

# Big Ben falls silent

The famous chimes of Big Ben are to fall silent after 157 years of nearly unbroken service. The iconic London landmark needs urgent repairs to prevent its mechanism from failing in a \$42m restoration project

Elizabeth Tower: Work of **Charles Barry** and **Augustus Pugin**. Height: 96m. Renamed in 2012 for Queen's Diamond Jubilee

Ayrton Light, which shines to indicate that Parliament is sitting, needs full restoration

## Bells

### GREAT BELL

Nickname "Big Ben" commonly used for clock and tower together. Probably named after **Benjamin Hall**, First Commissioner of Works



### QUARTER BELLS

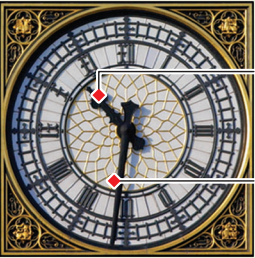
On quarter hours four smaller bells play chime based on **Handel's Messiah**:

*"All through this hour  
Lord be my guide  
that by Thy power  
No foot shall slide"*

First Great Bell cracked while being tested. Recast bell first struck hour on July 11, 1859

Weight: 13.7 tons  
Height: 2.2m  
Diameter: 2.7m  
Hammer weight: 200kg

## Clock faces



Four 7m cast iron dials each contain 312 pieces of pot opal glass

**Hour hands**  
Length: 2.7m  
Weight: 300kg  
Material: Gun metal

**Minute hands**  
Length: 4.2m  
Weight: 100kg  
Material: Copper sheet

Clock faces will be stripped of black and gold paint applied in 1980s to return to Victorian appearance, thought to feature green and gold

## Clock stoppages

- 1962: Clock chimes in New Year ten minutes late due to heavy snow on hands
- 1976: Clock shut down for 26 days over nine months after chiming mechanism disintegrates through metal fatigue
- 2005: Clock mechanism stopped for two days to allow inspection of brake shaft
- 2007: Mechanism replaced by electric motor to allow six-week maintenance work. Clock dials cleaned and repaired
- Early 2017: Major refurbishment plan due to start – expected to last three years

Work needed in tower to fix cracks in masonry and corrosion to bell frame. Lift will be installed in ventilation shaft to improve access

## Mechanism of Great Clock

Gravity-driven, consisting of three "trains" – **Going**, **Chime** and **Strike** – each made up of barrel connected to weight suspended below by steel wire. As weights drop, barrels turn, setting in motion hands and bells via series of gears, wires and shafts

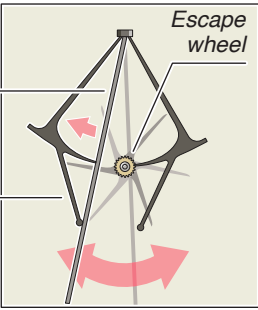
Built by clockmaker **Edward Dent** from design by lawyer, MP, and amateur horologist **Edmund Beckett Denison** with assistance from Astronomer Royal, **George Airy**

### GOING TRAIN

Moves clock hands via gears driven by single shaft

Going train controlled by **Double Three-Legged Gravity Escapement** – Denison's ground-breaking invention in which impulse to pendulum is not given by escape wheel, as in deadbeat escapement, but through gravity force of two arms. This frees pendulum from friction, ensuring accuracy

Pendulum alternately touches each of two arms every two seconds, unlocking escape weight  
Locking arms then fall back under own gravity, hitting pendulum to keep swinging



Weights

Pendulum

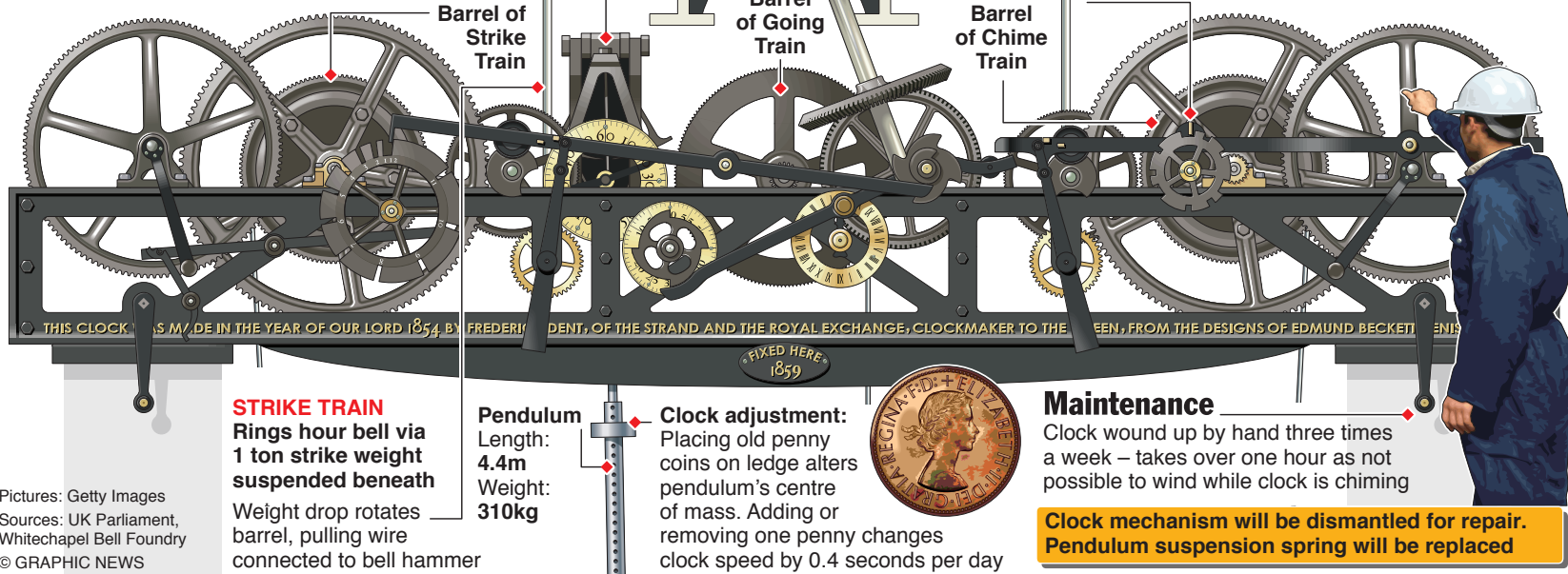
Fly fans: Air brakes regulate descent of weights

### Mechanism dimensions

Length: 4.7m  
Width: 1.4m  
Weight: 5 tons  
Frame material: Cast iron girder

## CHIME TRAIN: Rings four quarter bells via steel wires connected to bells' hammers

Every 15 minutes, lifting arm falls off relevant wheel segment. Length of segment determines length of chiming sequence



### STRIKE TRAIN

Rings hour bell via 1 ton strike weight suspended beneath  
Weight drop rotates barrel, pulling wire connected to bell hammer

Pendulum  
Length: 4.4m  
Weight: 310kg

Clock adjustment: Placing old penny coins on ledge alters pendulum's centre of mass. Adding or removing one penny changes clock speed by 0.4 seconds per day



## Maintenance

Clock wound up by hand three times a week – takes over one hour as not possible to wind while clock is chiming

Clock mechanism will be dismantled for repair. Pendulum suspension spring will be replaced