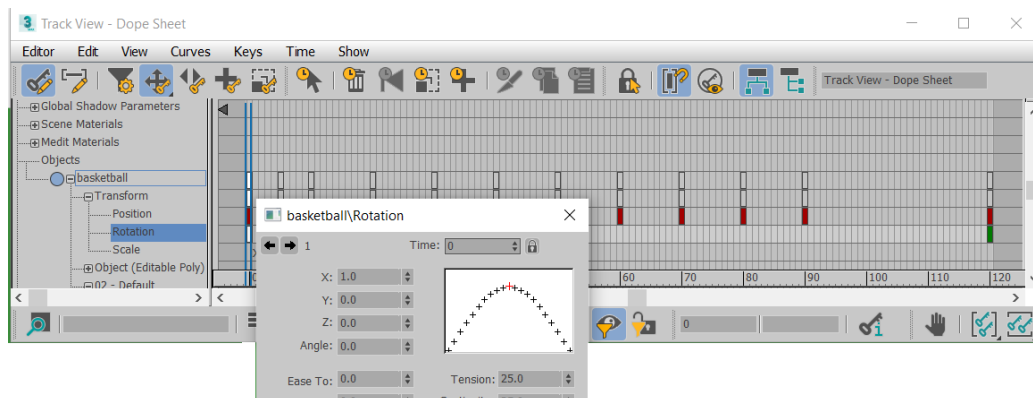
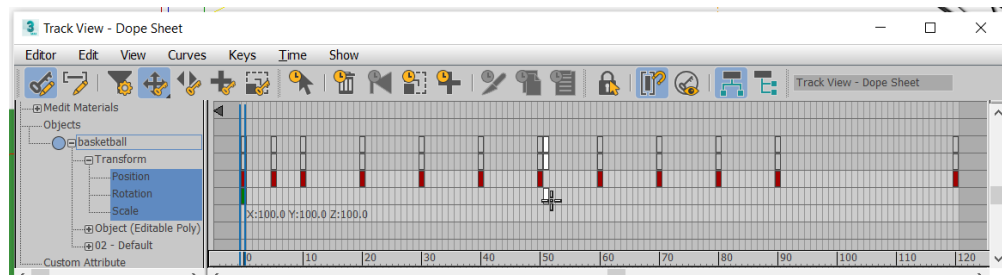*Figure 15-29 The **basketball/Rotation** dialog box*

Figure 15-30 Keyframe dragged to frame 51

17. Similarly, copy the keyframe on the **Rotation** track at frame 0 to frames 71 and 90. Next, copy the keyframe on the rotation track at frame 30 to frame 80.

18. Make sure the **Add/Remove Key** button is chosen on the upper left of the **Track View - Dope Sheet** window and then click on the **Rotation** track for *basketball* at frame 50; a keyframe is created at frame 50.

19. Right-click on the keyframe on the **Rotation** track at frame 50; the **Basketball/Rotation** dialog box is displayed. In this dialog box, set **360** in the **Angle** spinner and make sure **1** is displayed in the **X** spinner. Next, close this dialog box. Now, copy the keyframe on the **Rotation** track at frame 50 to frames 70 and 120.

    Next, you will create the squash and stretch effect on *basketball* when it touches Floor.

20. Select **Scale** from the list in the **Track View Dope Sheet** window. Next, choose the **Add/Remove Key** button on the upper left of the **Track View - Dope Sheet** window and then click on the **Scale** track for *basketball* at frame 0; a keyframe is created at frame 0, refer to Figure 15-31.

    Next, you will copy the keyframe at frame 0 to frame 29 so that *basketball* is not scaled till it touches the floor.
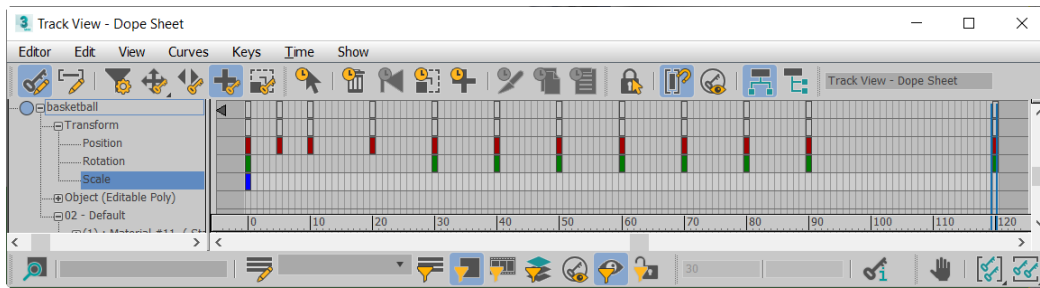
Figure 15-31   Keyframe created at frame 0

21. Choose the **Move Keys** button on the upper left of the **Track View - Dope Sheet** window. Next, select the keyframe on the **Scale** track at frame 0 and copy this keyframe to frame 29 as discussed earlier.

