New Functionalities from Air Bearings Acting On Films

Presented by Tim Claffey
AIMCAL WEB Coating & Handling Conference
October 21-24, 2012
New Way “Air Turn” Demo

.002” THK. STAINLESS STEEL BELT

DRIVE BAR

BEARING LOAD ADJUSTMENT

GIMBAL MOUNTED DIRECTION CONTROL BEARING

AIR TURNS (NON-ROTATING)

BELT TENSION ADJUSTMENT
Company Snapshot
New Way Air Bearings

www.newwayairbearings.com
Porous Media Technology

UNIFORM PRESSURE DISTRIBUTION
UNIQUE MAINTENANCE FREE
SUPERIOR DAMAGE TOLERANCE
NO PROBLEM NO AIR,
The ideal air bearing design would supply air pressure equally across the whole face of the bearing, and automatically restrict and dampen the air flow to the face at the same time.
In Stock!

Frictionless Motion™

NEWWAY® air bearings
Air Bar System Example

Floating Glass Inspection System

APPLICATION DRAWING

- GRANITE METROLOGY FRAME
- GLASS TRANSLATING MECHANISM ATTACHED
- FLOATING GLASS
- EXTRUDED ALUMINUM FRAMING SYSTEM WITH LEVELING FEET

NEWWAY air bearings
Air Bar System Configuration

www.newwayairbearings.com
The Physics of Glass Flotation

May Issue

www.newwayairbearings.com
FFT results of vibration measurements using New Way Porous Media Precision Chuck

**HEPA Filter On/Off**

- air_on, fac vac
- air_off, fac vac
- air_on, fac vac, Hepa on
- air_off, fac vac, Hepa on

**Current Chuck**
The Sauber wind tunnel is large enough to measure full-size Formula 1 cars.

The Sauber aerodynamicists will work mainly with 60 percent models.
Wind Tunnel Project

Full array of custom vacuum air bearings under the rolling road belt
Wind Tunnel Project
Wind Tunnel Project
90 m/s Speed with 300psi in the Gap

RACE CAR WHEEL

STAINLESS STEEL BELT (300 KPH)

TIRE PATCH BEARING

VACUUM PRESSURE CONTROL AREA

VACUUM PRESSURE CONTROL AREA

FORCE GAGES

STRUCTURAL SUPPORT

NEWWAY®

www.newwayairbearings.com
Wind Tunnel Project
New Way “Air Turn” Demo

- .002” THK. STAINLESS STEEL BELT
- DRIVE BAR
- BEARING LOAD ADJUSTMENT
- GIMBAL MOUNTED DIRECTION CONTROL BEARING
- AIR TURNS (NON-ROTATING)
- BELT TENSION ADJUSTMENT

www.newwayairbearings.com
New Way “Air Turn” Demo

www.newwayairbearings.com
New Way “Air Turn” Demo

www.newwayairbearings.com
Air Gaps: About 25 Microns

AIR TURN

AIR TURN 1.500 RADIUS

GAPS VARY WITH INPUT PRESSURE AND LOADING

CONTROL BEARING 1.505 RADIUS

DIRECTION CONTROL BEARING

.002 THICK STAINLESS STEEL BELT
New Way "Air Turn" Demo
New Way “Air Turn” Demo

Forward

Backwards

www.newwayairbearings.com
Leonardo da Vinci (ca 1500)
Air Turn Test Array

NEWWAY®
air bearings
Dead Weight Loading of Air Films
Air Gap and Angle Measurement
Air Turn Test Array

LOAD ON DRIVE ARM

SCALE READOUT

www.newwayairbearings.com

Frictionless Motion™

NEWWAY® 
Air Bearings
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<th>LOAD ON FIXTURE (LBS)</th>
<th>BEARING/HARDWARE WEIGHT (LBS)</th>
<th>PRESSURE IN GAP (PSI)</th>
<th>FACE PRESSURE (PSI)</th>
<th>FLOW (SCFH)</th>
<th>GROOVE PRESSURE (PSI)</th>
<th>FLOW (SCFH)</th>
<th>TOTAL DIRECTION CONTROL BEARING FLOW (SCFH)</th>
<th>MASS (GM)</th>
<th>TORQUE (OZ/IN)</th>
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<th>SIDE TOWARDS LOAD (IN)</th>
<th>DRIVE ARM TILT ANGLE (DEGREES)</th>
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Results

