

Pinsetter Theory of Operation and Malfunctions

The purpose of this page is to give a bowler a bit more information on what causes a pinsetter stop or malfunction. The machines are designed ideally to run, X number of cycles, malfunction free. As we all know, and probably seen that is not always the case. Pinsetters are much like kids, some days they behave and other days you just want to beat their butts. Yes the machine are old, but the machine are by no means worn out. All the parts are still available and will be available well into the future because the Brunswick A Series Pinsetter is one of the least changed, and one of the most reliable pinsetter made.

First, lets explain the theory of operation. The machine has a 360 degree life cycle, and certain functions happen at 44, 90, 144, 180, 270, and 360 degrees or Zero.

Lets break the machine cycle into quarters:

- 0 to 90 Degrees:

The cycle begins when the ball is thrown, and the ball breaks the Electronic Triggering Beam. Once the beam is broken a signal is sent to the Time Delay Module. The Time Delay Module waits 3 second to send the signal to the Triggering Solenoid. The ball also breaks the Automatic Scoring Ball Detect Beam. The Ball Detect Signal and the Electronic Triggering Signal lets the CCD Scanner Box acknowledge a ball was thrown and to take a comparison picture of the pins at 44 degrees, or when the deck is about 1 inch above the pins. The Trigger Solenoid fires engaging the gearbox clutch, and at 44 degrees the camera takes a picture of the standing pins. Once the rake drops, the pit curtain is raised to allow the ball to pass under the curtain and be lifted up the ball rods by the ball wheel. Once the machine reaches 90 degrees the mechanical detector can "detect" by the detector rod how far the deck has lowered. This indicates to the detector whether there are pins standing, a strike has been bowled, or a pin has slid Out of Range and can not be picked up, and needs cleared by the Front Desk Attendant.

- 90 to 180 Degrees:

All based on the Detector reading at 90 degrees, and series of projections, cams and levers the following can happen:

1. **Standing pins** are picked up while the dead wood is swept from the deck and the pins are re-spotted onto the lanes.
2. **Strike** - The dead wood is swept from the deck and a new rack of pins are set.
3. **Out of Range** where the gearbox clutch is dis-engaged and the machine cycle is halted. The Front Desk Attendant must clear any dead wood on the lane and manually re-engage the gearbox while blocking the rake from sweeping the Out of Range pins from the lane.

4. **Second ball cycle at 144 degrees** the second picture is taken by the Automatic Scoring Camera.

The deadwood pins and pins knocked down by the bowlers ball are shuffled off the pit carpet and into the clockwise rotating pin wheel. These pins are deposited into the turn around pan, where the pan orientates the pins so they move up the conveyor base first. The pins travel up to and over the pin gate and drop onto the turret trip lever. The pin gate is now locked and does not allow another pin to drop into the turret till the turret indexes to the next turret spot. This action also unlocks the pin gate and allows the next pin to drop onto the turret trip lever. This process is repeated 9 times. The 10th and last pin to drop in the turret is the 5 pin. The 5 pin passes through a chute and actuates the 5 pin probe. The actuation of the 5 pin probe allows the spoons, which are under rotational spring tension to rotate from underneath the base of the pin and drop from the turret wires into the deck buckets. This actuation rotates the time delay trip lever. The time delay rotates and the cam on the underside of the time delay gear simulates a pin dropping on the turret trip lever and allows the machine to index. When the turret indexes to all the first pin to drop into the turret, a long link is pushed to the rear. The link is captured by a roller and this capturing motion lets the clutch now the deck is ready to spot a new set of pins, it lowers a blocking finger to prevent a second set of pins from being dropped into an already full deck, and last keeps the clutch or engages the clutch at 180 degrees. Once the deck sets a new rack of pins, a roller on the deck shaft is rotated and releases the long link. This raises the blocking finger to say the deck is empty of pins. There are two conditions that must be met for the pins to release from the turret. The deck must at it's highest position. This is controlled by the restricted drop link and the right hand blocking finger, and the deck must be empty and in its shifted forward position. This is controller by the left hand finger and the moving deck and scissor shaft.

Meanwhile as the pins are carried to the turn around pan, another wheel rotating counter clockwise carries the ball up the lift rods. The bowling ball is transferred to the ball track and merges onto the underground subway at the y-switch and is boosted back to the bowler by the ball accelerator.

