

MADHAV INSTITUTE OF TECHNOLOGY AND SCIENCE,
GWALIOR



TECHNICAL ENGLISH (10016)
ASSIGNMENT

Technical description – USM MOTOR

SUBMITTED BY:

ASMITA JAIN
0901EO201017

SUBMITTED TO:

PROF. UMESH WAMAN
GURUMWAR
HUMANITIES DEPT.

TECHNICAL DESCRIPTION:

Piezoelectric Ultrasonic Motor

WHAT IS USM MOTOR? – AN OVERVIEW

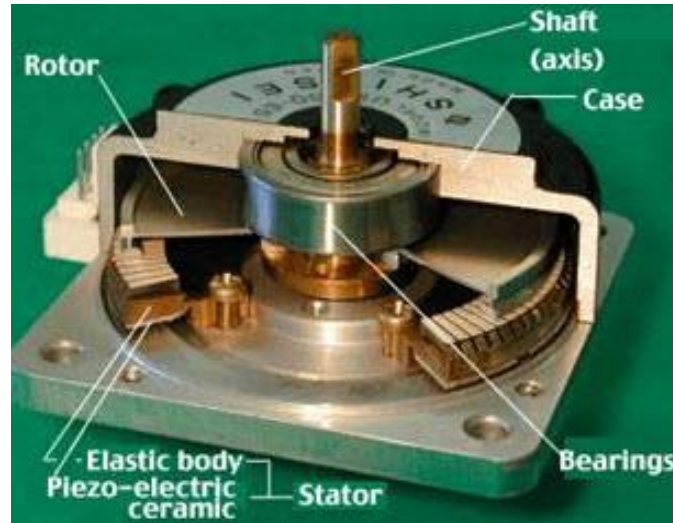
An ultrasonic motor is a type of piezoelectric motor powered by the ultrasonic vibration of a component, the stator, placed against another component, the rotor or slider depending on the scheme of operation (rotation or linear translation).

An ultrasonic motor rotates a rotor by using ultrasonic waves with high frequencies more than 20,000Hz. The ultrasonic motor generates ultrasonic waves using piezoelectric elements, while conventional motors use permanent magnets or coils to rotate a rotor.

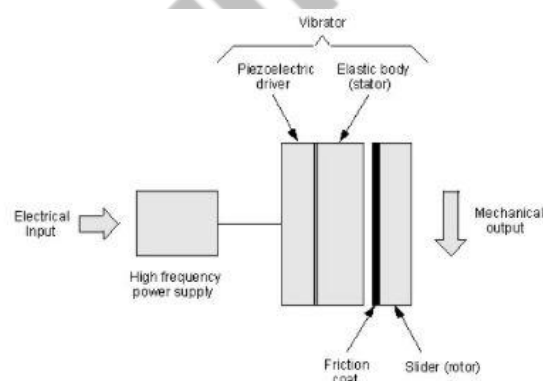
PARTS:

- Rotor
- Shaft
- Bearings
- Stator
 - Piezoelectric ceramic

- Elastic body
- Case



WORKING:



Ultrasonic Motor Working

The vibration is induced into the stator of the motor, and it is used for conveying the motion to the rotor and also to modulate the frictional forces. The amplification and (micro) deformations of active material are utilized for

generation of the mechanical motion. The macro-motion of the rotor can be achieved by the rectification of the micro-motion using the frictional interface between the stator and the rotor.

The ultrasonic motor consists of stator and rotor. The operation of the USM changes the rotor or linear translator. The stator of the USM consists of piezoelectric ceramics for generating vibration, a metal of the stator for amplifying the generated vibration and a friction material for making contact with the rotor.

Whenever voltage is applied, a travelling wave is generated on the surface of the stator metal which causes the rotor to rotate. As the rotor is in contact with the stator metal, as mentioned above – but only at each peak of the travelling wave – which causes the elliptical movement – and, with this elliptical movement, the rotor rotates in the direction conversely to the direction of the travelling wave.

TYPES:

The USMs are classified into different types based on different criteria, which are as follows:

Classification of USMs based on the type of motor rotation operation

- Rotary type motors
- Linear type motors

Classification of USMs based on the shape of the vibrator

- Rod type
- Π shaped
- Cylindrical shaped
- Ring (square) type

Classification based on the type of vibration wave

- Standing wave type – it is further classified into two types:
 1. Unidirectional
 2. Bidirectional
- Propagating wave type or travelling wave type

APPLICATIONS:

- Used for the autofocus of camera lens.
- Used in compact paper handling devices and watches.
- Used in conveying machine parts.
- Used for drying and ultrasonic cleaning.

- Used to inject oil into the burners.
- Used as the best motors known to offer high potential for miniaturization of equipment.
- Used in MRI magnetic resonance imaging scanning in medicine.
- Used to control the disk heads of computer like floppies, hard disk and CD drives.
- Used in many applications in the fields of medicine, aerospace and robotics.

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