Report on the Enchanted Forest Accident of Carousel Serial # 77-2845
(RI # 96), on Saturday July 19, 2003

A little before noon on Saturday 7/19/03, Harold Fera, the owner of the Enchanted Forest, located on Route 3 in the Town of Hopkinton paged me. When I called him back, Mr. Fera stated that the Carnival Carousel (Serial # 77-2845, RI # 96), which was set in the Enchanted Forest for the first time this year, had an accident. Mr. Fera also stated that in that accident, a Spreader Beam fell and injured a young woman patron. He also stated that the patron was transported to westerly hospital. I arrived at the park around 1 PM. I met Mr. Fera at the scene. I asked Mr. Fera if the bolts on which the spreader sat, had holes made to receive safety pins (R-keys, or cotter pins), he said that they did not have holes for safety pins. I can remember that I asked the same question back in May when I inspected the Enchanted Forest rides, and got the same answer. At that time, that answer seemed reasonable because the scenario under which the spreader beam would jump up and out of the bolt seemed the least likely among the two scenarios that can lead to the spreader fall. The other scenario being that of the weld failure of the plate at the end of spreader (see photo Figure 1 E). This time, however I asked for a ladder. When I got up the ladder, I could see the holes in each of the bolts. I made it clear to the owner that all holes in bolts must be secured by a safety pin (an R-key or a cotter pin). I continued my investigation and found that the sequence of events that led to the injury included the following facts:

1. One of the Cam-Shafts that cause the horses to go up and down broke out of its seat right next to the gear at its end (see Figure 1A, B, C & D and Figure 2). The core the connects the shaft's seat to the pedestal # "3", which is bolted to the driving gear "G" (see Figure 2), is made out of cast iron. The manufacturer (Bob Boyle of Chance) stated the cast iron connection ensures that, if stressed, the cam-shaft would be broken at that point where it could result in the least damage. Creating a point of stress release is a valid design approach because it safeguards against failure at a random point, which could result in worse conditions than when the failure is controlled (at a known point). The snapped cast iron section can be clearly seen at the bottom of the shaft's seat in picture Figure 1-B. Picture Figure 1-C shows a close up on the snapped section.

2. Once the cam-shaft broke loose, the horses were freed from the circular motion and proceeded to travel on a tangential path, causing the cam-shaft to slide away from the center of the ride. The cam-shaft was stopped from further sliding when the inner cam hit the inner spreader beam (see Figures 2 & 3).

3. The cam-shaft also jumped out of its seats, and the two outer horses separated from their telescope pipe assembly and the outer horse landed just off the platform (see picture Figure 1-F). The two inner horses landed on the platform, keeping the cam-shaft in a (more or less) horizontal position. Had the two inner horses been missing, the outer horse, which was off the edge of platform, would have caused the cam-shaft to pivot over the shaft seat and slide completely out of the platform. Since the two horses effected a balance and prevented pivoting, the camshaft stayed horizontal as it slipped out and was stopped from further sliding when the innermost cam hit the innermost spreader beam as stated above. Please notice in picture Figure 1-F that the innermost horse did not separate from the telescope pipe assembly, but the entire assembly snapped and moved with the horse out of its base in the platform. Please note the footprint of the snapped telescope pipe assembly, in line with the two outer assemblies, which remained fixed in the platform, as the outer horses separated from them.

4. The last, and most troubling event, is that the outer spreader beam fell on the mother holding her child, causing the injury.

Items 1 through 4 describe what happened. Why the above happened can only be based on theories. Following is a description of the most likely causes, and the source that theorized the likely cause, if applicable.

1. The most likely reason for the breaking of the camshaft, according to the manufacturer (Bob Boyle of Chance), is wear in the telescope pipe system. Excessive wear beyond a certain

tolerance, may cause the pipe attached to the horse, which slides between the outer pipe and the inner pipe (both attached to the platform) to jam. When the cam cannot push the jammed horse down, the jammed horse pushes the cam up, pulling the cam-shaft out of its seats and snapping it at the (controlled) failure point. The same ride has three seats with the same snapped cast iron section. The missing horses make the ride less balanced.

2. When the cam-shaft was freed from the circular motion, and the horses proceeded to travel on a tangential path, the two outer horses, along with their telescoping pipe, separated from the telescope pipe assembly, which remained fixed on the platform. The innermost telescope pipe assembly broke away from the platform and left with the horse telescoping pipe inside of it.