22. Make sure the **Add/Remove Key** button is chosen on the upper left of the **Track View - Dope Sheet** window and then click on the **Scale** track for *basketball* at frame 30; a keyframe is created at frame 30.

23. Similarly, create keyframes on the **Scale** track at frame 40.

24. Right-click on the keyframe on the **Scale** track at frame 30; the **Basketball/Scale** dialog box is displayed. Set **85** in the **Z Value** spinner, refer to Figure 15-32, and close the dialog box.
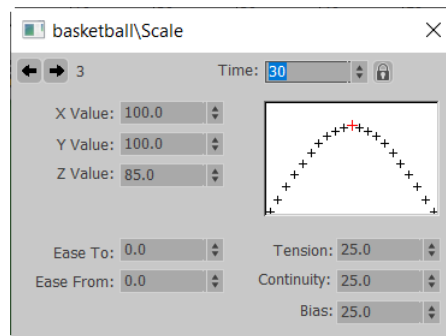

*Figure 15-32   The **basketball/Scale** dialog box*

25. Right-click on the keyframe on the **Scale** track at frame 40; the **Basketball/Scale** dialog box is displayed. Set **100** in the **Z Value** spinner and **85** in the **Y Value** spinner. Next, close the dialog box.

26. Choose the **Move Keys** button on the upper left of the **Track View - Dope Sheet** window. Next, select the keyframe on the **Scale** track at frame 30. Now, press and hold the SHIFT key and drag the keyframe to frame 50; the keyframe at frame 30 is copied to frame 50.

27. Similarly, copy the keyframe on the **Scale** track at frame 30 to frames 70 and 90. Also, copy the keyframe on the **Scale** track at frame 40 to frames 60 and 80.

28. Copy the keyframe on the **Scale** track at frame 0 to frame 120.

29. Choose the **Play Animation** button to play the animation.

Fine-tuning the Animation

In this section, you will fine tune the animation using the **Track View - Dope Sheet** window.

1. Make sure *basketball* is selected. Next, select the keyframe on the **Position** track at frame 30 and right-click on it; the **Basketball/Position** dialog box is displayed. In this dialog box, set **0** in the **Continuity** spinner, refer to Figure 15-33.
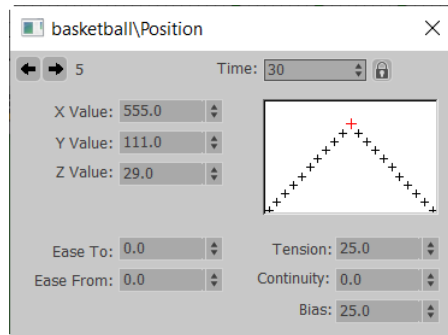

Figure 15-33　*The **basketball/Position** dialog box*

2. Repeat step 1 for the keyframes on the **Position** track at frames 50, 70, and 90. As a result, weight will be added to *basketball* when it touches floor.

Saving and Rendering the Animation

In this section, you will render the animation and create an AVI file. Next, you will play the rendered animation.

1. Choose **Save** from the **File** menu.

2. Make sure the Camera viewport is activated and invoke the **Render Setup** tool; the **Render Setup: Default Scanline Renderer** dialog box is displayed.

3. In the **Time Output** area, select the **Active Time Segment** radio button.

4. In the **Render Output** area, choose the **Files** button; the **Render Output File** dialog box is displayed. As the project folder is already set, the *renderoutput* folder of this project is displayed in the **Save in** text box. Select **AVI File (*.avi)** from the **Save as type** drop-down list.

5. In the **File name** text box, enter **c15tut2render** and choose the **Save** button; the path of the file is displayed in the **Render Output** area of the **Render Setup** dialog box.

If the **AVI File Compression Setup** dialog box is displayed, choose the **OK** button to close it.

6. Make sure that the **Save File** check box is selected in the **Render Output** area. Now, choose the **Render** button to render the animation and close the **Render Setup** dialog box.

