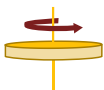


GYROSCOPIC INSTRUMENTS

WHAT IS A GYRO?

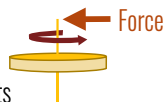
A gyro is a weighted disk. When it's rotating quickly it tends to resist switching planes of motion.



Anybody that has used a spinning top is familiar with its effects.

RIGIDITY IN SPACE

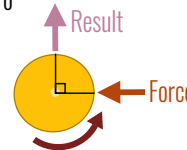
A spinning gyro exhibits a concept called "rigidity in space", or gyroscopic inertia. As objects in motion tend to stay in motion, a gyroscope in motion will remain in motion unless acted on by a net force.



PRECESSION

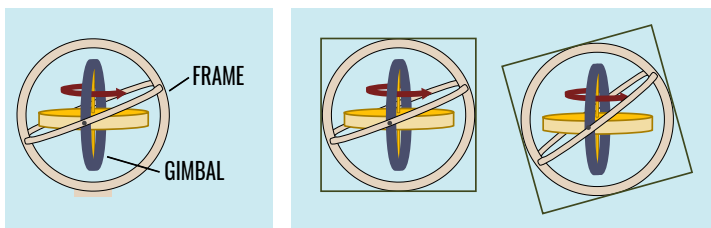
When a force acts upon a gyro it does have an effect.

But the effect occurs 90° from where the force was applied. This is gyroscopic precession.



FLYING APPLICATION

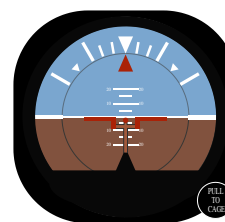
Gyros are useful to pilots because they can detect changes in orientation that our vestibular system cannot. Gyroscopic instruments consist of gyros mounted in a low-friction set-up. As the airplane changes orientation, the gyros tend to remain in place.



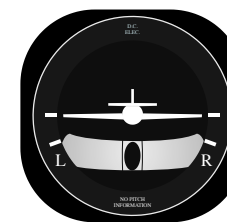
A gyro is installed using a frame and series of gimbals. Each gimbal permits the gyro to move freely in one plane of movement

Imagine a gyro in a box. When the box is tipped over, the gyro will tend to stay in place.

This is the essence of how gyroscopic instruments work. The airplane "turns around" the the gyros and the instruments measure the angular difference.



Attitude Indicator
(Vacuum Powered)

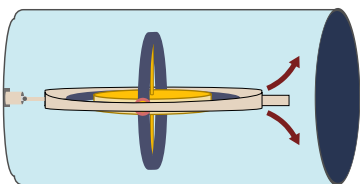


Turn Coordinator
(Electrically Powered)



Directional Gyro
(Vacuum Powered)

ATTITUDE INDICATOR

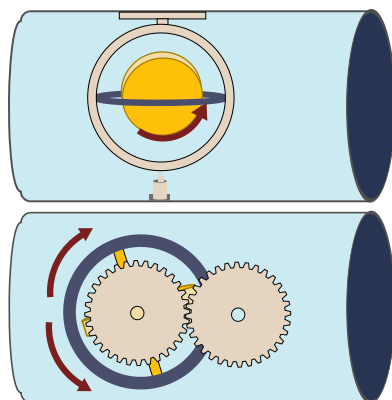


From the pilot's perspective the gyro rotates on a horizontal plane.

Two gimbals allow for pitch & roll movement.

A mechanical assembly measures the changes in pitch and bank and display them on the instrument face.

DIRECTIONAL GYRO



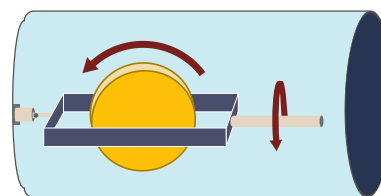
TOP-DOWN VIEW

From the pilot's perspective the gyro rotates front to back.

A single gimbal allows for yawing movements.

These yawing movements are translated through a series of gears and linkages to display the change in heading.

TURN INDICATOR

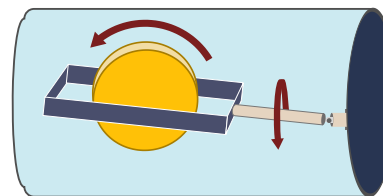


Pilot's perspective: gyro rotates front to back

A single gimbal allows for rolling movements.

Functions as a result of precession — when a yaw force occurs, the gyro precesses by rolling. This is what is measured. A spring restricts movement of the gyro which is what makes the instrument measure rate of turn, instead of simply bank.

TURN COORDINATOR



Operates similarly to the turn indicator, but an angled (canted) gyro allows the instrument to also respond to roll (not just yaw) forces. This increases response time and gives the pilot an indication of roll (although it does not show the bank!)