3. When the outer horses separated from the telescope pipe assembly, the landed hard on the platform, and the outermost horse actually fell off the edge of the platform. The impact caused the platform to move down. When it bounced back up, it caused the spreader beam to jump up off the sweep it was sitting on, and out of the bolt that kept it in place. This worst aspect of the accident would have never happened, had the R-keys were in place.

Following are the corrective actions that need to be taken:

1. All park rides must have cotter pins in all the holes located in the bolts on which spreader beams sit. In general, operators are not to exercise judgement. If a bolt has a hole, it means that the manufacturer wants a safety pin there, and it must be installed.

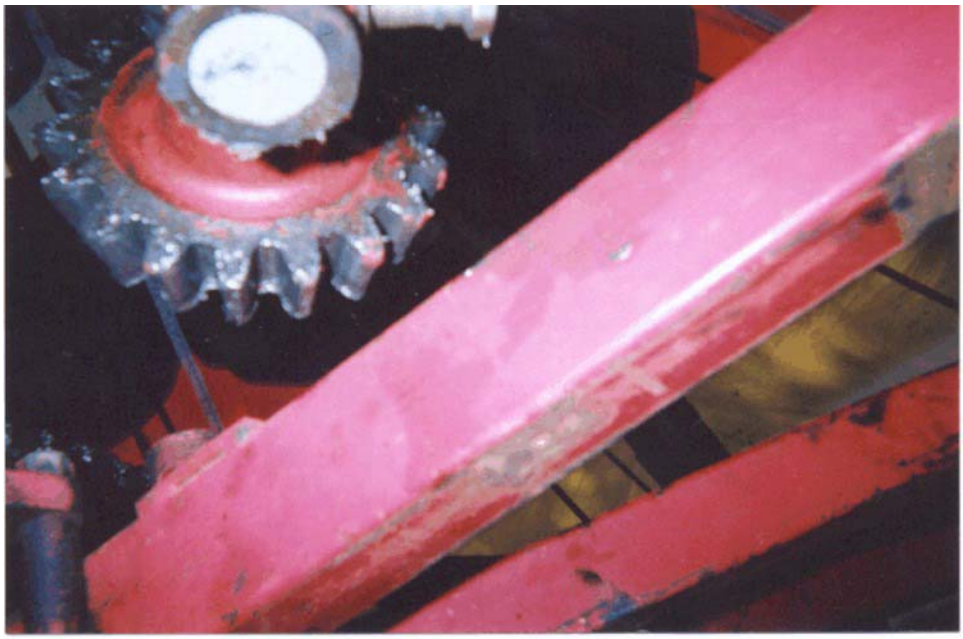
2. Owners of carousels must obtain maintenance requirements from manufacturers. The owner must know the tolerances of wear, beyond which he must replace the telescope pipe assembly and the horse pipe, or the recommended frequency of changing the telescope pipe assembly, as well as the horse pipe.

Finally, by the grace of God the injury to the patron was not serious. But this must not disguise the seriousness of what happened. The message must go out. The spreader beam CAN JUMP. Please make sure the safety pins are there. Please also observe the weld of the plate at the end of the spreader beams for possible cracks. Following are descriptions of Figures:

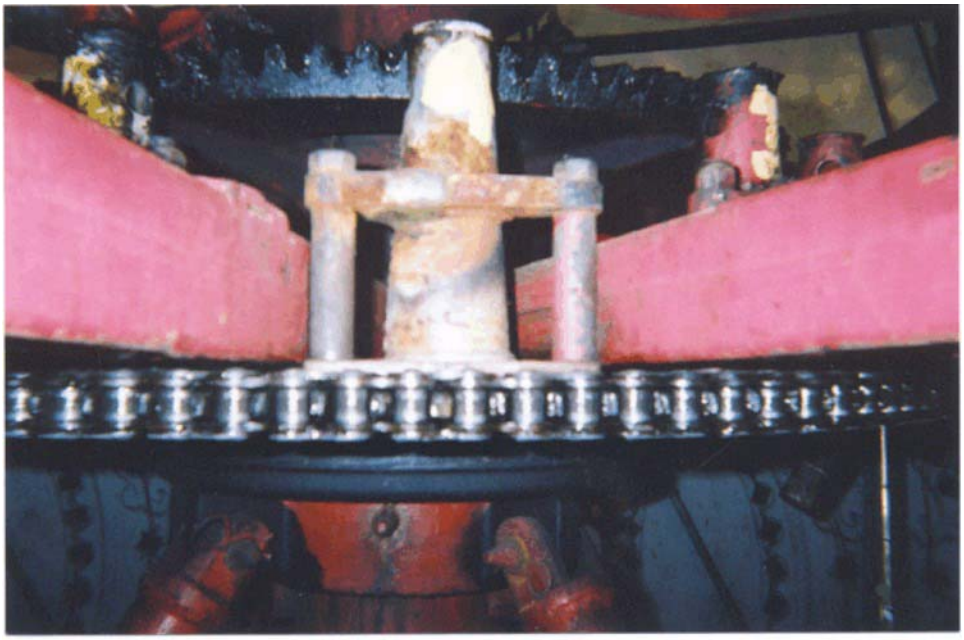
1. Photo Figure 1-A shows a healthy camshaft seated properly. Please notice the plane that snapped is the horizontal plane that lies about half an inch below the side screw.