If the deck is empty at 180 degrees, the rake will stop in this rear ward position till the turret delivers 10 pins to the deck. Pushing the recycle or rest button does not do a single bit of good, and can actually cause the machine to Christmas Tree after setting a full rack. If the machine stays back at 180 degrees for more than 5 to 7 seconds then generally there is a malfunction or some of the pins have been ejected from the machine.

- 180 to 270 Degrees

At 180 Degrees the full deck signal is given the clutch is re-engaged, and the deck lowers towards 270 degrees. At 270 degrees or when the deck is at it lowest position a new rack of pins are set on the lane. During this point in the cycle the rake is "blocked out" so the rake does not sweep into or under the deck.

The machine is now back to Zero or 360 degrees and the cycle starts all over again. This was the condensed version of how a machine operates, but I wanted everyone to get a feel for what goes on behind the masking units.

Malfuncions and what causes them to happen

A 180, (pronounced one eighty) The rake stays swept back to the rear of the deck. This is called a 180, since the machine has actually stopped at 180 degrees.

Causes:

- Pins Are Logged Jammed - this is where the pins beaver dam themselves and prevent themselves from dropping into the pin wheel.

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- Jam in the turnaround pan - This is where a pin is incorrectly orientated and jams against the pinsetter frame.

- Pin Gate Prematurely Locked - The pin gate is essentially the gate keeper. The pin gate does not allow a pin to drop into the turret till the turret has rotated and stopped to receive the pin.

- Bridged Pin - A pin bridges the conveyor and turret. This is caused by another pin pushing on the head of the lead pin and prevents the base of the pin from dropping into the turret.

- Failed to Index - This is caused when a pin drops onto the Turret Trip Lever, but does not depress the Lever hard enough to release the index latch and allow the turret to index.

- Failed to Index after the 5 pin only - When the 5 pin drops through the 5 pin chute and the machine does not index

- Failed to release pins after 5 pin drops in - When the 5 pins passes through the chute and fails to actuate the 5 pin probe

- Pin Head caught in the Halo Ring - A pin bounces back and gets caught in the halo ring. This prevents the turret from fully indexing to the next turret wire location.

- Pit Conveyor Drive Belt Breaks - Self Explanatory

- Snubber Bolt(s) or Snubber itself breaks - The snubber over time fatigues from being flexed and eventually fails and requires replacing.

- Various other belts breaking - Jack Shaft Belt, Ball Wheel Belt, Motor to gearbox, motor to elevator, cross conveyor belt, and cross conveyor drive belt.

How many times does each of the above function correctly, or has the chance to malfunction during a league match with two 5 person teams?

Pins are Logged Jammed - This one is for Murphys Law to explain. It's total chaos in the pit area. There is no science to explain the how and why.

Turn Around Pan - 3000 times the turn around pan correctly sent the pin up the conveyor base first

Pin Gate Operation - 3000 times the pin gate properly controlled the flow of pins into the turret

Bridged Pin - 2700 times the pins correctly dropped into the wires

Failed to Index - 2700 times the turret indexed properly

Failed to Index After the 5 pin only - 300 times the time delay gear indexed the turret clutch

Failed to Release pins after the 5 pin drops in - 300 times the pins released from the turret to the buckets

Pin Head caught in the Halo Ring - 2700 times the pins did not bounce back and get caught

Pit Conveyor Belt Breaks - I never tracked the life of a pit conveyor belt, but I would guess for 1-1/2 to 2 years the belts keeps a shaking the pit conveyor. Thats a lot of frames.

Snubber Bolt(s) or Snubber itself breaks - Some snubbers have lasted years, and others months. It varies from pinsetter to pinsetter, and snubber to snubber manufacturer quality and standards.

As you can see there are 11 plus areas that can malfunction on the pinsetter, with 1000's of opportunities for a 180 stop to happen. Even though the rake stays at the rear most of 180 degree position it may not be the same problem causing the stop to happen.

No Ball Calls:

Causes:

- All of the above 180 stops can cause a no ball call

- Machine fails to trigger

- Ball and pins are slow to move off the pit carpet and the ball gets caught in front of the pit cushion

- A ball from the odd and even lane collide at the y-switch.

- A pin is carried up by a ball and deposited on the ball track

- A pin is carried up the track and pushed down the underground subway ball return track

- If you see a mark on your ball similar to a rug burn mark, stop bowling and show the front desk attendant. A rug burn mark is a strong indicator a pin has gone down the "chute".

- Ball is yo-yo ing

- A ball has fallen onto the pit cushion

- A ball and pin are wedged on the ball lift rods.