Frictionless Motion™

110 MM

21.5 MM

21.5 MM

LOAD APPLIED

MEASUREMENT POINT 2

BALL MOUNT

MEASUREMENT POINT 1

FLAT AIR BEARING

FLAT AIR BEARING

FILM

www.newwayairbearings.com
### Summary

**Flat Air Bearing Tilt**

(Film floating on flat air bearing surface)

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**Notes:**
- **Load on Fixture:** Force applied to the bearing surface.
- **Pressure in Gap:** Internal pressure in the bearing.
- **Direction Control Bearing:** Pressure and flow in the control bearing.
- **Total Bearing Flow:** Combined pressure and flow of the bearing.
- **Mass:** Mass flow rate.
- **Side Away from Load:** Measurement position 1.
- **Side Towards Load:** Measurement position 2.
- **Drive Arm Tilt Angle:** Angle indicating tilt.
- **Scale Differential:** Measurement of differential scaling.

**Legend:**
- **Point 1** and **Point 2** are measurement positions.
- **Microns** indicate the vertical scale.
- **Flow Groove** and **Pressure** are key parameters in the measurement.

---

**NewWay Air Bearings**

www.newwayairbearings.com
Results
## Results

### Radial Air Bearing Tilt (Film Floating on Air Turn)

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Results

RADIAL AIR BEARING TILT
(FILM FLOATING ON AIR TURN)

MEASUREMENT POSITION

POINT 1

POINT 2

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Results

AIR BEARING TILT
(FILM FLOATING ON AIR BEARING SURFACES)

PULL (GRAMS)

RADIAL 444 N

FLAT 444 N

FLAT 222 N

BEARING TILT ANGLE (DEGREES)

www.newwayairbearings.com
Selective Use and Positioning
Selective Use and Positioning
“Air Control” Process Example

PROCESS

STABILIZER (OPTIONAL)

NON-ROTATING AIR TURN (TYP)

WEB

WEB TENSION FORCE EQUALS DRIVE TENSION BEARING FORCE

DRIVE TENSION BEARING

WEB FEED DIRECTION

DRIVE BEARING

DRIVE FORCE EQUALS DRIVE BEARING FORCE MINUS DRIVE TENSION BEARING FORCE

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“Air Control” Process Example

Frictionless Motion™
“Air Control” Process Example

NON-ROTATING AIR TURN (TYP)

ALIGNMENT FORCE

WEB FEED DIRECTION

WEB TENSION FORCE

WEB

ALIGNMENT FORCE

PROCESS

WEB TENSION BEARING (TYP)

WEB

DRIVE BEARING (TYP)

STABILIZER (OPTIONAL)

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2. Three primary—and unwanted—motions of a spindle are angular motion, axial motion, and pure radial motion. There are also two secondary motions: face motion, which combines axial and angular motion; and radial motion combining pure radial and angular
5-Probe Nest in Lathe

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5-Probe Nest in Milling Machine

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Error Motion Plots

Air Bearing

Air bearing spindle
(diamond turning machine)

Synchronous error: 0.010 μm
Asynchronous error: 0.002 μm

Rolling Elements

Ball bearing spindle
(milling machine)

Synchronous error: 0.105 μm
Asynchronous error: 0.742 μm

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Cranfield Precision Drum Lathe

Headstock, fixed position

Z Carriage, 1020 stroke

Tailstock, 500mm stroke

X Carriage, 140mm stroke

B Axis, toolpost

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Radial Air Bearings

ZERO FRICITION
ZERO WEAR
EASY
ROBUST
TO USE
INEXPENSIVE
HIGH
PERFORMANCE
SILENT
SMOOTH
LUBRICANT

NEW WAY
AIR BEARINGS

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Radial Air Bearings

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Drum Example
Radial Air Bearings

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Centered on end of shaft

End face of roll

Thrust plate on journal end
Radial Air Bearings

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Radial Air Bearings
Non-Contact Cleaning and Drying

ABSTRACT

A method and apparatus for cleaning, drying, coating, baking, or otherwise coating a working surface with a coating to enhance the performance and reliability of an electronic device. The method includes the steps of providing a working surface, providing a cleaning fluid, and depositing the coating on the working surface. The method also includes the steps of providing a vacuum, providing a drying fluid, and depositing the drying fluid on the working surface. The method further includes the steps of providing a baking fluid, providing a baking temperature, and depositing the baking fluid on the working surface.
Selective Use and Positioning

Frictionless Motion™

NEWWAY®
air bearings
Better Structural Support

For Non-Turning “Air Turns”
An “Air Turn” on Air Bushings

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Thank You