It will take several minutes to render the animation frame by frame. After the rendering is complete, close the render window.

7. Browse to the *renderoutput* folder of the *c15_tut2* project and double-click on the **c15tut2render.avi** file; the AVI file is played in the Windows Media Player.

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. Which of the following tools duplicates an object in its current state, but does not copy any animation key associated with the object?

    (a) **Copy**   (b) **Dummy**
    (c) **Snapshot**   (d) None of these

2. An object can be linked to a _____ object, and it will then follow the movement of the dummy object.

3. A dummy object will not be visible on _____.

4. The _____ window can be used to create a position key.

5. While adjusting the key information of a key in an object's visibility track, the setting of _____ in the **Value** spinner will make the object completely visible.

6. An object can be made invisible by creating a visibility track in **Track View - Dope Sheet** window, or by adjusting the object's _____.

7. When a camera is animated, both _____ and _____ can be moved or rotated.

8. On selecting _____ in the **Display Properties** rollout of the **Command Panel**, camera's path is displayed in the viewport.

9. Frames that have animation keys for the camera are indicated in the trajectory by white boxes. (T/F)

Review Questions

Answer the following questions:

1. Which of the following dialog boxes is used to set total number of frames in an animation?

    (a) **Set Controller Defaults**   (b) **Time Configuration**
    (c) **Object Properties**   (d) None of these

2. The _____ objects are used to control the movement of other objects by linking them, but they are not visible in rendering.

3. The _____ tool is used to link one object with another.

4. The _____ button is used to add keys to **Track View - Dope Sheet**.

5. The _____ option verifies the current state of animation.

6. The **Snapshot** tool is similar to the **Copy** command. (T/F)

EXERCISE

The rendered sequence of the scene used in the following exercise can be accessed by downloading the *c15_3dsmax_2020_exr.zip* from *www.cadcim.com*. The path of the file is as follows: *Textbooks > Animation and Visual Effects > 3ds Max > Autodesk 3ds Max 2020 for Beginners: A Tutorial Approach*

Exercise 1

Extract the contents of the *c15_3dsmax_2020_exr.zip* and then open *c15_exr01_start.max*. Next, animate the vise, refer to Figures 15-34 through 15-37.   (**Expected time: 20 min)**
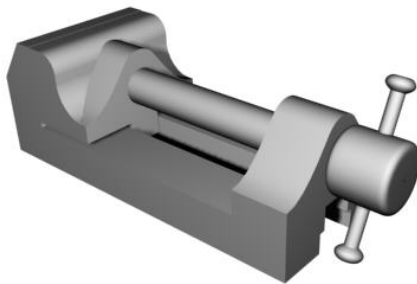

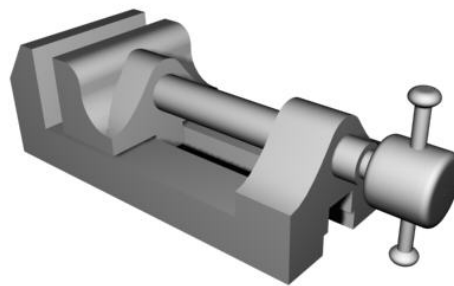***Figure 15-34*** *Animation at frame 50*
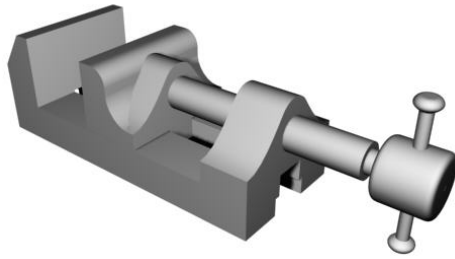

Figure 15-35 *Animation at frame 75*
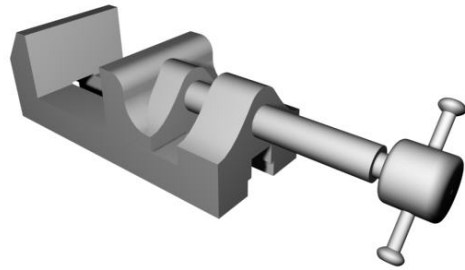
Figure 15-36 *Animation at frame 125*

Figure 15-37 *Animation at frame 150*

Answers to Self-Evaluation Test

1. c, **2.** dummy, **3.** rendering, **4. Track View - Dope Sheet**, **5.** 1.0, **6.** properties, **7.** camera, target, **8. Trajectory**, **9.** T