2. Photo Figure 1-B shows the snapped cast iron section.

3. Photo Figure 1-C shows a close-up on the failure plane shown in the previous picture.



4. Photo Figure 1-D shows the camshaft seat, bolted to the driving gear.



5. Photo Figure 1-E shows the spreader beam sitting on the sweep. Please note the missing R-Key. Please also note the missing spreader beam (which you see on the floor in the last picture), and the bolt designated to keep it in place.

6. Photo Figure 1-F shows how the horses fared. Notice that the outermost bottom pipe is off the platform. Notice that the two telescope assemblies of the outermost horses are still in place, while the third has been carried away with the innermost horse. Notice the footprint of the innermost horse telescope pipe assembly. Finally, notice the spreader beam on the platform.

7. Figure 2. Item 1 is the telescope pipe assembly. Item 2 is the camshaft. Item 3 is the camshaft seat. Item 4 is the spreader beam sitting on the sweep. "C" is the stationary central shaft. "R" is the rotating top shaft. "G" is the main driving gear. "M" is the motor, and "T" is the camshaft gear tray.

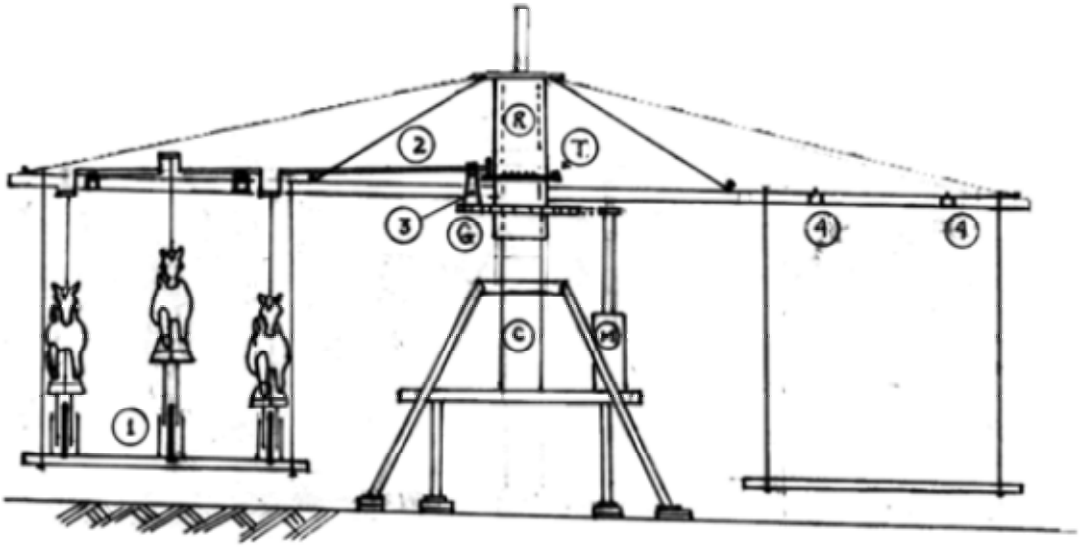


Figure 2

View of Merry-Go-Round
Model of Ride Serial #77-2845

8. Figure 3 shows the innermost cam as it hit the innermost spreader beam and stopped the camshaft from further sliding outwardly.

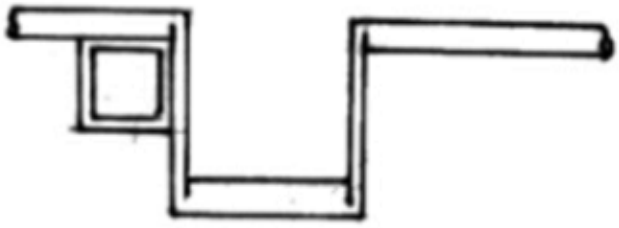


Figure 3

Final resting point of cam shaft,
stopped from further sliding outward
by inner-most cam shaft support beam.